WORLD GLAUCOMA CONGRESS

Boston, July 8-11, 2009

ABSTRACTS BOOK

NY Eye & Ear Infirmary

Continuum Health Partners, Inc.

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WORLD GLAUCOMA ASSOCIATION

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WORLD GLAUCOMA CONGRESS

ABSTRACTS BOOK

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DIDACTIC SESSIONS

Thursday, July 9, 2009

08.00-9.30 a.m.

D01 NOVEL DIAGNOSTIC TARGETS IN GLAUCOMA INCL ACG + S&F CONS

D01-01 THE VALUE OF CONSENSUS AND LEVELS OF EVIDENCE IN DIAGNOSTIC PRACTICE

P. Sample
La Jolla, USA

Objective: At the end of this session, the attendees will understand the various levels of scientific evidence, what findings are supported by sound evidence for each topic, what is the level of the evidence, and what is still not well understood or adequately documented. This information can improve the clinical management of glaucoma and the development of clinical trials. In addition, it will highlight new areas of research needed to address areas where a lack of good evidence and consensus persist.
Description: Using an evidenced-based approach this session will present our current knowledge of novel functional and structural measures used for the diagnosis and classification of primary open angle glaucoma and the angle-closure glaucomas. The relationship of function to structure in these disorders along with the epidemiological, demographic, clinical, and genetic findings associated with our understanding of these debilitating eye diseases will be presented. Areas where consensus has been reached among experts through the series of consensus meetings sponsored by the World Glaucoma Association will be summarized. Areas where consensus has not been reached and more research is needed will also be presented.

D01-02 FUNCTIONAL MEASURES OF GLAUCOMA

E.M Blumenthal
Jerusalem, Israel

D01-03 STRUCTURAL MEASURES OF GLAUCOMA

M.S. Kook
Seoul, Korea

Description: Optic disc and nerve fiber layer (NFL) damages in glaucoma have traditionally been assessed by clinical examination and stereoscopic photographs of the optic nerve and NFL photography. As it is well accepted in glaucoma practice that 20-40 % of optic nerve axons can be lost before irreversible visual field defects are observed in standardized white-on-white automated perimetry, careful observation of the optic nerve head and NFL for glaucomatous structural change is important in the early detection and prevention of glaucomatous optic neuropathy. Several instruments now attempt to measure the NFL thickness quantitatively since objective and accurate method of quantifying NFL thickness would enhance our detection and monitoring of this disease following treatment. Scanning laser polarimetry, confocal scanning laser ophthalmoscopy, time-domain optical coherence tomography, and spectral domain optical coherence tomography have been reported to be capable of producing objective and reproducible measures of NFL thickness, although limitations associated with each technology do exist. Although experiments with animal model have shown good histopathologic correlation with NFL thickness, variability regarding the ability of each instrument to discriminate between normal and glaucomatous eyes have been reported, particularly in the early stage of glaucoma. These conflicting data may be due to differences in the study design by different investigators, severity of the disease and characteristics of the study population, and innate differences in measurement technology among various imaging devices. It is also unfortunate that there is a relative lack of evidence-based reports on strength and limitations associated with various types of structural measures in the detection of glaucoma onset and progression. The goal of my presentation will be to show the novel approaches that are available currently in glaucoma detection within the context of the evidenced-based findings and also highlight future areas of research needed to address where there is a lack of good evidence and consensus for clinicians to apply clinically.

D01-04 THE RELATIONSHIP OF STRUCTURE AND FUNCTION IN GLAUCOMA

M.T. Nicolela
Halifax, Nova Scotia, Canada

Description: During my presentation, I will review the relationship of structure and function in glaucoma, particularly the relevant points for glaucoma diagnosis and monitoring the disease. The most relevant studies in this area will be discussed, with emphasis to clinically applicable concepts. At the end of the presentation, my goal is to ensure that the participants have a clear idea of the complex relationship of structure and function in glaucoma.

D01-05 EPIDEMIOLOGY AND CLASSIFICATION OF ANGLE-CLOSURE GLAUCOMA

E.M. Hoffman
Mainz, Germany

Objective*:* Attendees will understand how big the problem of ACG is worldwide. The need for a standardised definition of glaucoma resulted in the drawing up of the ISGEO classification for use in epidemiological surveys conducted in different populations. Ritch's classification of mechanisms of angle closure works from the anterior to posterior through the structures involved in angle closure. This classification is supported by ultrasound biomicroscopy imaging which illustrates the contribution of the iris, ciliary body, lens and structures posterior to the lens in cross-section.
Description*:* A brief presentation of the epidemiology and classification of angle closure glaucoma (ACG). Prevalence data worldwide and especially data from asia will be shown. The paper will furthermore present the nature and mechanisms of angle closure glaucoma. The classification of angle closure glaucoma is presented. The ISGEO (International Society of Geographic and Epidemiologic Ophthalmology) classification of glaucoma for epidemiological research will be explained as well as the 4-point classification by mechanism according to R. Ritch.

D01-06 DETECTION OF PRIMARY ANGLE CLOSURE AND ANGLE-CLOSURE GLAUCOMA
D. Friedman
Baltimore, USA

Objective: At the end of this lecture, the attendees will understand the various levels of scientific evidence, what findings are supported by sound evidence, what is the level of the evidence, and what is still not well understood or adequately documented. This information can improve the approach to detecting angle-closure glaucoma. In addition, it will highlight new areas of research.
Description: Using an evidenced-based approach this lecture will present our current knowledge of the detection of primary angle closure glaucoma. Areas where consensus has not been reached and more research is needed will also be presented.

D01-07 THE GENETICS OF GLAUCOMA
S. Chakrabarthi
Hyderabad, India

Objective: At the end of this session, the attendees will understand the various levels of scientific evidence, what findings are supported by sound evidence for each topic, what is the level of the evidence, and what is still not well understood or adequately documented. This information can improve the clinical management of glaucoma and the development of clinical trials. In addition, it will highlight new areas of research needed to address areas where a lack of good evidence and consensus persist.
Description: Using an evidenced-based approach this session will present our current knowledge of novel functional and structural measures used for the diagnosis and classification of primary open-angle glaucoma and the angle-closure glaucomas. The relationship of function to structure in these disorders along with the epidemiological, demographic, clinical, and genetic findings associated with our understanding of these debilitating eye diseases will be presented. Areas where consensus has been reached among experts through the series of consensus meetings sponsored by the World Glaucoma Association will be summarized. Areas where consensus has not been reached and more research is needed will also be presented.

D01-08 DIAGNOSIS OF GLAUCOMA: CONSENSUS
H.G. Lemij
Rotterdam, The Netherlands

Description: In 2003, the World Glaucoma Association put together a consensus meeting on the diagnosis of glaucoma and the role of structural and functional measurements in reaching a diagnosis. The results of that meeting will be summarized.

D02 NOVEL IMAGING TECHNOLOGY ADVANCES

D02-01 LONGITUDINAL EVALUATION OF RETINAL GANGLION CELL DAMAGE WITH BLUE-LIGHT CONFOCAL SCANNING LASER OPHTHALMOSCOPE
C.K.S. Leung
Hong Kong, People's Republic of China

Description: A number of experimental models to visualize retinal ganglion cells (RGCs) in vivo have been recently described. With retrograde injection of fluorescent tracers into the superior colliculus, lateral geniculate body, or optic nerve, RGCs can be detected in vivo with confocal laser scanning microscopy, fluorescent microscopy, or confocal scanning laser ophthalmoscopy. An ideal experimental model for evaluation of RGC damage should be non-invasive and reproducible. The introduction of a strain of transgenic mice that express fluorescent proteins under the control of Thy-1 promoter sequence has offered a non-invasive approach to image RGCs. Long term serial monitoring of RGCs over a year has been shown possible with this technique. In-vivo imaging of RGCs could provide crucial information to investigating the mechanisms of neurodegenerative diseases and evaluating the treatment response of neuroprotective agents.

D02-02 NOVEL GLAUCOMA IMAGING DIAGNOSTICS
J. Schuman
Pittsburgh, USA

D02-03 ADVANCES IN IMAGING NEUROPROTECTION IN VIVO
M.F. Cordeiro
London, UK

Objective: To provide a review of current and future imaging technologies and their application to neuroprotection.
Description: Currently, lowering IOP remains the only clinical therapy available in the treatment of glaucoma, despite the evidence that vision loss can continue in the presence of 'significant' IOP reduction. Neuroprotection has been increasingly recognized as an important alternative treatment approach, but its emergence has also highlighted the need for both better defined end-points in clinical glaucoma research, as well as earlier and better detection and measures of progression. This could have been a factor in the recent memantine trial. A recent FDA/NEI meeting on end-points in glaucoma emphasized the need for new measurements. As the RGC is the primary injured neuron in this disease, it would seem logical that any modality that could directly measure RGC dysfunction and disease would be ideal. Perhaps the greatest changes that we have encountered recently are in the field of imaging technologies, which have only relatively recently been applied to the eye. Advances in this area have allowed unprecedented in vivo access to the retinal layers, using many different properties of light to differentiate cellular structures. Over the next few years, developments in therapy & diagnostic methodologies, based on imaging, offer great potential in glaucoma.

D02-04 OPTOPHYSIOLOGY: FUNCTIONAL IMAGING OF THE RETINA WITH OCT
W. Drexler

D02-05 ULTRAHIGH SPEED AND RESOLUTION OPTICAL COHERENCE TOMOGRAPHY
James G. Fujimoto
Cambridge, USA

Description: Optical coherence tomography (OCT) enables real-time imaging of retinal pathology with resolutions that were previously impossible to obtain in vivo. Recently, advances in OCT technology known as spectral / Fourier domain detection enable dramatic improvements in imaging

speed. Commercial OCT instruments can now image at > 25,000 axial scans per second, ~ 50-100x faster than previous OCT systems, with resolutions of 5-7 um. Spectral / Fourier domain OCT has powerful advantages, including the ability to acquire high definition images with improved image quality, preservation of true retinal topography and improved retinal coverage. 3D-OCT data sets can be acquired and displayed analogous to MR imaging. OCT fundus images can be generated by axially summing 3D-OCT data, enabling precise and reproducible registration of cross-sectional OCT images to fundus features. Image data can be segmented to quantify retinal layer thickness and create topographic maps. Advances in OCT technology also enable ultrahigh resolution imaging with axial resolutions as fine as ~ 2-3 um in research prototype systems. The improved resolution, combined with the ability to more reproducibly register OCT data sets to fundus features promises to improve reproducibility and sensitivity of morphometric measurements. Ultrahigh resolution OCT also enables imaging small animal models, such as the rat or transgenic mouse. The ability to non-invasively and reproducibly measure changes in retinal pathology in small animals over time promises to improve the efficiency of drug discovery and assessment. Functional OCT techniques are also being developed which may provide integrated structural and functional imaging. The newest research technology using frequency swept lasers for swept source OCT or new high speed cameras for spectral domain OCT achieves even faster imaging speeds of > 200,000 axial scans per second, 500 x faster then previously technology. These technologies can acquire comprehensive volumetric OCT data sets with minimal motion artifacts. These advances promise to enable new research applications as well as enhance clinical ophthalmology.

D02-06 DETECTING GLAUCOMA PROGRESSION WITH OCT, CSLO AND SLP – TODAY AND TOMORROW

D.S. Greenfield
Miami, USA

Description: After two decades of validating imaging technologies, particularly for diagnosis, their use for detection of progression is at the verge of being implemented into clinical practice. Statistical methods for evaluating glaucomatous visual field progression have evolved considerably, yet criteria for defining progression remains inconsistent in the absence of established standards. Similar challenges exist with assessment of structural change. Imaging may serve as a useful adjunct to optic disc photography to provide complementary information that may facilitate progression detection using rate-based changes over time since the output data is quantitative, and highly reproducible at all stages of the glaucoma continuum. Still, there are few reported studies of imaging for glaucoma progression detection. It will be necessary to have long follow-up intervals to determine if the changes identified using only structural technologies predict the subsequent development of visual field progression. Other limitations exist. The costs of replacing older technologies with improved ones has been detrimental to their gaining widespread acceptance. For example, although Fourier-domain optical coherence tomography (OCT) offers higher speed and resolution as compared with time-domain OCT, along with the ability to perform three-dimensional imaging of posterior segment structures, it is not backwards compatible with previously collected data and change detection software does not exist. Longitudinal studies are needed to validate the use of imaging for detection of glaucoma progression. Further, image quality that is dependent on operator skill, patient-related factors such as pupil diameter and media clarity, and instrument dependent variables all still need to be addressed. In the final analysis, imaging may falsely identify glaucoma and its progression or fail to detect glaucomatous progression. Thus, clinicians should not make clinical decisions based solely on the results of one single test or technology.

D03 TRANSLATIONAL SCIENCE

D03-01 INTRODUCTION

K.R.G. Martin
Cambridge, UK

Description: A key challenge in glaucoma research is translating advances in the laboratory into new diagnostic and treatment approaches. In this session, we will explore some of the most promising new techniques which have potential to help us better understand the pathogenesis of glaucoma in order to develop new therapies.

D03-02 IDENTIFYING PRESSURE RESPONDING GENES IN THE HUMAN TRABECULAR MESHWORK

T. Borras
Chapel Hill, USA

Description: Mechanical insults to cells trigger a number of responses which are governed by the differential expression of their genes. Elevated intraocular pressure (IOP), the major risk factor for glaucoma, is produced when the trabecular meshwork (TM) exerts an increased resistance to the flow of the aqueous humor exiting the eye. To understand, and potentially treat high IOP it is essential to first study the molecular response to pressure of the TM genes. Our laboratory has developed a strategy which allows identification of individual pressure-responding genes. Eye pairs from human post-mortem donors are perfused in an organ culture setting that preserves the intact TM. One eye is maintained at physiological pressure, while the paired, contralateral eye is subjected to a high IOP insult by means of a computerized perfusion system. At the end the experiment, the transcriptome of the TMs of the normal and high pressure eyes are compared using GeneChip global expression profiles and TM-focused TaqMan arrays. Because comparisons occur between two tissues from the same individual, the results are not confounded by different genetic backgrounds. Using eyes from the same individual validates the comparison and allows studying individual differences. Applying this strategy has led us to the identification of a panel of human genes termed: molecular signature of pressure response. Among these genes, we have identified general and individual responders, whose expression was altered in either most, or just in a few individuals. Relevant general responders included matrix metalloproteinase 1 (MMP1) and angiopoietin-like 7 (ANGPTL7) while individual responders included the stress protein alphaB-crystallin and endothelial adhesion molecule 1 (ELAM1), a marker for glaucoma. The identification of pressure-responding genes with an individual component might help to understand the different response to pressure observed in the clinic and aid to elucidate mechanisms for the control of elevated IOP.

D03-03 STRUCTURAL AND FUNCTIONAL TESTING
J.G. Crowston
Melbourne, Australia

Description: A large number of retinal ganglion cells and their axons need to die before current clinical tests of optic nerve structure and function are able to reliably detect glaucoma progression in clinical practice. Recent advances in optic nerve imaging and function assessment in experimental animal models point to alternative endpoints, which may provide information on the state of optic nerve health. Translation of such technologies into clinical practice stands to have a significant impact on our ability to detect glaucoma progression and assess the impact of treatment.

D03-04 MECHANISMS OF UVEOSCLERAL OUTFLOW REGULATION
J. Lindsey
La Jolla, USA

Description: Uveoscleral outflow is one of the two major aqueous humor outflow pathways. It accounts for about half of total aqeuous humor outflow in healthy young eyes and is reduced with normal aging. Recent advances have clarified the mechanism of uveoscleral outflow regulation as well as its contributions to the health of various ocular tissues.
Discussion topics will include: 1. New clinical and basic insights into uveoscleral outflow contributions to intraocular pressure; 2. New understanding regarding aqueous humor protein targeting including the partitioning of aqueous humor proteins for different drainage routes according to molecular weight; 3. Drug effects on uveoscleral and conventional outflow tissues; 4. The significance of lymphatic contributions to the distal portion of the uveoscleral outflow drainage.

D03-05 GLAUCOMA MODELS: OF MICE AND MEN
H. Quigley
Baltimore, USA

Description: Studies of the cause of blindness from glaucoma and its therapy have benefited by the development of both spontaneous and induced models of the disease in animals. We have confirmed the structure–function relationship in humans by studies in monkeys, as well as improving understanding of axonal transport blockade and the site of injury to axons in models of monkeys, dogs, rats and mice. Despite some differences in eye size and composition, mice undergo damage to retinal ganglion cells in a similar manner to humans and the powerful transgenic technologies can now be harnessed to ask and answer important questions.

D03-06 MEASUREMENT OF AQUEOUS DYNAMICS IN HUMANS
A. Sit
La Jolla, USA

Objectives: 1. To understand the fluid dynamics of IOP. 2. To understand the methods of measuring aqueous humor dynamics in humans.
Description: Aqueous humor dynamics involves the study of the fluid dynamics influencing intraocular pressure (IOP). Understanding aqueous humor dynamics is critical to understanding the pathogenesis of glaucoma as well as the mechanisms of action of glaucoma therapies. The modified Goldmann equation relates the various fluid dynamics factors that contribute to IOP. These include aqueous humor flow rate, outflow facility, episcleral venous pressure, and uveoscleral outflow. Aqueous humor flow rate is measured using anterior segment fluorophotometry; outflow facility is measured using tonography; and episcleral venous pressure is measured using venomanometry. Uveoscleral outflow cannot be measured non-invasively. However, characterization of the aqueous humor dynamics state can be obtained through measurement of IOP and the other three variables. This allows calculation of uveoscleral outflow, providing a complete assessment of the aqueous dynamics state. Recent improvements in the measurement techniques may improve reliability.

D03-07 CHALLENGES: REWIRING THE EYE TO THE BRAIN IN GLAUCOMA
Y. Yücel
Toronto, Canada

Neuropathological and clinical studies in glaucoma have established that the disease extends from the retinal ganglion cells in the eye to involve visual pathways in the brain, including the optic nerve, optic chiasm, optic tract, lateral geniculate nucleus, optic radiations and visual cortex. Most retinal ganglion cells (RGCs) terminate in the lateral geniculate nucleus (LGN) of the brain. RGC injury can cause glial scar hostile to re-growth along the optic nerve and tract, and trigger degenerative changes in target LGN neurons. There is compelling evidence that glaucoma therapies should target RGCs in the eye, and also promote core connections in the brain.
Objectives are to discuss the opportunities and challenges related to anatomic and functional rewiring in the visual system in the context of glaucoma.

D03-08 CONCLUSIONS
R. Weinreb
La Jolla, USA

10.00-11.30 a.m.

D04 GLAUCOMA PROGRESSION I

D04-03 HOW MANY PARTICIPANTS WITH PRIMARY OPTIC DISC ENDPOINTS DEVELOP VISUAL FIELD LOSS?
M.A. Kass, M.E. Gordon, J.A. Beiser, O.H.T.S Group
Washington University School of Medicine, St. Louis, USA

Objective: To determine the incidence of glaucomatous visual field loss subsequent to a primary optic disc endpoint.
Design: Retrospective analysis of data from randomized clinical trial.
Participants: One hundred fifty-five participants in OHTS who developed POAG in one or both eyes prior to June 2002 or prior to reconsent, 47 in the medication group and 108 in the observation group.
Method of testing: Masked centralized readings of Humphrey visual fields completed every 6 months and of stereo optic disc photographs completed every 12 months.
Main outcome measure: An incident case of POAG required 3 consecutive abnormal visual fields or 2 consecutive stereophotographs showing progression. A masked Endpoint Committee reviewed all eyes with reproducible changes and

determined whether the change could be attributed to glaucoma.

Results: The initial POAG endpoint was optic disc progression in 84 participants, a visual field abnormality in 59 participants, and 12 participants developed both simultaneously. After development of POAG, all participants in the observation group initiated ocular hypotensive treatment. Participants in the medication group continued treatment. The participants who developed POAG were followed an additional 5.0 years. During that time, 32 of 84 (38%) participants with an initial optic disc endpoint developed reproducible glaucomatous visual field loss; and 29 of 59 (49%) participants with an initial visual field endpoint developed a reproducible glaucomatous optic disc endpoint. Participants in the original observation group were more likely to develop the second POAG endpoint in the same eye than were participants in the original medication group.

Conclusion: Despite medical treatment, a substantial proportion of eyes in which glaucomatous damage is initially detected by either disc progression or visual field abnormality subsequently develop reproducible damage in the other modality.

References:

1. Johnson CA, Sample PA, Zangwill LM, et al. Structure and function evaluation (SAFE): II. Comparison of optic disc and visual field characteristics. Am J Ophthalmol 2003; 135: 148-154. 2. Kass MA, Heuer DK, Higginbotham EJ, et al. The Ocular Hypertension Treatment Study: a randomized trial determines that topical ocular hypotensive medication delays or prevents the onset of primary open-angle glaucoma. Arch Ophthalmol 2002; 120: 701-713; discussion 829-830. 3. Schwartz B, Takamoto T, Martin J. Increased rate of visual field loss associated with larger initial visual field threshold values on follow-up of open-angle glaucoma. J Glaucoma 2004; 13: 120-129. 4. Sommer A, Katz J, Quigley HA, et al. Cinically detectable nerve fiber atrophy precedes the onset of glaucomatous field loss. Arch Ophthalmol 1991; 109: 77-83. 5. Strouthidis NG, Scott A, Peter NM, Garway-Heath DF. Optic disc and visual field progression in ocular hypertensive subjects: detection rates, specificity, and agreement. Invest Ophthalmol Vis Sci 2006; 47: 2904-2910. 6. Zangwill LM, Weinreb RN, Beiser JA, et al. Baseline topographic optic disc measurements are associated with the development of primary open-angle glaucoma: the Confocal Scanning Laser Ophthalmoscopy Ancillary Study to the Ocular Hypertension Treatment Study. Arch Ophthalmol 2005; 123: 1188-1197.

D04-04 BETA-ZONE PARAPAPILLARY ATROPHY, DISC HEMORRHAGE, AND VISUAL FIELD PROGRESSION

C.G.V. de Moraes[1], C.C. Teng[1], T.S. Prata[1], C. Tello[1], R. Ritch[1], J.M. Liebmann[2]

[1]Einhorn Clinical Research Center, New York Eye and Ear Infirmary, New York, USA, [2]New York University School of Medicine, New York, USA

Purpose: Beta-zone parapapillary atrophy (PPA) and disc hemorrhage (DH) are known risk factors for glaucoma progression and have been described as closely associated features of the disease. We compared their relative role in predicting glaucoma progression.

Design: Retrospective cohort.

Participants: Subjects from the Glaucoma Progression Study (GAPS, n = 43,660, total number of VF = 132,512) with glaucomatous optic neuropathy and repeatable VF loss, ≥ 9 VF SITA-Standard VF examinations, Heidelberg Retinal Tomograph II (HRT) examination, optic disc photographs, and < 6 D myopia.

Methods: All disc photos were reviewed by masked investigators searching for presence of DH and beta-zone PPA. Beta-zone PPA was defined as a region of chorioretinal atrophy with visible sclera and choroidal vessels adjacent to the optic disc. The contour of the optic nerve and beta-zone PPA were marked on the HRT image by an observer masked to the VF data. A DH was defined as a splinter-like or flame-shaped hemorrhage on or within the RNFL or neuroretinal rim. If peripheral to the disc margin, it needed to be contiguous with the beta-zone PPA when this feature was present. VF progression was determined by automated pointwise linear regression analysis.

Main outcome measures: Cox proportional hazard ratios were calculated in univariate and multivariate models to determine the role of each variable on VF progression. Variables evaluated were age, CCT, baseline MD, baseline IOP, disc area, rim area, rim area/disc area ratio, presence of beta-zone PPA, beta-zone PPA area, beta-zone PPA area/disc area ratio, and presence of DH.

Results: We enrolled 245 eyes of 245 patients. Mean age was 69.6 ± 12.3 years. Mean follow-up was 4.9 ± 1.4 years and the mean number of VFs after the HRT was 9.3 ± 2.7. Beta-zone PPA was present in 146 eyes (65%) and at least one DH in 41 (16%) eyes. Thirty-two (78%) of the DH eyes had beta-zone PPA. In the univariate model the following variables were significant: baseline IOP (HR: 1.07, $p < 0.01$), CCT < 525 µm (HR: 1.50, $p = 0.01$), presence of PPA (HR: 2.26, $p < 0.01$), and presence of DH (HR: 1.63, ≤ 0.01). In the multivariate model baseline IOP (HR: 1.09, $p < 0.01$) and presence of beta-zone PPA (HR: 2.42, $p < 0.01$) remained significant.

Conclusions: We confirmed the role of high IOP, thin cornea, presence of beta-zone PPA, and DH as predictors of VF progression. Beta-zone PPA connotes a relatively worse prognosis than presence of DH, regardless of the baseline structural and functional damage. Beta-zone PPA and DH are usually associated, even though the latter are transitory and often missed during clinical examination, which might help explain why presence of DH lost significance in the multivariate model. An increased susceptibility of the optic nerve head complex (optic nerve head, retinal nerve fiber layer, and parapillary retina) likely links these two features. Being a more stable and easily recognizable sign of glaucoma, greater attention should be given to the presence of beta-zone PPA during clinical examination and risk assessment.

D04-05 EVALUATION OF GLAUCOMA PROGRESSION BY MEASURING THE RATE OF CHANGE OF RETINAL NERVE FIBER LAYER THICKNESS

C. Leung[1], R.N. Weinreb[2], D. Lam[3]

[1]The Chinese University of Hong Kong, Hong Kong, People's Republic of China, [2]UCSD, La Jolla, USA, [3]CUHK, Hong Kong, People's Republic of China

Purpose: To evaluate progression with retinal nerve fiber layer thickness (RNFLT) measurements obtained with OCT and to measure the rate of change of RNFLT in glaucoma patients.

Design: Retrospective longitudinal study.
Participants: Seventy-two eyes from 41 glaucoma patients followed within a period of 5 years.
Main outcome measure: Rate of change of average and clock hour RNFL thicknesses.
Methods: All eyes had at least 4 serial RNFL measurements obtained with the Stratus OCT, and with the first and last measurements separated by at least 3 years. Visual field (VF) was performed with Humphrey VF analyzer at the same visits of RNFL imaging. Serial average and clock hour RNFLT were analyzed with a trend-based algorithm Guided Progression Analysis (GPA), which is a linear regression between RNFLT and age. VF progression was analyzed with linear regression between MD and age. Specificity was estimated by the proportion of eyes with significant improvement. Regression analysis was performed to investigate the relationship between age, refraction, baseline RNFL thickness and the rate of change of average RNFLT.
Results: A total of 586 OCT scan visits were included and the median number of OCT scans for each eye was 9.5. GPA (average RNFLT) detected more eyes (19 eyes) with progression compared with trend analysis with visual field MD (12 eyes) at specificity of 95%-99%. The rate of average RNFLT progression ranged between -1.1 and -15.4 µm/year. The agreement between progression by GPA (average RNFLT) and VF MD was poor. Seven o'clock, which corresponds to the inferotemporal sector, was the most frequent location that showed a significant trend of progression. Baseline RNFL thickness was positively correlated with the rate of RNFL reduction.
Conclusions: GPA offers a new approach to analyze localized and diffuse loss of RNFLT. The rate of RNFLT reduction was variable among glaucoma patients with a higher rate of reduction in patients with a higher baseline RNFLT value.
References:
1. Wollstein G, Schuman JS, Price LL, et al. Optical coherence tomography longitudinal evaluation of retinal nerve fiber layer thickness in glaucoma. Arch Ophthalmol 2005; 123: 464-470. 2. Leung CK, Cheung CY, Lin D, et al. Longitudinal variability of optic disc and retinal nerve fiber layer measurements. Invest Ophthalmol Vis Sci 2008; 49: 4886-4892. 3. Artes PH, Chauhan BC. Longitudinal changes in the visual field and optic disc in glaucoma. Prog Retin Eye Res 2005; 24: 333-354. 4. Strouthidis NG, Scott A, Peter NM, et al. Optic disc and visual field progression in ocular hypertensive subjects: detection rates, specificity, and agreement. Invest Ophthalmol Vis Sci 2006; 47: 2904-2910. 5. Budenz DL, Anderson DR, Varma R, et al. Determinants of normal retinal nerve fiber layer thickness measured by Stratus OCT. Ophthalmology 2007; 114: 1046-1052.

D04.1 STRUCTURE AND FUNCTIONAL PARAMETERS THAT PREDICT PROGRESSION

D04.1-03 PREDICTION OF GLAUCOMA PROGRESSION USING GDX AND OCT
D.S. Greenfield
Miami, USA

Description: Established risk factors for the progression of ocular hypertension to glaucoma include increased age, intraocular pressure, cup-disc ratio, optic disc hemorrhage, and reduced central corneal thickness. The Confocal Scanning Laser Ophthalmoscopy (CSLO) ancillary study to the Ocular Hypertension Treatment Study (OHTS) was the first evidenced-based validation for a glaucoma imaging technology and provided evidence that when the optic disc and standard visual field is normal, certain optic disc features obtained using baseline HRT imaging are predictive of the development of the development of primary open-angle glaucoma in patients with OHT. In the multivariate analysis, an abnormal global, nasal inferior, and temporal inferior MRA classification increased the risk of POAG by 3.4-, 4.2-, and 5.8-fold, respectively. Similar studies have been published using GDx and Stratus OCT. Mohammadi and colleagues prospectively studied 160 glaucoma suspects for a median of approximately 3 years and multivariate models adjusted for age, IOP, and central corneal thickness demonstrated that the following GDx parameters were significant predictors of VF conversion: inferior ratio, ellipse modulation, and UCSD linear discriminant function. Lalezary and colleagues studied 116 eyes prospectively enrolled in the Diagnostic Innovations in Glaucoma Study (DIGS) and reported that baseline RNFL thinning using Stratus OCT is predictive of future glaucomatous change in glaucoma suspects. Multivariate analysis adjusted for age, IOP, CCT, and SAP pattern standard deviation (PSD), 10-µm thinner baseline RNFL measurements in the average, superior and inferior quadrants on OCT were significant predictors of the development of glaucoma progression (hazard ratio [95% CI] 1.51 [1.11-2.12], 1.57 [1.17-2.18], and 1.49 [1.19-1.91], respectively). Although presently unavailable, predictive models of global risk assessment will undoubtedly evolve that incorporate structural assessments of the optic disc and RNFL in patients with established glaucomatous optic neuropathy and visual field loss.

D04.1- 04 SELECTIVE TESTS OF FUNCTION (FDT,SWAP) THAT PREDICT PROGRESSION
Ch.A. Johnson
Portland, USA

Objective: At the end of this lecture, the attendees will understand the various levels of scientific evidence, what findings are supported by sound evidence, what is the level of the evidence, and what is still not well understood or adequately documented. This information can improve the approach to detecting angle closure glaucoma. In addition, it will highlight new areas of research.
Description: Using an evidenced-based approach this lecture will present our current knowledge of the detection of primary angle closure glaucoma. Areas where consensus has not been reached and more research is needed will also be presented.

D04.1-05 DISC HEMORRHAGE AND RETINAL NERVE FIBER LAYER DEFECT IN NORMAL-TENSION GLAUCOMA
Kazuhisa Sugiyama
Kanazawa, Japan

Description: Disc hemorrhage (DH) has been reported to be a significant negative prognostic factor in patients with normal-tension glaucoma (NTG) and may be a sign of progressive damage of the retinal nerve fiber layer, leading to deterioration of the visual field. We investigated the difference in clinical characteristics between the cases with enlarged retinal nerve fiber layer defect (RNFLD) and stable RNFLD in NTG. We examined the RNFLD using red-free fundus photographs, measured the angle of RNFLD and divided into two groups; one is the enlarged RNFLD cases

which RNFLD enlarged more than 2 degrees and the other is the non-enlarged RNFLD cases, and compared the incidence of DH, visual field loss progression.
We detected the enlargement of RNFLD in 36 of 80 eyes in NTG patients. DH was found in 25 (69.4%) of 36 eyes in the enlarged RNFLD group and in 2 (4.5%) of 44 eyes in the stable RNFLD group. The difference was statistically significant ($P < 0.0001$, χ^2 test). All of 8 eyes exhibited recurrent DH enlarged RNFLD. In 32 eyes (88.9%) of 36 eyes of the enlarged RNFLD group, RNFLD enlarged toward the fovea. Of 37 disc hemorrhages, 30 (81.1%) were coincident in location with RNFLD. DHs located apart from RNFLD were excluded, RNFLD enlarged in the direction of DH in 23 DH (79.3%) of 29 DH. The cumulative probability of progression of visual field loss was significantly greater in patients with the enlarged RNFLD group than in patients with the stable RNFLD group.
The enlargement of RNFLD seems to be closely associated with DH occurrence and the progression of visual field loss.

D04.1-06 HRT
L. Zangwill
La Jolla, USA

Objective: To review the evidence for using the Heidelberg Retina Tomograph (HRT) for: 1. Detecting glaucomatous change over time; 2. Prediction of future glaucomatous changes.
Description: Quantitative methods that facilitate longitudinal analysis of HRT topographic information are continuously changing. Currently, the automated analyses available for detecting change over time include the topographic change analysis (TCA) and the detection of change in normalized stereometric parameters. This presentation will review the strengths and limitations of these and newer methods for HRT change detection including Statistical Image Mapping (SIM) and Proportional Orthogonal Decomposition (POD). Barriers to progression detection such as variability, frequency of testing and image quality will also be discussed. In addition, the evidence for using HRT stereometric parameters in multivariate risk models for the development of glaucoma in ocular hypertensive patients will be reviewed.

D04.2 DETECTING AND ESTABLISHING RATES OF GLAUCOMA FUNCTIONAL PROGRESSION
A. Heijl (chair), D. Garway Heath, B. Bengtsson

Objective: To discuss tools for perimetric progression analysis.
Description: Glaucoma treatment aims at maintaining patient's visual function and related quality of life. Therefore it is suitable to measure visual function. In glaucoma this is best done by perimetry. It may be possible to measure progression using structural parameters, but unfortunately the agreement is poor between the visual field, and disc appearance or nerve fiber layer thickness. Since glaucoma is a progressive disease, we may expect most glaucoma patients to show at least some progression during the course of the disease. This is true only if we are able to follow the patients long enough, and have sensitive methods for measuring progression. Detection of glaucoma progression is typically performed by event analysis flagging visual field deterioration. Important randomized clinical glaucoma trials, *e.g.*, AGIS, CIGTS, EMGT, all had rules for flagging the event of progression. The rules applied in EMGT are now implemented in a commercially available perimeter. If progression occurs in early follow-up the patient is likely to have fast progression, but if it occurs after many years it is most likely that the patient has slow progression may be of limited importance for the patient's visual functional outcome. The rate of progression concept is based on a trend analysis typically presenting the yearly rate of change. The global rate of progression tells how fast or slow the patient is progressing, and is displayed over patient age. This type of analysis is of great help in the clinical management of glaucoma patients, and is of great importance for the patient's functional outcome. Rate of progression, calculated using the global MD index over time, has been commercially available for almost 20 years, and is also available with the new VF index designed to be less affected by increasing cataract.

10.00 – 10.45 a.m.

D05 EPIDEMIOLOGY AND SCREENING

D05-01 WHICH POPULATIONS SHOULD BE SCREENED FOR POAG
D.S. Friedman
Baltimore, USA

D05-02 FUNDAMENTAL ISSUES RELATED TO SCREENING FOR DISEASE
R. Wilson
Denver, USA

D05-03 WHERE DO WE STAND WITH ANGLE-CLOSURE GLAUCOMA SCREENING?
A. Azuara Blanco
Aberdeen, UK

D05-04 WHAT WILL SCREENING FOR GLAUCOMA LOOK LIKE IN 10 YEARS?
Paul R. Healey
Westmead, Australia

Objective: To describe the possible impacts of current research on glaucoma screening.
Description: Glaucoma screening is currently characterized by an ad-hoc, opportunistic approach by optometrists and ophthalmologists based on poorly defined criteria. Research currently planned or underway should lead to a major change in approach over the next ten years. By 2019 a simple, inexpensive and reasonably accurate screening test should be able to detect visually important disease. Genetic risk factor profiling may play an important part in glaucoma risk analysis. With a better understanding of the relationship between ophthalmic end points (visual field and disc damage) and disability, screening trials should show which portion of the population should be screened and the frequency of testing. Better understanding of progression and monitoring should reduce cost of delivery of glaucoma care. These factors will allow standardized glaucoma screening to have positive cost-benefit and allow widespread screening programs to greatly improve global eye health.

D05-05 SHOULD POPULATIONS WITH HIGH RATES OF PXF BE SCREENED MORE FREQUENTLY?

F. Topouzis
Thessaloniki, Greece

Description: The goal of glaucoma screening is to prevent visual impairment, preserve quality of life and visual functioning. There are many reasons why screening for glaucoma remains a challenge, both in the community and in populations. These include, among others, the absence of a universal glaucoma definition so as to determine the burden of the disease, missing data on glaucoma prevalence in several important regions of the world, limited knowledge on the natural history of glaucoma and the lack of an 'optimal' single test or combination of tests for screening glaucoma. Several analysts have concluded that general screening for open-angle glaucoma is not cost-effective. In this context, it has been suggested that screening yield might be important by limiting screening to those with risk factors for glaucoma. Results from population-based studies where pseudoexfoliation (PXF) was assessed are consistent on its role as an important risk factor for glaucoma. Also, the proportion of glaucoma among subjects with PXF has been reported to be much higher than that of glaucoma among subjects without PXF. Therefore, one may suggest that populations with high rates of PXF may be more likely to fulfill criteria for screening in terms of cost-effectiveness. However, PXF glaucoma is less likely to remain undiagnosed compared to primary open-angle glaucoma according to the Thessaloniki Eye Study findings. This, in a way, may limit the anticipated additional yield of a population-based screening process for new glaucoma cases identification in populations with high rates of PXF. The objective of this lecture is to discuss cost-effectiveness and practical issues with regards to screening in populations with high rates of PXF.

10.45 – 11.30 a.m.

D06.1 CEREBROSPINAL FLUID PRESSURE IN GLAUCOMA

R. Ren[1], J.B. Jonas[2], N.L. Wang[3]
[1]Beijing Institute of Ophthalmology, Beijing Tong Ren Hospital, Beijing, China, [2]Department of Ophthalmology, Medical Faculty Mannheim of the Ruprecht-Karls-Universität, Mannheim, Germany, [3]Beijing Tong Ren Hospital, Beijing, China

Purpose: To assess whether a low cerebrospinal fluid pressure (CSF-P) is associated with open-angle glaucoma with normal intraocular pressure (IOP).
Design: A prospective study.
Participants and controls: The study included 43 patients with open-angle glaucoma (14 patients with normal IOP and 29 patients with elevated IOP) and 71 subjects of a control group without glaucoma.
Main outcome measure: All patients underwent measurement of lumbar CSF-P and IOP.
Results: Lumbar CSF-P was significantly ($P < 0.001$) lower in the normal-IOP glaucoma group (9.5 ± 2.2 mmHg) than in the high-IOP glaucoma group (11.7 ± 2.7 mmHg) or the control group (12.9 ± 1.9 mmHg). The trans-lamina cribrosa pressure difference (IOP minus CSF-P) was significantly ($P < 0.001$) higher in the normal-IOP glaucoma group (6.6 ± 3.6 mmHg) and the high-IOP glaucoma group (12.5 ± 4.1 mmHg) than in the control group (1.4 ± 1.7). The amount of glaucomatous optic nerve damage was negatively correlated with the height of CSF-P and positively with the trans-lamina cribrosa pressure difference. In the control group, CSF-P was significantly correlated with systolic blood pressure ($P = 0.04$) and IOP ($P < 0.001$). The trans-lamina cribrosa pressure difference was not significantly associated with blood pressure ($P = 0.97$).
Conclusion: In open-angle glaucoma with normal IOP, CSF-P is abnormally low leading to an abnormally high trans-lamina cribrosa pressure difference. Pathogenetically, a low CSF-P in normal-IOP glaucoma may be similar to a high IOP in high-IOP glaucoma. Consequently, glaucomatous optic nerve damage was positively correlated with the trans-lamina cribrosa pressure difference and inversely correlated with the CSF-P. In non-glaucomatous subjects, CSF-P, blood pressure and IOP are significantly associated with each other.
References:

1. Yablonski M, Ritch R, Pokorny KS. Effect of decreased intracranial pressure on optic disc. Invest Ophthalmol Vis Sci 1979; 18(Suppl):165. 2. Morgan WH, Yu DY, Cooper RL, Alder VA, Cringle SJ, Constable IJ. The influence of cerebrospinal fluid pressure on the lamina cribrosa tissue pressure gradient. Invest Ophthalmol Vis Sci 1995; 36: 1163-1172. 3. Morgan WH, Chauhan BC, Yu DY, Cringle SJ, Alder VA, House PH. Optic disc movement with variations in intraocular and cerebrospinal fluid pressure. Invest Ophthalmol Vis Sci 2002; 43: 3236-3242. 4. Berdahl JP, Allingham RR and Johnson DH (Cerebrospinal fluid pressure is decreased in primary open-angle glaucoma. Ophthalmology 2008; 115: 763-768. 5. Hayreh SS. Optic disc edema in raised intracranial pressure. V. Pathogenesis. Arch Ophthalmol 1977; 95: 1553-1565. 6. Mitchell P, Lee AJ, Wang JJ, Rochtchina E. Intraocular pressure over the clinical range of blood pressure: blue mountains eye study findings. Am J Ophthalmol 2005; 140: 131-132. 7. Xu L, Wang H, Wang Y, Jonas JB. Intraocular pressure correlated with arterial blood pressure. The Beijing Eye Study. Am J Ophthalmol; 2007; 144: 461-462. 8. Lashutka MK, Chandra A, Murray HN, Phillips GS, Hiestand BC. The relationship of intraocular pressure to intracranial pressure. Ann Emerg Med 2004; 43: 585-591.

D06.2 24-H DIURNAL OCULAR PERFUSION PRESSURE IN PRIMARY OPEN-ANGLE GLAUCOMA

V.P. Costa[1], J. Jimenez-Roman[2], F. Gil Carrasco[2], A. Harris[3]
[1]University of Campinas, Sao Paulo, Brazil, [2]Associacion Para Evitar la Ceguera, Mexico, Mexico, [3]University of Indiana, Indianapolis, USA

Purpose: To compare the 24-hour IOP, blood pressure (BP), and perfusion pressure (PP) of primary open-angle glaucoma (POAG) patients and healthy individuals.
Design: Prospective, comparative series. Participants: 24 healthy individuals and 29 POAG patients were prospectively recruited. Exclusion criteria for both groups were: a) previous intraocular surgery or laser procedure; b) systemic hypertension, diabetes mellitus, or any other disease that may affect arterial BP; c) use of vasoactive medications that could influence BP measurements; d) presence of other ophthalmic diseases.
Methods: Individuals were admitted at the Hospital and underwent IOP and BP measurements every 2 hours, starting at 8:00 AM until 6:00 AM of the next morning. IOP measurements were made by a masked observer with a Goldmann tonometer at the slit-lamp from 8:00 AM to 10:00 PM and with

the Perkins tonometer, with the patient in supine position, from 12:00AM to 6:00 AM. Systolic and diastolic BP (SDP and DBP) measurements were performed with an automated device, which remained on the right arm of the patient.
Main outcome measures: Intraocular pressure, diastolic and systolic blood pressures, systolic and diastolic perfusion pressures. IOP, blood pressure and perfusion pressure fluctuation (defined as the difference between the highest and lowest measurement throughout 24 hs).
Results: Mean age, race and gender distributions did not differ significantly between the groups ($P > 0.05$). Mean IOP measurements in POAG patients were significantly higher than those obtained in controls at all time intervals ($P < 0.001$). Mean SBP was significantly higher in POAG patients from 4:00 AM to 10:00 AM, and also at 2:00 PM and 6:00 PM ($p < 0.05$). Mean DBP was significantly higher in POAG patients at 8:00 AM and 10:00 AM ($p < 0.01$), but was significantly lower in POAG patients at 4:00 AM ($p = 0.025$). Mean SPP was significantly higher in POAG patients at 8:00 AM and 10:00 AM ($p < 0.01$). Mean DPP was significantly lower in POAG patients at night, from 12:00 AM to 6:00 AM ($p < 0.05$) Mean IOP fluctuation was significantly higher for POAG patients ($p < 0.001$). There was no significant difference regarding blood pressure and perfusion pressure fluctuations between the groups ($p > 0.05$).
Conclusion: POAG patients show a distinct diurnal behavior of PP. Although higher SPPs are observed in POAG patients during the morning, lower DPPs are found during the night.
References:
1. Quigley HA, West SK, Rodriguez J, et al. The prevalence of glaucoma in a population-based study of Hispanic subjects: Proyecto VER. Arch Ophthalmol 2001; 119: 1819-1826. 2. Leske MC, Heijl A, Hyman L, et al. EMGT Group. Predictors of long-term progression in the Early Manifest Glaucoma Trial. Ophthalmology 2007; 114: 1965-1972. 3. Tielsch JM, Katz J, Sommer A, et al. Hypertension, perfusion pressure, and primary open-angle glaucoma. A population-based assessment. Arch Ophthalmol 1995; 113: 216-221. 4. Leske MC, Connell AM, Wu SY, et al. Risk factors for open-angle glaucoma. The Barbados Eye Study. Arch Ophthalmol 1995; 113: 918-924. 5. Mitchell P, Smith W, Attebo K, et al. Prevalence of open-angle glaucoma in Australia. The Blue Mountains Eye Study. Ophthalmology 1996; 103: 1661-1669. 6. Bonomi L, Marchini G, Marraffa M, et al. Vascular risk factors for primary open angle glaucoma: the Egna-Neumarkt Study. Ophthalmology 2000; 107: 1287-1293.

D06 CLINICAL USE OF RISK FACTOR INFORMATION

D06-01
A.L. Coleman
Los Angeles, USA

D06-02
T. Yamamoto
Gifu, Japan

D06-03 CENTRAL CORNEAL THICKNESS AS A RISK FACTOR FOR GLAUCOMA
J. Brandt
Sacramento, USA

Objective: To discuss the development, usage, and caveats of risk calculators, as well as the evidence for IOP fluctuation as a risk factor for glaucomatous progression.
***Description*:** Researchers have developed multivariate risk calculators that predict the risk of developing glaucoma from ocular hypertension. These calculators simplify complex clinical trial results and facilitate application to individual patients. However, these risk calculators can be misused and applied inappropriately. IOP fluctuation and its role in glaucomatous progression is controversial. I will discuss the evidence for IOP fluctuation as a risk factor for glaucoma using a causation model.

D06-04 IOP-RELATED RISK FACTORS (INCLUDING IOP FLUCTUATION)
S.L.M. Mansberger
Portland, USA

D06-05 SYSTEMIC MEDICATIONS AND HYPERTENSION AS RISK FACTORS
S. Miglior
Milan, Italy

D06-06 VASCULAR RISK FACTORS FOR GLAUCOMA (EXCLUDING SYSTEMIC HYPERTENSION)
R. Susanna
Sao Paulo, Brazil

D06-07 RISK FACTORS FOR PRIMARY ANGLE-CLOSURE
P. RojanaPongpun
Bangkok, Thailand

10.00 – 11.30 a.m.

D07 NEW IDEAS

D07-02 PREAPOPTOTIC RETINAL GANGLION CELL DEGENERATION IN GLAUCOMA
J. Morgan
Cardiff, UK

Description: Major advances have been made in our understanding of the cellular events that precede neuronal death. Neurons undergo prolonged periods of compromise and structural change prior to the activation of cell death pathways in which mitochondrial dysfunction is a key initiating event. From a biological perspective the ability to detect these changes in vivo, prior to the point at which cells are fully committed to cell death, would be of great benefit in the management of glaucoma, since it would allow the precise timing for the administration of therapeutic agents for the prevention of cell death. For the purposes of detecting these changes in vivo, the dimensions of subcellular organelles such as the mitochondria are critical. In their discrete form they are 0.7- 4 um in length, and are thus close to the wavelength of the light used in OCT (0.7-.08 um). They therefore represent ideal optical candidates for detection of these early cellular changes since the scattering coefficient is maximal when the target is close to the illuminating wavelength. The development of ultrahigh resolution optical coherence tomography (UHR-OCT) allows tissue to be imaged in vitro with an image resolution better than 2 μm.
3-D UHR OCT was performed using a microscope, with 1-2 um isotropic (axial and transverse) resolution, employing a compact, commercially available ultrabroad bandwidth (up to 200 nm) titanium: sapphire laser, in combination with a high

numerical aperture (~ 0.4-.05) microscope objective at video-rates (up to 25 B-scans/second). In this project we aim for the first time to image single cells and detect pre-apoptotic signatures using UHR-OCT. Cells from a retinal ganglion cell line (RGC-5) were seeded onto glass coverslips and cells were treated with 1 µm Staurosporine to induce apoptosis. Cells were also incubated with the mitochondrial tracker dye CMxRos in culture medium for 20 minutes at 37°C before fixing with 1% paraformaldehyde, after which cells were labelled for apoptotic markers. During apoptosis different death stimuli target the mitochondria and stimulate the release of pro-apoptotic factors, including cytochrome c, which leads to the activation of the caspase cascade. Figure 1 shows that apoptosis has been initiated during the first 60-90 mins in culture with Staurosporine, indicated by the detection of active caspase 3 and cytochrome c in the cytosol of the cells, the lack of TUNEL labelling indicates that these cells are not yet apoptotic. Live cell images were obtained at a sampling 1024 x 466 x 1024 voxel at 20 Mvx/s, at 800 nm central wavelength and a bandwidth of 230 nm, enabling visualization of sub-cellular structures, images were recorded every 10 mins over a 2 hour time period. Images were analysed using ImageJ to generate 3D representations of cells within the region of interest, a 30 by 400 micron segment of the culture. Granulometry indices (Prodanov et al 2005) were performed to provide an index of subcellular integrity as represented by the structural elements (SE) of the image. The granulometric size density (GSD) increases with the size of the remaining SEs, which we hypothesised, would be expected if mitochondrial fragmentation preceded apoptosis. Figure 2 A-C shows cross-sectional UHR-OCT cell images taken during a 2-hour time period. Granulometry scores (Figure 2D) obtained from en face images increased following the administration of staurosporine (T60 and T90) indicating that healthy cells (T0) have a lower proportion of higher granulometric size density (GSD) compared with cells that are undergoing apoptosis (T120). Our data is consistent with the hypothesis that subcellular changes, occurring prior to programmed cell death, generate optically detectable changes as quantified by granulometric size density analysis. It is important to emphasise that our data is not contingent on the imaging of any given subcellular component- only that subcellular preapoptotic changes generate optical signals that can be detected by OCT. Further work is required to isolate the cellular source of these signals. Our data provides the first evidence that UHR-OCT has the potential to identify neuronal cells that are predisposed to cell death.

D07-03 ESTABLISHMENT OF NEW GLAUCOMA MODEL
M. Aihara
Tokyo, Japan

Description: Based on the fact that IOP reduction is the only evidence-based treatment of glaucoma, several ocular hypertension animal models have been developed. Laser-induced ocular hypertension models from monkey to mouse are available. Mouse is easy to be treated and for genetic modifications, and also to gain the sufficient number of experiment. I want to introduce one useful tool and a new animal model for glaucoma. Transgenic mice expressing fluorescent protein in retinal ganglion cells facilitate us to detect the subtle changes of RGC loss over time by fluorescent microscope without any insult to label RGC by experimental procedures and also to detect the special loss of axons in the optic paths. We also established a new ocular hypertension model with ferret, which is useful animal with a binocular vision to investigate the cerebral changes associated with glaucoma.

D07-05 DECREASED CEREBRAL BLOOD FLOW IN HUMAN GLAUCOMA
R. Duncan
La Jolla, USA

Objective: Primary open-angle glaucoma (POAG) is a neurodegenerative disorder known to affect the lateral geniculate nuclei (LGN) and the primary visual cortex (V1). However, in vivo evidence of human glaucomatous neurodegeneration is lacking. Consequently, we have developed functional magnetic resonance imaging (fMRI) methods to measure changes in cerebral blood flow (CBF) associated with glaucomatous neurodegeneration. Arterial spin labeling (ASL) is a non-invasive fMRI method that can measure resting CBF in the absence of visual stimulation. Thus, ASL is well suited for inferring which regions of the cortex might be damaged by ischemia or reperfusion injury.
Description: Ten patients with POAG participated in a cross-sectional study design. Visual function was tested using standard automated perimetry (SITA-SAP) and short-wavelength automated perimetry (SITA-SWAP). Mean pattern deviation values were computed for the combined superior and inferior hemifields of each subject (PD_{MEAN}). Standard blood oxygen level dependent (BOLD) fMRI methods were used to obtain retinotopic maps of dorsal and ventral V1. Mean resting CBF in dorsal and ventral V1 (CBF_{MEAN}) was measured using ASL fMRI. Patients were not presented with visual stimulation during the ASL scans. For both tests of visual function, the superior-inferior difference in visual function (ΔPD_{MEAN}) was correlated with the dorsal-ventral difference in cerebral blood flow (ΔCBF_{MEAN}). The correlation statistics (r-values) between ΔPD_{MEAN} and ΔCBF_{MEAN} for SITA-SAP and SITA-SWAP were 0.49 and 0.64, respectively (all $p < 0.05$). Thus, the severity of vision loss in glaucoma is correlated with chronic alterations of resting blood perfusion in V1. ASL fMRI may be used to measure changes in chronic blood perfusion that are associated with glaucomatous neurodegeneration.

D07-06 COMPARTMENTALIZED RGC DAMAGE
S. John

Description: Glaucoma is a common neurodegenerative disease that affects retinal ganglion cells (RGCs). As in various neurodegenerative diseases, a large research effort focuses on characterizing apoptotic self-destruct pathways that kill neurons. However, apoptosis is not the only self-destruct mechanism that damages neurons. It is now known that neurons have distinct classes of self-destruct program that are spatially localized in different compartments of the neuron. RGCs are no exception to this. Recent data, from in-vitro studies and from an inherited mouse model of glaucoma, suggest that molecularly distinct degenerative pathways underlie the destruction of RGC somata and RGC axons. In various neurodegenerative diseases, axons, dendrites and synapses often degenerate well before the cells die. Work from our lab and others suggest that compartmentalised molecular programmes are of critical importance in the pathophysiology of glaucoma, and we suggest that studies of these processes are essential for a complete understanding of this complex disease.

D07-07 IMPACT OF LONGITUDINAL CHANGE IN THE ANTERIOR CHAMBER DEPTH IN GLAUCOMA
K. Kashiwagi
Yamanashi, Japan

D07-08 CELLULAR INTERACTINOS IN RETINAL CELL SURVIVAL
J. Sahel
Paris, France

Description: It is clear that cellular interactions play a crucial role in the faith of most hereditary non-congenital retinal degeneration. Indeed, the cascade of cellular events triggered by deleterious mutations largely determines the clinical outcome of these diseases, often even more than the initial mutation itself. Secondary neuronal degeneration is usually a very slow process, that begins early in life in the case of retinitis pigmentosa (RP). This offers theoretically a large therapeutic window for neuroprotective strategies. On the other hand, this slow progression creates a challenge for therapeutic evaluation, especially if the goal is function preservation rather than restoration. In this regard, high-resolution imaging of individual photoreceptors such as obtained by adaptive optics is crucial to appreciate the progression of degeneration. Of particular interest in RP is that adaptive optics seems to specifically image cone outer segments, which is the structure at risk during RP. Determining the cause of secondary neuronal degeneration, especially of cone degeneration, is a matter of active search by several laboratories in the world. We pioneered the discovery of rod-derived trophic factors for cones, and have identified yet two such factors that will soon undergo clinical trials. Other factors may participate to secondary neuronal degeneration as well. For instance, it is clear that there is a low-grade inflammation during RP, the mechanism of which has not been clearly identified. Microglial activation may be involved. In order to document the in vivo behavior of microglial cells during retinal degeneration, we have been developing in vivo microglial labeling procedures. We will present preliminary data of microglial locomotion in rodents, which show that microglial locomotion is a complex process persisting several days after local damage. Thus, in vivo follow-up of retinal degeneration and of microglial activation may further help to uncover novel therapeutic strategies for RP.

D07-09 NEW INSIGHTS INTO RETINAL GANGLION CELL OXYGENIZATION
G. Tezel
Louisville, USA

Description: Recent evidence of hemoglobin expression in retinal ganglion cells and glia provides new insights into retinal oxygenation with important implications in glaucoma. Retinal hemoglobin expression is regulated by hypoxia through hypoxia-inducible factor 1α/erythropoietin signaling. Hypoxia-regulated hemoglobin expression appears to be a compensatory mechanism facilitating oxygen transport to retinal ganglion cells, and perhaps also providing free radical scavenging and nitric oxide detoxification. An insufficiency and/or dysfunction of such an intrinsic protective mechanism against hypoxic/oxidative injury may open a new perspective in glaucoma, selective hypoxia of retinal ganglion cells even in the existence of sufficient vascular perfusion.

Friday, July 10, 2009

08.30-9.15 a.m.

D08 IOP, FLUCTUATION, CCT, REFRACTIVE SURGERY, CONSENSUS

D08.1 INTRAOCULAR PRESSURE FLUCTUATION AND ASSOCIATED RISK FACTORS IN EYES WITH ANGLE CLOSURE
R.S. Kumar[1], M. Baskaran[1], C.G. Vallei[2], M.H. Hla[1], C.Y. Wong[2], S.A. Perera[2], T.L. Wong[2], T. Aung[2]
[1]Singapore Eye Research Institute, Singapore, Singapore, [2]Singapore National Eye Center, Singapore, Singapore

Objective: To investigate diurnal intraocular pressure (IOP) fluctuation in eyes with angle closure in comparison with normal subjects, and to look for associated risk factors for IOP fluctuation.
Design: Prospective case-control study.
Participants: Ninety-eight Asian subjects with angle closure (consisting of 32 primary angle closure suspects (PACS), 34 primary angle closure (PAC) and 32 subjects with primary angle closure glaucoma [PACG]) and 21 normal control subjects.
Methods: PAC/PACG subjects were enrolled after laser peripheral iridotomy but before commencement of any medical or surgical treatment. Ophthalmic examination including dynamic gonioscopy and automated perimetry were performed, and diurnal IOP measurements were made using non-contact air puff tonometry at hourly intervals between 8 am-5 pm. Multiple linear regression analysis was performed to study the association of IOP fluctuation with clinical variables such as age, extent of peripheral anterior synechiae (PAS), central corneal thickness, vertical cup-disc ratio and pattern standard deviation (PSD) on automated perimetry.
Main outcome measures: Comparison of mean diurnal IOP, peak diurnal IOP, trough IOP and IOP fluctuation (peak IOP – through IOP) between groups.
Results: The majority of subjects were Chinese (89.1%) and female (61.3%). IOP fluctuation was significantly higher in PACG (5.4 ± 2.4 mmHg) and PAC (4.5 ± 2.3 mmHg) subjects compared to PACS (3.7 ± 1.2 mmHg) and normal controls (3.8 ± 1.1 mmHg) ($p = 0.005$), with highest IOP found in the early morning. Combined PACG/PAC group had more than twice the risk (OR 2.38, 95%CI = 1.1-5.1, $p = 0.025$) of having IOP fluctuation > 3 mmHg compared to PACS/normal groups. Extent of PAS (Pearson's $r = 0.37$; $p = 0.0001$) and visual field PSD (Pearson's $r = 0.34$; $p = 0.0002$) were found to be associated with greater IOP fluctuation.
Conclusions: PACG and PAC eyes showed diurnal IOP fluctuation of 4-5 mm Hg, and the fluctuation was higher than in PACS eyes and normal controls. The degree of PAS and visual field loss were associated with IOP fluctuation in PAC/PACG eyes.
References:
1. Asrani S, Zeimer R, Wilensky J, et al. Large diurnal fluctuations in intraocular pressure are an independent risk factor in patients with glaucoma. J Glaucoma 2000; 9: 134-142. 2. Saccà SC, Rolando M, Marletta A, et al. Fluctuations of intraocular pressure during the day in open-angle glaucoma, normal-tension glaucoma and normal subjects. Ophthalmologica 1998; 212: 115-119. 3. Sihota R, Saxena R, Gogoi

M, et al. A comparison of the circadian rhythm of intraocular pressure in primary chronic angle closure glaucoma, primary open angle glaucoma and normal eyes. Indian J Ophthalmol 2005; 53: 243-247. 4. Aung T, Lim MC, Chan YH, et al; For the EXACT study group. Configuration of the drainage angle, Intraocular pressure, and optic disc cupping in subjects with chronic angle closure glaucoma. Ophthalmology 2005; 112: 28-32. 5. Ogbuehi KC. Assessment of the accuracy and reliability of the Topcon CT80 non-contact tonometer. Clin Exp Optom 2006; 89: 310-314.

D08-01 WORLD GLAUCOMA ASSOCIATION IOP CONSENSUS

J. Brandt
Sacramento, USA

Description: In 2007 a panel of the World Glaucoma Association met online and at a satellite meeting at ARVO to arrive at a consensus regarding intraocular pressure (IOP) – its basic science, measurement, epidemiology, role as a risk factor. The panel also addressed the role of IOP in clinical trials and the use of a 'target' IOP in clinical practice. In this brief talk I will present the highlights of the final consensus document, which include statements related to central corneal thickness, the precision, accuracy and agreement of various tonometers, the role of IOP and IOP fluctuation as a risk factor for glaucoma, the contradictory data available regarding the epidemiology of IOP, recommendations for the design of clinical trials where IOP is a major endpoint, and the use of target IOP in the clinical management of patients.

D08-02 SHORT-TERM IOP FLUCTUATION (DIURNAL)

M. Irkec
Ankara, Turkey

Description: The issue of whether ophthalmologists are most concerned about the mean intraocular pressure (IOP) over time, the IOP fluctuations over time or peak pressures over a safe level is still argued. In other words, still we do not have sufficient evidence for assessing that IOP fluctuation is a separate and independent risk factor for glaucoma. Short-term fluctuations can occur over hours or days and can be subdivided into daytime and nocturnal variations. Circadian IOP fluctuations occur both in healthy and glaucomatous eyes, however, during the diurnal period, IOP fluctuates more in glaucomatous patients compared to normal's. Twenty-four-hour fluctuations of 8 to 10 mmHg have potentially harmful effects on the optic nerves. On the other hand, the diurnal IOP variation in the sitting as well as in the supine position has been shown to be larger in glaucomatous eyes than in normal eyes. From the clinical point of view, 24-hour IOP measurements are almost very difficult to perform. Some authors have suggested that short-term fluctuation could be a risk factor for glaucoma. In Asrani study it has been concluded that large diurnal IOP fluctuations are a significant risk factor for visual field progression independent of the IOP level. On the contrary, another study failed to support the concept that a large 24-hour IOP variation is associated with early glaucomatous changes. So far, studies have shown inconsistent results as to whether IOP variation constitutes a risk factor for glaucoma.

D08-03 CENTRAL CORNEAL THICKNESS

L.W. Herndon, Jr
Durham, USA

Description: The relevance of central corneal thickness to glaucoma diagnosis isn't a new idea. It was first discussed 25 or 30 years ago, although it wasn't widely covered in American journals until about 10 years ago. However, the nuances of the relationship between glaucoma and CCT continue to unfold, both in terms of IOP and possible connections between CCT and other anatomical features such as nerve fiber layer thickness. *The biomechanics factor:* One of the most interesting developments in the past few years has been the revelation that corneal biomechanics – the physical characteristics of corneal tissue – may affect the accuracy of IOP applanation measurement as much as, or even more than, CCT. Goldmann applanation tonometry measures IOP by flattening the cornea, which is not neutral in this measurement. A stiff cornea requires greater force to applanate than a soft one, leading to overestimation of IOP. Biological variability likely encompasses both thick, soft corneas and thin, stiff corneas. Theory predicts that the accuracy of the measurement is predominantly influenced by biomechanical properties, rather than CCT. This is illustrated in the pathologic case of Fuchs' corneal dystrophy, in which edema results in a thick, soft cornea. Goldmann IOP tends to generate low readings despite very thick corneas. As a result of this new perspective, researchers are studying new parameters including corneal hysteresis, which is a measure of corneal viscoelasticity, or time-dependent response to an air puff. Currently, the only instrument that can measure corneal hysteresis is the Reichert Ocular Response Analyzer, which uses an air puff to generate both an inward applanation event, as well as an outward applanation event as the cornea recovers its original shape. Data from both applanation events are used to calculate corneal hysteresis, corneal resistance factor, Goldmann-correlated IOP, and a 'corneal compensated' IOP, less affected by corneal properties. Of course, another approach to this problem is to find a way to measure IOP that is unaffected by the cornea's thickness or biomechanical properties. The Pascal Dynamic Contour Tonometer (Zeimer Ophthalmics) is a digital tonometer that uses the principle of contour matching instead of applanation to measure IOP. A recent prospective, *in vivo* clinical study found that IOP measured by the DCT was within 1 mmHg of the intracameral pressure measured manometrically with a reference pressure sensor, over a wide range of pressures. Although there are new tonometers available, clinicians are likely to continue using Goldmann and trying to understand the interaction between CCT, biomechanical properties, and the measurement of IOP.

D08-05 TONOMETRY IN THE REFRACTIVE SURGERY PATIENT

T. Samuelson
Minneapolis, USA

9.15 – 10.00 a.m.

D09 INITIAL TREATMENT FOR GLAUCOMA: MEDICAL VS LASER VS SURGERY

D09-01 INTRODUCTION

R. Susanna
Sao Paulo, Brazil

The decision to treat glaucoma should be made jointly by physician and patient. While the physician has the expertise in the care of the disease, many patient-related factors must be considered. Glaucoma is a chronic disease that is controlled, not cured. This implies a partnership. Several choices are available for the initial treatment of glaucoma and include medical therapy, laser surgery, and incisional surgery. There may be patients for whom there is a clear and obvious choice. For others, the choice of initial therapy must weigh the possible benefits with the potential complications. In this session, the faculty will present various options for initial treatment of glaucoma and relevant data from clinical trials. This information will help the ophthalmologist guide each patient to an appropriate choice for initial therapy of glaucoma.

D09-02 RANDOMIZED CLINILCAL TRIALS – DESIGNS

F.J. Goni
Barcelona, Spain

Description: During the last years the development of different fixed combinations of ocular hypotensive drugs has lead to changes in prescription habits of ophthalmologists. Guidelines support the use of a monotherapy to start medical glaucoma treatment, but recently voices arise to claim fixed combinations could be prescribed as an alternative first choice when needed. This presentation aims to discuss the rationale to corroborate monotherapy as the first option when medical therapy is selected to start glaucoma treatment.

D09-03 WHY MEDICAL TREATMENT FIRST?

D.E. Grigera
Buenos Aires, Argentina

Objective: To bring in evidence showing that the most reasonable first step of therapy in open-angle glaucoma is medication.
Description: There is no consensus yet as to the initial medication of choice for the beginning of treatment. CIGTS and AGIS have showed us that a strong enough reduction of IOP, obtained with antiglaucomatous medications, may halt damage progression. In the past decade many new drugs have been introduced. These drugs exert few systemic side effects, are very effective in lowering the intraocular pressure and, furthermore, are easier to comply with. In later years the advent of fixed combination alternatives has also brought additional advantages such as less daily dosage, less preservatives and therefore, reduced toxicity and allergy and increased compliance. The hypotensive efficacy of current glaucoma medications is well known. Therefore, the amount of IOP reduction can be tailored to the individual needs with reasonable accuracy. Overtreatment and undertreatment may be easily corrected by adjusting the medication, while excess filtration and underfiltration in glaucoma surgery and other complications may pose more complex problems. The duration of effect of laser therapy is not predictable for the individual and it cannot be attempted in angles narrower than 2 in Shaffer´s classification. CIGTS and AGIS demonstrate that eyes that underwent trabeculectomy are prone to increased incidence of subsequent cataract extraction. Cataract surgery following trabeculectomy may in some cases impair function of the latter. Strikingly, in CIGTS, the surgery group reported more local eye symptoms than the medication group. CIGTS investigators did not recommend changes to the current approach to managing newly diagnosed open-angle glaucoma patients. At present, most patients with open-angle glaucoma are started on medical therapy.

D09-04 WHY LASER SURGERY FIRST?

T. Realini

Laser trabeculoplasty is a safe and effective means of achieving reduction of intraocular pressure, but its place in the stepped treatment of glaucoma has remained poorly defined. Initially utilized as a means of avoiding surgery in patients using maximal tolerated medical therapy, trabeculoplasty is now commonly utilized as primary therapy. What has fueled this transition to earlier trabeculoplasty in glaucoma management? In this presentation, we will review the data supporting the role of early trabeculoplasty. We will also discuss the advantages and disadvantages of primary trabeculoplasty in the management of newly-diagnosed glaucoma.

D09-05 WHY INCISIONAL SURGERY FIRST?

G.L. Skuta
Oklahoma City, USA

Past and recent studies have confirmed that incisional glaucoma surgery (trabeculectomy) represents a reasonable and effective option for the initial treatment of open-angle glaucoma. The Moorfields Primary Treatment Trial determined that initial trabeculectomy achieved greater intraocular pressure reductions than initial medical therapy or laser surgery and was more likely to stabilize visual field performance. The Collaborative Initial Glaucoma Treatment Study (CIGTS) showed similar visual acuity and visual field outcomes at five years when the trabeculectomy-first group was compared to the medication-first group. However, recently reported data from CIGTS revealed that in patients with a greater degree of visual field loss (mean deviation of -10 dB or worse), patients who underwent trabeculectomy first were less likely to experience visual field deterioration over eight years than those who were treated with medications first. The results of these and other studies will be reviewed to support the concept that initial incisional glaucoma surgery represents a viable management option.

D09-06 IS COST A CONSIDERATION?

R. Fechtner
Newark, USA

Description: The decision to treat glaucoma should be made jointly by physician and patient. While the physician has the expertise in the care of the disease, there are many patient-related factors to consider. Glaucoma is a chronic disease that is controlled, not cured. This implies a partnership. There are several choices for initial treatment of glaucoma. These include medical therapy, laser surgery, and incision-

al surgery. There may be patients for whom there is a clear and obvious choice. For others the choice of initial therapy must weigh the possible benefits with the potential complications. In this session the faculty will present various options for initial treatment of glaucoma and relevant data from clinical trials. This information will help the physician guide each patient to an appropriate choice for initial therapy of glaucoma.

Outline: 1. Introduction – overview, goals of treatment, why there is a debate; 2. Randomized clinical trials – designs (not results) of major trials relevant to this session (CIGTS, GLT, EMGT, others as identified by other speakers); 3. Why medical treatment first?; 4. Why laser surgery first?; 5. Why incisional surgery first?; 6. Is cost a consideration? (*e.g.*, Kymes, Vold); 7. Discussion & Summary.

D09-07 DISCUSSION AND SUMMARY

R. Susanna
Sao Paulo, Brazil

8.30 – 10.00 a.m.

D10 SURGICAL MANAGEMENT ACG INCL CONSENSUS

D10.1 INCREASED IRIS THICKNESS, CURVATURE AND VOLUME ARE RISK FACTORS FOR ANGLE CLOSURE

N. Ramli[1], B.S. Wang[1], L.M. Sakata[1], D.S. Friedman[2], Y.H. Chan[3], L. Raghavan[1], H. Mingguang[4], T.Y. Wong[1], T. Aung[1]
[1]Singapore National Eye Centre, Singapore, [2]Wilmer Eye Institute and Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA, [3]Biostatistcis Unit, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, [4]State Key Laboratory of Ophthalmology, Zhongshan Ophthalmic Center, Sun Yat-se, Guangzhou, China

Purpose: To investigate the relationship between iris parameters and risk of angle closure.

Design: Cross-sectional, observational, community-based study.

Participants: two thousand forty-seven subjects over 50 years old without ophthalmic symptoms recruited from a community clinic in Singapore.

Methods: All subjects underwent gonioscopy and anterior segment OCT (AS-OCT imaging under dark conditions. Gonioscopy was performed by a single masked examiner, and angle closure was defined as the presence of at least 180 degrees of angle in which the posterior pigmented trabecular meshwork was not visible on non-indentation gonioscopy in the primary position. Customized software was used on horizontal AS-OCT scans to measure iris parameters. The right eye of all subjects and an average of both temporal and nasal measured values were used for analysis.

Main outcome measures: Iris curvature (I-Curv), Iris area (I-Area) and Iris thickness 750um (IT750) and 2000 um (IT2000) from the scleral spur.

Results: Iris parameters from 1465 eyes (71.6%) were available for analysis. Of these, 315 subjects (21.5%) had angle closure on gonioscopy. Mean I-Curv (0.366 v 0.259 mm, p < 0.001), IT750 (0.476 v 0.453 mm, p < 0.001) and IT2000 (0.491 v 0.482 mm, p = 0.020) were greater in those with than without angle closure. After adjusting for age, gender, anterior chamber depth, axial length and pupil size, greater I-Curv, I-Area, IT750 and IT2000 were significantly associated with angle closure (4th vs 1st quartile, multivariate adjusted odds ratio [OR] 2.5, 95%CI 1.3-5.1; OR 2.7, 95% CI 1.6-4.8; OR 2.6, 95% CI 1.6-4.1; OR 2.7, 95% CI 1.5-4.7; respectively). After stratifying by gender and age, women (but not men) were found to have significant multivariate adjusted ORs for all iris parameters, and subjects aged 60 years or more had significant ORs for I-Area, IT750 and IT2000.

Conclusions: Our findings show that iris curvature, iris area and iris thickness are risk factors for angle closure even after adjusting for other known ocular risk factors. These factors are particularly important in women and those aged 60 years or more.

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D10.2 PHACOEMULSIFICATION VERSUS COMBINED PHACO-TRABECULECTOMY IN CHRONIC ANGLE-CLOSURE GLAUCOMA WITH CATARACT – PROGNOSTIC FACTORS FOR INTRAOCULAR PRESSURE CONTROL

C.Y. Tham[1], Y.L. Leung[1], Y.Y. Kwong[1], S.W. Lam[1], T.Y.H. Chiu[1], J.C.H. Chan[2], F.C.H. Li[1], S.C. Lam[1], S.M. Lai[3]
[1]The Chinese University of Hong Kong, Hong Kong Sar, People's Republic of China, [2]Queen Mary Hospital, Hong Kong Sar, People's Republic of China, [3]The University of Hong Kong, Hong Kong Sar, People's Republic of China

Objective: To identify prognostic factors that predict intraocular pressure (IOP) control after phacoemulsification and combined phaco-trabeculectomy in chronic angle-closure glaucoma (CACG) with coexisting cataract.

Design: Randomized clinical trial.

Participants: One hundred twenty-three CACG eyes with cataract of 123 patients

Intervention: Recruited patients were randomized into receiving either phacoemulsification alone, or combined phaco-trabeculectomy with adjunctive mitomycin C chemotherapy. Post-operatively, patients were reviewed 3-monthly for 2 years. An 'IOP Control Index', defined as the number of IOP-lowering drugs plus 1, and then multiplied by IOP, was created to represent the quality of IOP control. Univariate and multivariate analyses were performed to identify clinical factors significantly associated with the post-operative IOP Control Index.

Main outcome measures: pre-operative clinical factors significantly associated with the post-operative IOP Control Index.

Results: Sixty-two CACG eyes were randomized to receive phacoemulsification alone, and 61 eyes had combined phaco-trabeculectomy. With univariate analysis in the pha-

coemulsification group, the following pre-operative factors were associated with a lower post-operative IOP Control Index: plateau iris configuration ($p = 0.022$), fewer IOP-lowering drugs ($p < 0.001$), lower pre-operative IOP Control Index ($p = 0.001$), and lower pattern standard deviation (PSD) on Humphrey automated perimetry ($p = 0.032$). With univariate analysis in the combined phaco-trabeculectomy group, a low pre-operative IOP ($p = 0.002$) and a low pre-operative IOP Control Index ($p = 0.012$) were found to be associated with a lower post-operative IOP Control Index. With multivariate analysis, the pre-operative IOP Control Index was the only factor significantly associated with the post-operative IOP Control Index, conferring a relative risk [RR] of 1.03 per unit increase (95% confidence interval = 1.01 to 1.06) to Group 2 (poorer control), in both the phacoemulsification group ($p = 0.025$) and the combined phaco-trabeculectomy group ($p = 0.021$).

Conclusion: The IOP Control Index, encompassing both the IOP and the number of IOP-lowering drugs, was created to represent IOP control with a single number. The pre-operative IOP Control Index was found to be the only factor significantly associated with the post-operative IOP Control Index after both phacoemulsification and combined phaco-trabeculectomy in CACG eyes with cataract.

References:

1. Tham CC, Kwong YY, Leung DY, Lam SW, Li FC, Chiu TY, Chan JC, Chan CH, Poon AS, Yick DW, Chi CC, Lam DS, Lai JS. Cataract extraction versus combined phaco-trabeculectomy in medically-controlled chronic angle closure glaucoma with cataract. Ophthalmology 2008; 115: 2167-2173. 2. Tham CC, Kwong YY, Leung DY, Lam SW, Li FC, Chiu TY, Chan JC, Lam DS, Lai JS. Cataract extraction versus combined phaco-trabeculectomy in medically-uncontrolled chronic angle closure glaucoma with cataract. Ophthalmology (in press). 3. Tham CC, Kwong YY, Leung DY, Lam SW, Li FC, Chiu TY, Chan JC, Lam DS, Lai JS. Cataract extraction versus combined phaco-trabeculectomy in chronic angle closure glaucoma with cataract - complications and additional interventions. Submitted to Ophthalmology 2009. 4. Tham CC, Leung DY, Kwong YY, Lam SW, Chiu TY, Chan JC, Li FC, Lam DS, Lai JS. Phacoemulsification versus combined phaco-trabeculectomy in chronic angle closure glaucoma with cataract – prognostic factors for intraocular pressure control. Submitted to Ophthalmology 2009. 5. Tham CC, Baig N, Kwong YY, Leung DY, Li FC, Lai JS, Chan CW, Lam DS. Phacoemulsification versus phaco-trabeculectomy in chronic angle-closure glaucoma with cataract – improvements in quality of life. Submitted to Journal of Cataract and Refractive Surgery 2009.

D10-01

D. Lam
Hong Kong, People's Republic of China

Description: The key challenges for management of primary angle-closure glaucoma are to achieve rapid reduction of intraocular pressure (IOP) during acute primary angle-closure (APAC), reduce the incidence of IOP rise after APAC, and prevent disease progression in chronic angle-closure glaucoma (CACG). Recent advances in aborting acute angle-closure include argon laser peripheral iridoplasty, anterior chamber paracentesis and corneal indentation. Both ALPI and anterior chamber paracentesis have been shown superior to medical treatment in achieving rapid IOP reduction. While laser peripheral iridotomy is the gold standard in preventing recurrence of APAC after initial control of IOP, early cataract extraction is a definitive option to reduce the incidence of IOP rise. Recent randomized control trials have established the role of cataract extraction in controlling IOP and preventing progression in CACG. With existing and upcoming new data on management of PACG, an optimal treatment algorithm would be established.

D10-02

J. Thygesen
Copenhagen, Denmark

D10-03 PROPHYLACTIC LASER IRIDOTOMY FOR NARROW ANGLE

T. Aung
Singapore

D10-04 GLAUCOMA DRAINAGE DEVICES (GDD) – ANY ROLE IN ACG?

P.T.K. Chew
Singapore

D10-05 AN INTEGRATED EVIDENCE-BASED MANAGEMENT APPROACH IN ACG

D.S. Friedman
Baltimore, USA

D10-06 ALTERNATE TREATMENTS (AC PARACENTESIS AND CORNEAL INDENTATION) IN ACUTE ACG

D. Lam
Hong Kong, People's Republic of China

D10-07 FILTRATION SURGERY IN ANGLE-CLOSURE GLAUCOMA

P. Palmberg
Miami, USA

Objective: To discuss important modifications of filtration surgery in the setting of angle-closure glaucoma.

Description: Surgery in the setting of acute angle closure glaucoma requires modifications to reduce the otherwise increased risks of aqueous misdirection, suprachoroidal hemorrhage, choroidal detachment, lens injury and of filtration failure. When initial management of an angle closure fails one is faced with the need to perform filtration surgery in a congested eye. The administration of local anesthesia to a congested eye is more difficult. A superior orbital block can eliminate pain, so that the patient will not feel the administration of a peribulbar block. Since the anesthetic will likely be metabolized more quickly in a congested orbit, and anesthetics will not be as effective in hypoxic, acidic tissue, one should bring the remaining block into the operating room for supplemental application as needed with a blunt canula. The use of a wide conjunctival-Tenon's flap allows one to achieve nearly bloodless surgery, even in a congested eye, as the conjunctiva and Tenon's capsule are only cut at their insertions. The eye should be decompressed quite gradually, to reduce the risk of sudden decompression intraoperatively which might induce a suprachoroidal hemorrhage. The use of a valve-like scleral flap may help to keep the anterior

chamber formed during surgery and to limit any suprachoroidal hemorrhage that might occur. An iridectomy is required to eliminate the pupil block mechanism, and iris repositing is done with external stroking on the cornea. The chamber should be well formed, the IOP adjusted to a high normal pressure at first, and atropine applied, to reduce the risk of aqueous misdirection. The use of MMC greatly increases the chance of filtration success in congested eyes, and frequent post-operative steroid application is indicated.

D10-08 PRE-OPERATIVE ASSESSMENT IN ACG
L. Sakata
Curitiba, Brazil

Objective: To discuss how to incorporate the pre-operative assessment results to indicate the most appropriate surgical or laser procedures for eyes with angle closure glaucoma.
Description: This lecture will focus on the most relevant aspects of a pre-operative clinical assessment of patients with angle closure glaucoma: the severity of the angle closure process and glaucomatous optic neuropathy.

D10-09 GONIOSYNECHIALYSIS (GSL)
H. Tanihara
Kumamoto, Japan

Description: Goniosynechialysis (GSL) is a surgical procedure to relieve peripheral anterior synechiae from the angle structure in order to restore the function of conventional outflow pathway in cases of angle-closure glaucoma. The usefulness of this surgical modality has been shown in many clinical investigations. Also, its combination with lens extraction (and intraocular lens implantation) and/or laser gonioplasty improves long-term surgical outcome. When compared with filtration operation, this non-filtering surgery can achieve success in controlling intraocular pressure without any serious visual-threatening and bleb-related complications. In this presentation, I will talk on surgical techniques, adjunctive use of lens extraction and/or laser gonioplasty, surgical outcome and complications of GSL.

D10-10 LENS EXTRACTION IN ACG
C. Tham
Hong Kong, People's Republic of China

Objective: This presentation aims to help participants develop an evidence-based strategy in the surgical management of ACG.
Description: A series of randomized controlled trials to define the role of lens extraction in acute primary angle closure and chronic angle closure glaucoma have been undertaken and published. The evidence from these trials will be presented, and a management approach with lens extraction as the core procedure for ACG will be discussed.

D10-11 AN OVERVIEW OF SURGICAL OPTIONS IN ACG
J. Thygesen
Copenhagen, Denmark

10.30 – 12.00 p.m.

D11 EMERGING SURGERY

D11.1 MMC-DEEP SCLERECTOMY WITH IMPLANT VERSUS MMC-TRABECULECTOMY IN ADULTS AFFECTED BY ADVANCED OPEN ANGLE GLAUCOMA: A 24-MONTH RANDOMIZED CONTROLLED TRIAL
R. Carassa[1], C. Ciampi[1], P. Bettin[2], M. Fiori[2]
[1]Italian Glaucoma Center, Milano, Italy, [2]Ophthalmology Unit, S. Raffaele Hospital, Milano, Italy

Purpose: Operative complications during and after trabeculectomy may dramatically affect visual function in advanced glaucomatous eyes. Since non-penetrating surgery was shown safer than trabeculectomy, the aim of the present study was to compare safety and efficacy of MMC- Deep Sclerectomy with implant (MMC-DSI) with MMC-Trabeculectomy (MMC-TR) in the treatment of adults affected by advanced open angle glaucoma in a randomized prospective trial.
Methods: Fifty eyes with POAG, PXFG or PDSG, no previous ocular surgery, affected by advanced glaucomatous VF loss (Hodapp classification) with IOP uncontrolled despite MTMT, were randomized to MMC-DSI (group 1) or MMC-TR (group 2). Reticular hyaluronic acid implant or collagen implant were used during MMC-DSI. Cellulose sponges soaked with 0.3 mg/ml MMC were placed for 2 min under the congiunctiva during both surgeries. Post-operative goniopuncture and bleb or flap manipulations were allowed in all eyes when IOP was found > 15 mmHg in 2 consecutive visits. Success was defined as an IOP ≤ 14 mmHg without medications, with a reduction from baseline > 20%, and with a reduction in visual acuity < 2 lines. Results: In group 1 (N = 25, age 54.1 ± 17.0 years), initial and final IOP was 24.8 ± 5.7 mmHg and 11.9 ± 2.3 mmHg (p = 0.000). Complete success at 24 months was 74.1%. In group 2 (N = 25, age 61.3 ± 11.9), initial and final IOP was 23.4 ± 6.9 mmHg and 11.0 ± 2.8 mmHg (p = 0.000). Complete success at 24 months was 67.4%. Seven failures occurred in group 1: 4 eyes needed additional medical therapy, 1 eye had a surgical revision due to iris incarceration, and 2 eyes needed additional surgery for uncontrolled IOP. Group 2 had 8 failures: 3 eyes needed additional medical therapy and 3 eyes had additional surgery for uncontrolled IOP (1 after phaco) and 2 eyes showed a decrease in VA due to persistent hypotony. Complications (group 1 and 2) were choroidals (8% and 24%), persistent IOP < 6 mmHg) (0% and 16%), VA reduction > 2 lines (0% and 8%), cataract (12% and 24%), blebitis (0% and 4%).
Conclusions: MMC-DSI when compared to MMC-TR in advanced open angle glaucomas, provides similar final IOPs with less complications, and this leads to an higher success rate.
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medications or surgery. Ophthalmology 2001; 108: 1943-1953. 4. Shaarawy T, Karlen M, Schnyder C, Achache F, Sanchez E, Mermoud A. Five-year results of deep sclerectomy with collagen implant. J Cataract Refract Surg 2001; 27: 1770-1778. 5. Cillino S, Di Pace F, Casuccio A, Lodato G. Deep sclerectomy versus punch trabeculectomy: effect of low dosage mitomycin C. Ophthalmologica 2005; 219: 281-286.

D11.2 SCHLEMM'S CANAL CROSS-SECTIONAL AREA INCREASES AT COLLECTOR CHANNEL JUNCTIONS

E. Kagemann, G. Wollstein, H. Ishikawa, R.A. Bilonick, M.L. Gabriele, J.S. Schuman
University of Pittsburgh, Pittsburgh, USA

Purpose: Aqueous humor passes through the trabecular meshwork, is collected in Schemm's canal (SC), and drains through collector channels (CC) to scleral veins. Segmental SC aqueous outflow would have open and closed SC segments on imaging, and accumulation of aqueous near SC and collector channel (CC) junctions (SC/CC), while circumferential flow would be expected to show a generally open SC. The purpose of this study was to non-invasively compare cross-sectional SC areas at, and away from, SC/CC's in human eyes in-vivo with optical coherence tomography.
Design: This was a prospective cohort clinical study
Participants: Images were obtained from both eyes of 14 healthy subjects.
Methods: SC was imaged in each eye with Bioptigen (Bioptigen Inc, USA) spectral-domain optical coherence tomography and a 200 nm bandwidth broadlighter, yielding a theoretical axial resolution under 1µm in the eye (SuperLum LTD., Ireland). Cross-sectional SC image sequences were obtained at 3 and 9 o'clock. CC's were tracked to confirm the location of the SC/CC. Ten frames (700 1.3 mm A-scans x 0.6 mm) centered at the SC/CC were recorded. Eighteen sequential A-scans were averaged for structural imaging. Frame sequences contained both a SC/CC and an adjacent area of SC with a visible disconnect from the junction. Contrast and magnification were adjusted to maximize visualization. SC was traced 3 times, from a single frame, in ImageJ (ImageJ 1.40g, http://rsb.info.nih.gov/ij/) and mean SC area was recorded.
Main outcome measures: The SC area, on or off SC/CC, and OD/OS and nasal/temporal laterality were analyzed by a linear mixed effects model.
Results: SC cross-sectional area was significantly larger on SC/CC's than off (12,890 vs. 7,391 μm^2, 95% confidence interval (CI) of the difference: 3,871-6,229; $p < 0.0001$). SC cross-sectional area was significantly larger on the nasal side (10,983 vs 8,308 μm^2; 95% CI of the difference: 441-2,773 $p = 0.009$) than temporal.
Conclusion: Schlemm's canal cross-sectional area is larger nasally and at SC/CC's, suggesting segmental flow and supporting a funneling theory of aqueous drainage.
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D11-01

S. Melamed
Tel Hashomer, Israel

D11-02

P. Netland
Memphis, USA

Objective: The Glaukos I-stent is a safe new surgical procedure to provide IOP reduction over at least a period of two years without conjunctival injury in patients with glaucoma.
Description: The Glaukos I-Stent is a trabecular micro-bypass stent designed to allow direct aqueous from the anterior chamber into Schlemm's canal in patients with glaucoma. The I-stent is implanted into the Schlemm's canal ab interno using a gonioscope through clear cornea without manupilation of the conjunctiva. Since 2001 there were several multi-country studies performed as a single procedure or in combination with cataract surgery. In all of the presented studies a substantial reduction of the intraocular pressure could be achieved. In the combined procedure of cataract extraction and stent implantation the mean medicated IOP from 21.9 mmHg could be reduce to 16.9 mmHg at month 24 (20.7%). At 24 months, the majority of patients (36/43, 83.7%) had an IOP of ≤ 18 mm Hg and were medication-free (22/36, 61.1%). The adverse events were minimal.

D11-03 UPDATE ON GLAUCOMA DRAINAGE IMPLANTS: STANDARD FOR SECONDARY SURGERY

V.P. Costa
Campinas, Brazil

Description: This lecture will discuss the strategies available for the surgical treatment of patients who have already undergone a primary filtering procedure. Advantages and disadvantages of a new trabeculectomy vs. shunt device vs. ciclophotocoagulation will be listed and discussed.

D11-04 EX-PRESS IMPLANT UNDER SCLERAL FLAP

L.W. Herndon Jr
Durham, USA

Objective: To compare the success and complication rates of glaucoma patients who had Ex-press device implantation versus those who had conventional trabeculectomy.
Methods: The records of 76 eyes of 69 subjects who had Ex-press implants and 77 eyes of 65 controls who had tra-

beculectomy procedures were reviewed. All surgeries were performed by one of the authors (LWH).
Success was defined as an IOP between five and 21 mmHg in patients who did not require further glaucoma surgery in the eye of note.
Results: The Ex-press group had an overall greater surgical success rate than the standard trabeculectomy group (81% and 71%, respectively), though this did not reach statistical significance (P = 0.182). There was a greater percentage of hypotony cases in the standard trabeculectomy group (16 %) compared to the Ex-press group (4 %), which was statistically significant (P = 0.023).
Conclusions: The present study demonstrates that Ex-press device implantation is at least as effective as the standard trabeculectomy in lowering the IOP of glaucoma patients. Furthermore, the data suggest that the Ex-press device results in an overall greater percentage reduction in IOP than with trabeculectomy, though this did not reach statistical significance.

D11-05 OPHTHALMIC MICROCATHETER AND CANALOPLASTY
R.A. Lewis
Sacramento, USA

Description: Filtering surgery in glaucoma has been associated with short and long term complications since its introduction over 50 years ago. New and evolving technology has been introduced to avoid many of the problems associated with creating a fistula and bleb. The new procedures lower IOP by a variety of mechanisms including devices or approaches based in the canal of Schlemm, the suprachoroidal (supraciliary) space, and innovative procedures in the subconjunctival area. We will discuss the background of the procedures, the surgical approach (ab interno vs ab externo) and the clinical data available to date.

D11-06 TRABECTOME
S. Mosaed
Irvine, USA

D11-07 GOLD MICRO SHUNT
M. Nardi
Pisa, Italy

D11-08 MODIFIED TRABECULECTOMY: STANDARD FOR PRIMARY SURGERY
P. Palmberg
Miami, USA

Objective:To present a form of trabeculectomy with MMC and long-term results.
Description: Trabeculectomy with application of Mitomycin C is the glaucoma surgery against which newer procedures should be compared for efficacy and safety. Results are presented with 10-year follow up showing no net visual field progression. Technical details are presented that can minimize the complications of bleb leaks/infection and hypotony. We illustrate a modified trabeculectomy technique (Suner *et al*., Ophthalmology, 1997) which has several potential advantages in achieving nearly bloodless surgery, avoiding the need for an iridectomy, avoiding hypotony and flat chambers, and achieving rather predictable pressures in the low-normal range. The technique begins with a wide conjunctival flap which allows identification and isolation of Tenon's insertion, so that the sub-Tenon's space can be entered from the side, allowing a nearly bloodless creation of the conjunctival-Tenon's flap. The conjuctival flap is then everted to give direct visualization of the superior quadrants for blunt dissection for placement of MMC soaked, wide, thin sponges. A valve-like scleral flap is then created which reduces the risk of hypotony and allows omission of an iridectomy. The technique creates a scleral flap resistance corresponding to an equilibrium pressure of about 4-6 mmHg prior to suture placement, and 8-12 mmHg after suture placement. The minimal suture tension required minimizes the risk of producing claw holes or of inducing significant astigmatism. The conjuctiva is sutured with buried mattress and running sutures, with an underneath tie-back of the side relaxing incisions that allows all knots to be buried. The life table success at < 21 and < 16 mmHg over a decade, mean pressures, visual field results, and complications will be presented.

D11-09 NON-PENETRATING SURGERY
T. Shaarawy
Geneva, Switzerland

D11-10 I-STENT
D. Spiegel
Regensburg, Germany

Description: The Glaukos I-Stent is a trabecular micro-bypass stent designed to allow direct aqueous from the anterior chamber into Schlemm's canal in patients with glaucoma. The I-stent is implanted into the Schlemm's canal ab interno using a gonioscope through clear cornea without manupilation of the conjunctiva. Since 2001, there were several multi-country studies performed as a single procedure or in combination with cataract surgery. In all of the presented studies a substantial reduction of the intraocular pressure could be achieved. In the combined procedure of cataract extraction and stent implantation the mean medicated IOP from 21.9 mmHg could be reduce to 16.9 mmHg at month 24 (20.7%). At 24 months, the majority of patients (36/43, 83.7%) had an IOP of ≤ 18 mmHg and were medication-free (22/36, 61.1%). The adverse events were minimal.
Objective: The Glaukos I-stent is a safe new surgical procedure to provide IOP reduction over at least a period of two years without conjunctival injury in patients with glaucoma.

10.30 – 11.15 a.m.

D12 LASER TREATMENT FOR OAG

D12.1 ARGON LASER TRABECULOPLASTY IN THE EARLY MANIFEST GLAUCOMA TRIAL
D. Peters, B. Bengtsson, A. Heijl
Malmö University Hospital, Lund University, Malmö, Sweden

Purpose: To determine the amount and sustainability of and factors influencing intraocular pressure (IOP) reduction through argon laser trabeculoplasty (ALT) in the Early Manifest Glaucoma Trial (EMGT).
Design: Cohort study of patients enrolled in the EMGT, followed for up to 8 years.
Participants: One hundred twenty-seven patients with new-

ly diagnosed open-angle glaucoma from the treatment group of EMGT.

Methods: All patients obtained the same treatment (topical betaxolol BID plus ALT) independent of baseline and follow-up IOP. Pre-ALT IOP readings were obtained after patients had received betaxolol for 2 weeks. Analysed data included IOP readings obtained every 3 months for up to 8 years as long as no progression occurred. The relationship between IOP reduction and pre-ALT IOP was analysed as was sustainability and influence of the following factors: amount of trabecular pigmentation, presence of exfoliation syndrome, baseline damage as expressed by MD and surgeon.

Main outcome measure: Intraocular pressure reduction.

Results: Mean pre-ALT IOP was 18.2 mmHg. IOP reduction after ALT was 2.7 mmHg on average at the 3-month visit. Treatment effects were larger with higher pre-ALT IOP levels (Pearsons correlation coefficient = 0.656, $p < 0.001$); thus every 3 mmHg of higher pre-ALT IOP was associated with additional mean IOP reduction of approximately 2 mmHg (linear regression analysis). IOP had a significant long-term upward drift. The difference between pre-ALT IOP and last IOP measurement after 8 years was approximately 1 mmHg (two-tailed Wilcoxon test, $p = 0{,}004$). IOP reduction depended significantly on the surgeon (one-way ANOVA, $p < 0.001$); mean IOP reductions among surgeons ranged from 5.6 mmHg to -0.9 mmHg.

Conclusions: In EMGT laser treatment reduced IOP by 2.7 mmHg on average from a mean IOP level of 18.2 mmHg in patients already treated with betaxolol. Baseline IOP and treating surgeon were factors that significantly influenced the amount of IOP reduction.

References:

1. Rolim de Moura C, Paranhos A Jr., Wormald R. Laser trabeculoplasty for open angle glaucoma. Cochrane Database Syst Rev 2007(4):CD003919. 2. Leske MC, Heijl A, Hyman L, Bengtsson B. Early Manifest Glaucoma Trial: design and baseline data. Ophthalmology 1999; 106: 2144-2153. 3. Heijl A, Leske MC, Bengtsson B, et al. Reduction of intraocular pressure and glaucoma progression: results from the Early Manifest Glaucoma Trial. Arch Ophthalmol 2002; 120: 1268-1279. 4. Bergeå B, Bodin L, Svedbergh B. Primary argon laser trabeculoplasty vs pilocarpine. II: Long-term effects on intraocular pressure and facility of outflow. Study design and additional therapy. Acta Ophthalmol (Copenh) 1994; 72: 145-154. 5. Odberg T, Sandvik L. The medium and long-term efficacy of primary argon laser trabeculoplasty in avoiding topical medication in open angle glaucoma. Acta Ophthalmol Scand 1999; 77: 176-181. 6. Shingleton BJ, Richter CU, Dharma SK, et al. Long-term efficacy of argon laser trabeculoplasty. A 10-year follow-up study. Ophthalmology 1993; 100: 1324-1329. 7. The Glaucoma Laser Trial (GLT). 2. Results of argon laser trabeculoplasty versus topical medicines. The Glaucoma Laser Trial Research Group. Ophthalmology 1990; 97: 1403-1413. 8. The Advanced Glaucoma Intervention Study (AGIS): 11. Risk factors for failure of trabeculectomy and argon laser trabeculoplasty. Am J Ophthalmol 2002; 134: 481-498. 9. Traverso CE, Spaeth GL, Starita RJ, et al. Factors affecting the results of argon laser trabeculoplasty in open-angle glaucoma. Ophthalmic Surg 1986; 17: 554-559.

D12-01 LASER TRABECULOPLASTY: WHICH WAVELENGTH SHOULD BE USED?

I. Goldberg
Sydney, Australia

D12-02 THE GLAUCOMA TREATMENT PARADIGM: WHERE DOES LASER TRABECULOPLASTY FIT?

L.J. Katz
Philadelphia, USA

D12-03 FROM THE BEDSIDE TO THE BENCH AND BACK AGAIN: PREDICTING AND IMPROVING THE OUTCOMES OF SLT GLAUCOMA THERAPY

J. Alvarado
San Francisco, USA

Purpose: To determine whether Selective Laser Trabeculoplasty (SLT) and specific topical glaucoma medications share a common mechanism of action. To assess whether competition over this mechanism affects the IOP lowering achieved by SLT when used in conjunction with particular medications.

Methods: The effect of SLT on the barrier function of Schlemm's canal endothelial cells (SCEs) was assessed in perfusion experiments by measuring the conductivity (µl/min/mm Hg) in treated and control preparations. The SCEs barrier was visualized in the 'living state' using transfection methods with a Plasmid construct containing genes for the intercellular junction protein ZO-1, and a green-fluorescent protein. Junctional assembly/disassembly of SCEs exposed to SLT and the six medications was documented using time-lapse confocal fluorescent microscopy. The effect of SLT on the barrier function of SCEs was then compared with the effects of PGA analogs (latanoprost, bimatoprost, travoprost), selective alpha agonists (brimonidine), beta-blockers (timolol), and carbonic anhydrase inhibitors (dorzolamide). Following the in vitro experiments, a prospective clinical study was conducted in which PGA analogs were removed prior to SLT.

Results: The prostaglandin analogs (PGAs) tested shared a common mechanism of action with SLT. Each of the PGAs and SLT demonstrated widening of the paracellular fluid-flow pathway of SCEs, induction of intercellular junction-disassembly, and decreased resistance. Preliminary review of the clinical data suggests that removal of PGAs prior to SLT may improve the IOP lowering achieved by SLT.

Conclusion(s): The SCE-barrier plays an important role in controlling the egress of aqueous from the eye. SLT and PGAs share a common mechanism of action whereby the permeability of the SCE-barrier is increased. This finding may have clinical implications, as SLT and PGAs may be less effective when used concurrently due to a similar mechanism of action.

D12-04 TECHNIQUE MODIFICATIONS AND REPEATABILITY

T. Wells
Wellington, New Zealand

Objective:To understand the range of options available for laser trabeculoplasty while staying within or near recommended guidelines, the theoretical impact of changes in technique and settings, and to review the evidence for repeatability of LT.

Description: Laser Trabeculoplasty (LT) may be performed

with Argon or frequency-doubled YAG laser, and while staying close to recommended guidelines many variations are possible. These may include endpoint, treatment area selected, spacing of laser applications, and delivery lens. It is likely that such variants will affect outcomes and repeatability, although existing evidence on this topic is light. The most significant potential advantage of Selective Laser Trabeculoplasty (SLT) over other forms of LT is that it may be repeatable. Theory and evidence for repeatability of SLT will be reviewed.

D12-05 SLT IN PXF GLAUCOMA
O. Geyer
Haifa, Israel

11.15 – 12.00 p.m.

D13 DIDACTIC MORNING SESSION 13: BLOODFLOW INCL CONSENSUS

D13.1 DECREASED CEREBRAL BLOOD FLOW IN HUMAN GLAUCOMA
O. Duncan[1], A. Sample[2], R.N. Weinreb[2], M. Zangwill[2]
[1]York College / Cuny, Jamaica, NY, USA, [2]University of California, San Diego, La Jolla, USA

Purpose: Primary open-angle glaucoma (POAG) is a neurodegenerative disorder known to affect the lateral geniculate nuclei (LGN) and the primary visual cortex (V1) of non-human primates (Vickers *et al.,* 1997; Crawford et al., 2000; Weber *et al.,* 2000; Yucel *et al.,* 2003). While one human post-mortem study has found evidence of neurodegeneration in LGN and V1 (Gupta, *et al.,* 2006), evidence of glaucomatous neurodegeneration in vivo is lacking. Consequently, we have developed functional magnetic resonance imaging (fMRI) methods to measure changes in cerebral blood flow (CBF) associated with glaucomatous neurodegeneration. Arterial spin labeling (ASL) is a non-invasive fMRI method that can measure resting CBF in the absence of visual stimulation. Thus, ASL is well suited for inferring which regions of the cortex might be damaged by ischemia or reperfusion injury.
Method: Ten patients with POAG participated in a cross-sectional study design. Visual function was tested in both eyes using standard automated perimetry (SITA-SAP) and short-wavelength automated perimetry (SITA-SWAP). The Glaucoma Hemifield Test indicated that patients had superior-inferior visual field asymmetries. Visual field data were combined, and superior-inferior visual field asymmetries were confirmed using a Monte Carlo simulation (all $p < 0.05$). Mean pattern deviation values were computed for the combined superior and inferior hemifields of each subject (PD-MEAN). Standard blood oxygen level dependent (BOLD) fMRI methods were used to obtain retinotopic maps of dorsal and ventral V1. Mean resting CBF in dorsal and ventral V1 (CBF-MEAN) was measured using ASL fMRI. Patients were not presented with a visual stimulus during the ASL scans. Instead, patients were scanned in the dark with their eyes open. Differences in resting CBF between ventral and dorsal V1 (ΔCBF-MEAN) were compared to differences in visual function between the superior and inferior visual fields (ΔPD-MEAN).
Results: For both tests of visual function, the superior-inferior difference in visual function (ΔPD-MEAN) was correlated with the dorsal-ventral difference in cerebral blood flow (ΔCBF-MEAN). The correlation statistics (r-values) between ΔPD-MEAN and ΔCBF-MEAN for SITA-SAP and SITA-SWAP were 0.49 and 0.64, respectively (all $p < 0.05$).
Conclusion: The severity of vision loss in glaucoma is correlated with chronic alterations of resting blood perfusion in V1. ASL fMRI may be used to measure changes in chronic blood perfusion that are associated with glaucomatous neurodegeneration.
References:
1. Crawford ML, Harwerth RS, Smith EL, 3rd, Shen F, Carter-Dawson L. Glaucoma in primates: cytochrome oxidase reactivity in parvo- and magnocellular pathways. Invest Ophthalmol Vis Sci 2000; 41: 1791-1802. 2. Gupta N, Ang LC, Noel de Tilly L, Bidaisee L, Yucel YH. Human glaucoma and neural degeneration in intracranial optic nerve, lateral geniculate nucleus, and visual cortex. Br J Ophthalmol 2006; 90: 674-678. 3. Vickers JC, Hof PR, Schumer RA, Wang RF, Podos SM, Morrison JH. Magnocellular and parvocellular visual pathways are both affected in a macaque monkey model of glaucoma. Aust N Z J Ophthalmol 1997; 25: 239-243. 4. Weber AJ, Chen H, Hubbard WC, Kaufman PL. Experimental glaucoma and cell size, density, and number in the primate lateral geniculate nucleus. Invest Ophthalmol Vis Sci 2000; 41: 1370-1379. 5. Yücel YH, Zhang Q, Weinreb RN, Kaufman PL, Gupta N. Effects of retinal ganglion cell loss on magno-, parvo-, koniocellular pathways in the lateral geniculate nucleus and visual cortex in glaucoma. Prog Retin Eye Res 2003; 22: 465-481.

D13-03 ANATOMY AND PHYSIOLOGY OF THE BLOOD SUPPLY TO THE EYE
J. Jonas
Mannheim, Germany

D13-04 CLINICAL RELEVANCE OF OBF AND IMPACT OF MEDICATION
M. Araie
Tokyo, Japan

D13-05
N. Gupta
Toronto, Canada

D13-06 CLINICAL METHODS OF OBF
A. Harris
Indianapolis, USA

D13-07 CLINICAL ASSESSMENT OF RETINAL BLOOD FLOW BY SCANNING LASER DOPPLER FLOWMETRY (HRF) IN GLAUCOMA
G. Michelson
Erlangen, Germany

Background: In the OHTS-Study the presence of cardiovascular disease is a significant and independent risk factor for conversion from ocular hypertension to glaucomatous optic nerve atrophy. The main risk factor for cardiovascular disease is an impaired endothelial function with changes in the microcirculation. Thus the knowledge about the microvascular circulation in the retina and in the optic nerve head may constitute a central factor in the pathogenesis of normal tension glaucoma.
Purpose: to give an overview about the method of Scanning Laser Doppler Flowmetry (HRF).
Methods: The method of Scanning Laser Doppler Flowme-

try (SLDF or HRF) is described in respect to the parameters: (1) location of measurement, (2) principle of measurement, (3) time consumption for the patient, (4) time consumption for the analysis, (5) complexity of performing the examination, (6) reliability, and (7) clinical impact.
Results: The device Scanning Laser Doppler Flowmetry (HRF) focusses on two aspects: (1) retinal and optic nerve head capillaries, and (2) retinal arterioles and veins. The method measures (1) the capillary blood flow in arbitrary units in the retina and optic nerve head tissue and (2) the wall-to-lumen-ratio of retinal vessels. The time consumption for measurement and analysis showed a range of 15 minutes to 60 minutes. The reliability is about 0.7- 0.8.
Conclusion: Scanning Laser Doppler Flowmetry (HRF) is a device measuring blood flow parameters in the retina and optic nerve tissue. In addition the morphological parameter wall-to-lumen-ratio is assessible. The degree of the clinical impact of these measured parameters in the progression of glaucoma is unknown.

10.30–11.15 a.m.

D14 GLAUCOMA PROGRESSION II: DETECTING ESTABLISHING RATES OF GLAUCOMA STRUCTURAL PROGRESSION

D14-03 OPTIC DISC PHOTOGRAPHY AND CLINICAL EXAMINATION
D.S. Greenfield
Miami, USA

D14-04 HRT STRUCTURE CHANGE AND RATE
B. Chauhan
Halifax, Canada

This presentation will focus on progressive glaucomatous changes detected with confocal scanning laser tomography (CSLT) in glaucoma patients. Focus will be on: 1. Detection of early progressive glaucomatous change; 2. The functional consequence of CSLT detected progressive change; 3. Comparison of CSLT detected changes with conventional techniques; 4. Rates of change in glaucoma patients and healthy controls.

D14-05 GDX RNFL STRUCTURE CHANGE AND RATE
H.G. Lemij
Rotterdam, The Netherlands

Several long-term studies in glaucoma have been conducted (or are still underway) that look into monitoring any progression with scanning laser polarimetry (SLP), the technology commercially available as the GDx (Carl Zeiss Meditec). The principles of glaucoma detection and some results will be presented. These will be compared to functional measurements of change.

D14-06 OCT RNFL STRUCTURE CHANGE AND RATE
F. Medeiros
La Jolla, USA

11.15 – 12.00 p.m.

D15 CLINICIAN SCIENTIST SYMPOSIUM

D15-01 SYMPOSIUM OUTLINE
P.R. Healey
Westmead, Australia

Objective: To explain the role of genetic and molecular medicine in glaucoma by presenting the work of outstanding young clinician-scientists.
Description: Better understanding of Cell Biology has lead to a great proliferation of research in glaucoma genetics and molecular biology. This symposium will take the audience on a journey from the macrocosm to the microcosm and finally to the bedside in clinical and molecular genetics. The first two talks will explore genetic mechanisms in glaucoma, at the epidemiolgical and laboratory levels. The next two talks will examine molecular mechanisms in glaucoma and the recent advances in our understanding of this disease. The last two talks will report the latest research in molecular and genetic therapies for glaucoma including clinic results of the first ocular gene therapy trial.

D15-02 MOLECULAR MECHANISMS OF INTRAOCULAR PRESSURE REGULATION
M. Aihara
Tokyo, Japan

Description: IOP regulation is full of mystery. Its molecular mechanism is still under investigation. Deep insight of IOP regulation will lead to clarify the mechanism of IOP increase and to develop IOP-lowering drugs. IOP varies physiologically dependent on the diurnal rhythm, season, body position, light cycle, articles of taste and so on. Recently, it was found in mouse that diurnal changes are regulated by clock genes expressing in suprachiasmic nucleus. The receptors acting for strong IOP reduction, such as prostanoid receptors for prostaglandin-analogues and adrenergic alpha-2 receptor for brimonidine, may be associated with physiological IOP regulation. However, the knock-out mouse studies indicate that the deletion of these receptors exerts no influence on both diurnal changes of IOP and the baseline of IOP. These suggest that complicated mechanisms are present in IOP regulation.

D15-03 GENETICS
J. Craig
Adelaide, Australia

D15-04 AGING AND MITOCHONDRIAL DYSFUNCTION IN GLAUCOMA
J.G. Crowston
Melbourne, Australia

Description: Glaucoma prevalence and incidence increase rapidly with accumulating age. This can result from age-related factors that damage the optic nerve. Impaired blood flow, increased mechanical and oxidative injury as well as glial cell-mediated damage have all been implicated in contributing to the increased rates of retinal ganglion cell death that is characteristic of glaucoma. An alternative explanation is that older retinal ganglion cells become increasingly vulnerable to injury. This may be a consequence of mitochondrial

dysfunction, which is a biochemical hallmark of aging. Defective mitochondrial oxidative phosphorylation reduces ATP production and increases free radical production and oxidative stress. This will increase oxidative stress in old nerves and result in reduced energy supplies that will reduce the capacity for repair. This talk will provide evidence demonstrating that aging increases optic nerve vulnerability to oxidative stress from acute IOP elevation. Additionally we will present some clinical data showing that impaired oxidative phosphorylation is associated with increased vision loss in an inherited mitochondrial optic neuropathy.

D15-05 GENETIC STUDY BASED ON THE TWINS
M. He
Guangzhou, P.R. China

Description: To share the experience on running the Guangzhou Twin Eye Study and summarize the major findings on the genetic basis of the glaucoma-related traits, the future development will also be discussed.

D15-06 MOLECULAR/GENE THERAPIES
K.R.G. Martin
Cambridge, UK

Description: As our understanding of the molecular processes involved in retinal ganglion cell death in glaucoma has increased, new targets for therapeutic intervention have been revealed. Gene therapy is a promising approach in the treatment of eye disease and a number of gene therapy approaches have shown benefit in animal models of glaucoma. In particular, delivery of neurotrophic factors such as BDNF and CNTF appear to slow the loss of retinal ganglion cells. Until recently, concerns about the safety of viral vectors in the eye and the tolerability of intravitreal injections have made clinical translation seem a long way off. However, intravitreal injections are now a widespread and well tolerated treatment for age-related macular degeneration and no safety concerns have been identified using adeno-associated virus (AAV) vectors in clinical trials for Leber's congenital amaurosis. Thus, the use of gene therapy approaches for severe progressive glaucoma refractory to other treatments is certainly conceivable and clinical trials are now needed. New discoveries about the molecular mechanisms involved in the death retinal ganglion cells and their axons point to other promising new therapeutic approaches.

D15-07 GENE THERAPY IN LEBER AMAUROSIS – PRELIMINARY RESULTS FROM A CLINICAL TRIAL
A. Viswanathan
London, UK

Saturday, July 11, 2009

08.30 - 10.30 a.m.

D16 VIDEO SESSION GLAUCOMA SURGERY

D16-03 GOLD SHUNT
I. Ahmed
Toronto, Canada

D16-04 EYE PASS
R.H. Brown
Atlanta, USA

D16-05 TRABECTOME
G.P. Condon
Pittsburgh, USA

D16-06 ANGLE-CLOSURE GONIOSYNECHIAE
N. Congdon
Hong Kong, P.R. China

D16-07 EXPRESS SHUNT
L.W. Herndon, Jr
Durham, USA

Description: Multicenter, randomized control clinical trials have shown the importance of lowering intraocular pressure in primary open-angle glaucoma. Trabeculectomy surgery has for years been the gold standard for glaucoma surgery, but there are known complications of this surgery, including bleb-related infections and irritation. Newer glaucoma surgical procedures are now available, which appear to have fewer of the complications associated with trabeculectomy. Techniques and principles of new procedures, such as canaloplasty, ex-press shunt surgery, and trabectome surgery will be discussed.

D16-08 TRAB CLOSURE
P. Khaw
London, UK

D16-09 TRAP FLAP AND PUNCH OR CUT OF TRAB
D. Rhee
Boston, USA

D16-10 GLAUCOS SHUNT
T. Samuelson
Minneapolis, USA

D16-11 CANALOPLASTY
M. Tetz
Berlin, Germany

D17 UVEOSCLERAL OUTFLOW

D17.01 COMPUTERIZED IMAGING AND MEASUREMENT OF EPISCLERAL VENOUS PRESSURE
A. Sit, S. Ekdawi
Mayo Clinic, Rochester, MN, USA

Purpose: Episcleral venous pressure (EVP) is critical in understanding aqueous humor dynamics. In particular, accurate calculation of uveoscleral flow depends on knowing EVP. Noninvasive EVP measurement involves compressing an episcleral vein with a pressurized silicone balloon and recording the pressure at which partial vein collapse occurs. However, this is a poorly defined endpoint with different stages of vessel collapse spanning more than 10 mmHg. Consequently, uncertainty exists concerning EVP measurements and subsequent calculation of uveoscleral flow. As well, some existing medications may affect EVP but this has been difficult to access due to measurement uncertainty. Our goal was to develop a system to allow precise EVP measurements to enable

detection of physiologic and therapeutic changes in aqueous humor dynamics in future studies.
Design: New device and technique development with prospective sequential testing
Participants: Healthy male and female volunteers aged 18-45 years.
Methods: A commercially available Episcleral Venomanometer (EyeTech Ltd, Morton Grove, IL) was extensively modified and several key features incorporated. A computer-controlled motor drive was used to automatically increase pressure at the balloon tip. A high-definition video camera was used to image episcleral veins during compression with the balloon tip. Pressure was automatically recorded using a transducer and synchronized with each frame of the video. Post-hoc image analysis software (Analyze, Biomedical Imaging Resource, Mayo Clinic) was used to identify different states of collapse episcleral vein collapse and the corresponding pressure determined. Healthy volunteers aged 18-45 years were recruited from employees and students at the Mayo Clinic (Rochester, MN) for our pilot study. Subjects with glaucoma, narrow angles, history of eye surgery or trauma, suspicion for glaucoma, or use of systemic medications known to affect IOP were excluded. EVP was measured in 4 quadrants (superotemporal, inferotemporal, superonasal, and inferonasal) in each eye and calculated using post-hoc analysis. IOP was measured using Goldmann tonometry.
Main outcome measure: Mean EVP.
Results: Image quality of episcleral veins was excellent and suitable for analysis. The degree of vessel collapse and EVP could be easily measured by trained users. Ten eyes from 5 subjects (2 females, 3 males) were included in the study. Average age of the subjects was 28 years (range 21 to 35 years). The IOP was 12.0 ± 2.6 mmHg (mean ± SD. The EVP was found to be 5.2 ± 0.3 mmHg (mean ± SD) at 10% vein compression and 9.3 ± 1.1 mmHg (mean ± SD) at 50% vessel compression.
Discussion and Conclusions: Our system provides a method to precisely measure EVP. This is an important requirement in understanding normal aqueous dynamics as well as physiologic and glaucomatous changes. Precise EVP measurements may also enhance our understanding of mechanisms of action for existing and future medical and surgical therapies. In our pilot study, smaller amounts of vein compression appear to provide more consistent results (smaller SD) but further work is required to determine the optimal parameters for measurement. Further software development is also required to automate the image analysis.
References:
1. Zeimer RC, et al. Arch Ophthalmol 1983; 101: 1447. 2. Gaasterland DE, Pederson JE. Invest Ophthalmol Vis Sci 1983; 24: 1417. 3. Sit AJ, et al. Invest Ophthalmol Vis Sci 2008; 49: 1473. 4. Brubaker RF. Surv Ophthalmol 2001; 45 Suppl 4: S347. 5. Lim KS, et al. Ophthalmology 2008; 115: 790.

D17-01 MEASUREMENT OF UVEOSCLERAL OUTFLOW IN HUMANS

A. Sit
Rochester, MN, USA

Objectives:To understand the basics of aqueous humor dynamics; To understand the methods of calculating uveoscleral outflow in humans using non-invasive measurements
Description: Measurement of uveoscleral outflow cannot be performed non-invasively. As a result, measurement of uveoscleral outflow in humans needs to be performed indirectly. The modified Goldmann equation relates the various fluid dynamics factors that contribute to intraocular pressure (IOP). These factors include four variables: aqueous humor flow rate, outflow facility, episcleral venous pressure, and uveoscleral flow. Uveoscleral outflow can be calculated by measuring IOP and the three remaining variables. Aqueous humor flow rate is measured using anterior segment fluorophotometry; outflow facility is measured using tonography; and episcleral venous pressure is measured using venomanometry. Alternate methods of calculating uveoscleral outflow involve measurement of IOP and two variables under different conditions and 'eliminating' one variable.

D17-02 MORPHOLOGY OF THE UVEOSCLERAL PATHWAY

E. Tamm
Regensburg, Germany

D17-03 ANIMAL MODELS OF UVEOSCLERAL OUTFLOW

J. Lindsey
La Jolla, USA

Description: Recent animal studies advances have clarified the mechanism of uveoscleral outflow regulation as well as its contributions to the health of various ocular tissues. This approach has allowed investigations that are not possible to conduct in human subjects. These studies have provided new insight into the functions of uveoscleral outflow. Discussion topics will include: 1. Comparison of uveoscleral outflow in various laboratory animal species; 2. Interpretation considerations for animal studies of uveoscleral outflow; 3. Animal studies providing new basic insights into uveoscleral outflow contributions to intraocular pressure; 4. Animal tracer studies of aqueous humor protein targeting including the partitioning of aqueous humor in animal models; 5. Drug effects on uveoscleral and conventional outflow tissues; 6. The significance of lymphatic contributions to the distal portion of the uveoscleral outflow drainage.

D17-04 IS UVEOSCLERAL OUTFLOW ALTERED IN GLAUCOMA?

C. Toris
Omaha, USA

Objectives: Based on our current understanding of uveoscleral outflow in the healthy eye and in eyes with elevated IOP, this review proposes a role for uveoscleral outflow in glaucoma.
Description: Although the existence of uveoscleral outflow has been known for many years, there is still little known about its role in primary open angle glaucoma (POAG). In a small study, Yablonski (1985) reported that patients with uncontrolled glaucoma show an increase in uveoscleral outflow when maintained on maximally tolerated medications. Unfortunately, the presence of medications can confound the interpretation of these results. Uveoscleral outflow has not been measured in patients with POAG without ocular medications because the washout period puts the patient at risk for further glaucomatous damage. We do know that patients with ocular hypertension (OHT) without glaucoma have reduced uveoscleral outflow. Uveoscleral outflow also is reduced in exfoliation syndrome with OHT but unchanged in

pigment dispersion syndrome with OHT. When these syndromes are associated with normal IOP, uveoscleral outflow remains normal. These studies were conducted on patients after washout of all ocular medications. These studies lead us to hypothesize that reductions in uveoscleral outflow may contribute to OHT in POAG. However, if the ocular hypertension in POAG becomes uncontrolled, then the resistance in the trabecular meshwork can become severely elevated, thereby diverting a large proportion of aqueous humor to the ciliary muscle and uveoscleral outflow pathway. Uveoscleral outflow may be reduced in exfoliative glaucoma but not pigmentary glaucoma. Identifying causes for the elevated IOP in each type of glaucoma may one day enable the clinician to tailor treatments to target specific abnormalities.

D17-05 FUTURE THERAPY FOR UVEOSCLERAL OUTFLOW

L. Wheeler
Irvine, USA

Objective: To present a pharmacological basis for remodeling of the ciliary muscle that results in enlarged spaces for fluid to flow out of the eye. A variety of prostaglandin analogues have shown this effect on the primate ciliary muscle. Unfortunately, there is no consensus on a clinical instrument or methodology to measure UVS outflow easily in humans. Receptor expression, signal transduction, gene transcription and measurement of matrix metalloproteinases have been the focus of research to help explain drugs effects on UVS outflow. Additional mechanisms that may contribute to increased UVS outflow include relaxation of the ciliary muscle, cell shape changes, etc. These ideas and data will discussed as a background and basis to what the future holds for next generation of UVS outflow drugs.
Description: The uveoscleral (UVS) outflow pathway can be pharmacologically modified to reduce IOP in glaucoma patients. Some of the most efficacious drugs for lowering IOP enhance UVS outflow. A brief review of the research on the mechanisms of action and pharmacology of prostaglandin analogues and adrenergic agents will provide a background for a discussion of future therapies that may enhance UVS outflow.

D17-07 EVIDENCE OF A UVEOLYMPHATIC OUTFLOW PATHWAY IN THE EYE

N. Gupta
Toronto, Canada

Description: Aqueous humor flows into the anterior chamber, and then drains from the eye by conventional outflow via the trabecular meshwork and Schlemm's canal, and the unconventional outflow via the ciliary body, an anatomically ill-defined pathway. We hypothesized that absorption of aqueous humour from the anterior chamber of the eye occurs in part, via transport into the lymphatic circulatory system. Predicting that aqueous humour will be drained into a network of lymphatic vessels located in the ciliary body, we studied post-mortem human eyes to identify lymphatic vessels with specific markers for lymphatic endothelium. Tracer studies with fluorescent nanospheres injected intracamerally in sheep were conducted to determine the relationship between the lymphatic circulation in the ciliary body and aqueous humour outflow. Radiation tracer levels in sheep plasma and tissue samples were measured following intracameral injection of 125I human serum albumin. Results revealed a rich network of lymphatic vessels within the ciliary body. Fluorescent nanoparticles were drained by lymphatic channels in the sheep ciliary body and radioactive tracer count was greater in the head and neck lymph nodes compared to other lymph nodes. A distinct uveolymphatic pathway is described in the human and sheep ciliary body. The flow of aqueous humor into lymphatic channels within the ciliary body indicates a novel mechanism by which aqueous humor flows out of the eye, and a possible therapeutic target for glaucoma.

D18 NEW IDEAS IN MEDICAL TREATMENT

D18-01 ADJUNCTIVE MEDICAL THERAPY: NEW EVIDENCE AND TREATMENT STRATEGIES FOR GLAUCOMA

M. Aquino
Manila, Phillipines

Description: IOP-lowering with monotherapy is ideal, however, monotheraphy may not be enough. Over the course of years of treatment, many of our patients end up on multiple medications. This is usually done by adding one additional agent at a time. An ideal adjunctive agent should ideally have a maximum additive IOP-lowering and 24-hour IOP control, safe, tolerable and an easy-to-comply dosing regimen, and must enhance or have a neutral effect on ocular perfusion pressure. For the majority of our glaucoma patients, our first choice for treatment is usually prostaglandin monotherapy. When were adding to a prostaglandin, our options for adjunctive medical therapy include beta-blocker, topical anhydrase inhibitors and alpha2-agonist. Which one is the better agent? Current available evidence will be presented to address this question.

D18-02 TOPICAL INSTILLATION: IS IT POSSIBLE TO CAUSE LOCAL PHARMACOLOGIC EFFECTS IN THE IPSILATERAL POSTERIOR FUNDUS OF AN EYE BY LOCAL PENETRATION?

M. Araie
Tokyo, Japan

Objective: To study the route of local penetration of a topically instilled drug to the ipsilateral retrobulbar space and posterior retina in experimental animals.
Description: A topically instilled drug locally diffuses from conjunctival cul-de-sac to retrobulbar space around the optic nerve insertion via periocular Tenon tissue and then to the posterior retina-choroid across the posterior sclera at pharmacologically active levels. To elucidate the penetration route of topically instilled drugs to the ipsilateral posterior parts of the eye, we determined the ocular and periocular distribution and the concentration of radio-labeled nipradilol, a beta-1,2 and alpha-1 receptors antagonist which was registered as an antiglaucoma agent in Japan, after its topical instillation, intracameral injection or sub-Tenon injection in rabbits and monkeys by whole head autoradiography. After unilateral instillation of 1%[^{14}C]nipradilol in monkeys, nipradilol levels in the retrobulbar space around the optic nerve insertion and posterior retina-choroid were significantly higher on the ipsilateral than contralateral side (140 vs. 40 ng, and 636 vs. 521 ng). This finding was also reproduced in rabbits. After intracameral injection of [^{14}C]nipradilol in rabbits, radioac-

tivity was observed only in the anterior, but not in the posterior parts of the ipsilateral eye or in the contralateral eye. After sub-Tenon injection of [^{14}C]nipradilol, radioactivity was observed only in the ipsilateral posterior retina-choroid and retrobulbar space around the optic nerve insertion. The level of unchanged nipradilol determined by LC/MS/MS in the isolated posterior retina after instillation of 1 % solution was 69 and 58 ng on the ipsilateral and contralateral side (P = 0.008). These findings indicated that in rabbits topically instilled nipradilol diffused from conjunctival cul-de-sac to retrobulbar space around the optic nerve insertion via periocular Tenon tissue at pharmacologically active levels and diffusion from retrobulbar space across the posterior sclera may be the main route to reach the posterior retina-choroid.

D18-03 UPDATE ON CYTOSKELETAL APPROACHES TO GLAUCOMA THERAPY
P.L. Kaufman
Madison, USA

D18-04 THE CALCIUM HYPOTHESIS OF GLAUCOMATOUS NEURODEGENERATION
D. Calkins
Nashville, USA

Objective and Description: Recent evidence from our group and others indicates that a key early event in retinal ganglion cell degeneration in glaucoma is loss of axonal transport accompanied by a prevalence of axonal dystrophies within the optic pathways. In most degenerative diseases of the central nervous system, progressive axonopathy involves one or more calcium-dependent cascades. These may link to oxidative stress, cytoskeletal reorganization and metabolic dysfunction. This presentation will summarize key recent experiments that implicate a novel cation channel in mediating multiple aspects of calcium-dependent degeneration in glaucoma.

D18-05 THE USE OF ANTIBIOTICS IN GLAUCOMA
S. John
Bar Harbor, USA

Description: Findings from various groups have implicated components of innate immune pathways in glaucoma. For example and along with our collaborators, we have implicated molecules of the complement pathway as potentially early mediators of synapse elimination in glaucoma. A potential role of innate immune markers, suggests that inflammatory signals are important in glaucomatous neurodegeneration. Importantly, neuroinflammation has been implicated in various neurodegenerative disease, including glaucoma. This raises the possibility that various microbes including some bacteria may alter inflammatory signals and impact the onset or progression of glaucoma. Thus, antibiotic treatments may prove beneficial. Some antibiotics have also been suggested to have protective effects that are independent of their antibacterial properties. On the other hand, various off target effects of these compounds could have potentially worsening effects on disease progression. The talk will discuss some of these ideas.

D18-07 CONSIDERATIONS FOR TREATMENTS DIRECTED AT GANGLION CELL SURVIVAL
R. Nickells
Madison, USA

Description: The description that retinal ganglion cells die by apoptosis in glaucoma opened a whole new area of study to develop and test agents and treatments designed to block the cell death process. The goal of this research has been to augment long established pressure lowering strategies to treat this disease. How close are we to seeing this 'neuroprotective' strategy reach the clinical arsenal of glaucoma management? To answer this question, we must consider how much we know about the pathology of glaucoma that leads to ganglion cell death. This consideration must take into account new models of cell death whereby different compartments of the ganglion cell die by molecularly distinct and independent pathways. Axon death does not necessarily mean soma death, and vice versa. Additionally, our understanding of apoptosis, which is the independent destruct pathway executed only by ganglion cell somas, is still relatively naïve. Even therapies that profoundly reduce ganglion cell loss in animal models of glaucoma, for example, leave these 'survivors' crippled, unable to function, and usually without an axon. There is undoubtedly a future for 'neuroprotection', but the road to it may be longer than we think.

D18-08 RHO-ROCK SYSTEM AND CONVENTIONAL OUTFLOW PATHWAY
H. Tanihara
Kumamoto, Japan

Description: Numerous drugs to lower intraocular pressure (IOP) have been developed and used to treat glaucoma. In addition to them, we have reported that instillation of selective ROCK (Rho-associated coiled coil-forming protein kinase) inhibitors significantly reduced IOP, the mechanism of which was attributed to improved conventional outflow. Rho guanosine triphosphatase, a member of the Rho subgroup of the Ras superfamily, participates in signaling pathways that lead to formation of actin stress fibers and focal adhesions. ROCK is one of Rho effectors. Rho-ROCK signaling system is also involved in diverse physiological functions associated with cytoskeletal rearrangement related to cell shape, cell motility, cytokinesis, and smooth muscle contraction. The expression of ROCK has been shown in ocular tissues, including the trabecular meshwork (TM) and ciliary muscle (CM). Also, inhibition of ROCK activity has been shown to induce alterations in TM cellular responses such as migration, adhesion, and changes in cell shape. Our clinical trials have demonstrated that selective ROCK inhibitor eye drops can decrease IOP even in human eyes with and without glaucoma.

10.30 – 12.00 a.m.

D19 WGA-ASCRS VIDEO SESSION GLAUCOMA & CATARACT

D19-01 CONQUERING ANGLE CLOSURE WITH CATARACT SURGERY ± GONIOSYNECHIALYSIS
R.H. Brown
Atlanta, USA

D19-02 PHAKO-DEEP SCLERECTOMY
T. Shaarawy
Geneva, Switzerland

D19-03 LATE IOL DISLOCATION: THE REAL DEAL
G.P. Condon
Pittsburgh, USA

D19-04 WEAK ZONULES, SMALL PUPILS, AND OTHER CATARACT CHALLENGES IN GLAUCOMA PATIENTS
A.S. Crandall
Salt Lake City, USA

D19-05 IOP FLUCTUATIONS POST CATARACT AND POSTGLAUCOMA SURGERY
A.G. Konstas
Thessaloniki, Greece

Objective: To present and discuss available evidence on the fluctuation of 24-hour intraocular pressure (IOP) control after cataract and glaucoma surgery.
Description: New controlled evidence over the last few years has increased the understanding and importance of monitoring 24-hour IOP control in glaucoma. Published evidence suggests that prostaglandins and fixed combinations significantly reduce fluctuation of 24-hour IOP after cataract surgery. A well-functioning trabeculectomy provides significantly lower fluctuation and better quality of 24-hour IOP than successful medical therapy. More evidence is needed on the role and value of reduced fluctuation of IOP in glaucoma.

D19-06 COMBINED SURGERY
T. Samuelson
Minneapolis, USA

D19-07 PSEUDOEXFOLIATION: TIPS FOR SUCCESSFUL CATARACT SURGERY
B. Shingleton
Boston, USA

Description: Video presentation will highlight critical preoperative and operative considerations to enhance safety of cataract surgery in pseudoexfoliation patients. Emphasis will be placed on intraoperative assessment of capsule/zonule status, hydrodissection, phacoemulsification techniques and IOL choice and positioning.

D19-08 PHAKO SURGERY FOR CACG CASES
D. Lam
Hong Kong, P.R. China

10.30 – 11.15 a.m.

D20 IMPROVING OUTCOMES IN GL MINIMIZE NEGATIVE IMPACT

D20-01 AVOIDING SURGICAL COMPLICATIONS: HOW TO ACHIEVE THE BEST LONG-TERM FILTERING BLEB
F. Grehn
Würzburg, Germany

Description: Biomicroscopic observation of the early development of the filtering bleb as well as confocal microscopic imaging, optical coherence tomography, and ultrasound biomicroscopiy can help to detect early signs of bleb failure. A well defined dose of antimetabolites during operation (concentration x volume) is a prerequisite to avoid avascular blebs with increased risk of infection. A number of subjective and objective bleb complications, ranging from bleb dysesthesia to chronically leaking bleb with blephitis/endophthalmitis can nowadays be solved by specific approaches. Using the concept of intensified postoperative care, the long-term success rate of filtering blebs as defined by the EGS Guidelines target pressure reached without additional medication can be nearly be doubled.

D20-02 LIKE ADDING ANOTHER DROP, AND IT'S (ALMOST) FREE:
IMPROVING ADHERENCE
H. Quigley
Baltimore, USA

Description: The dirty little secret of glaucoma therapy is that many patients take their eyedrops less often than the prescribed frequency. Confirmation by electronic means of this fact with modern drugs has shown that only 70% of doses are likely to be used by the average patient – among insured and well-educated persons. The risk factors for poor adherence will be reviewed and recent interventional trials to improve adherence will be presented. Physician communication and patient re-education and reminder systems can act in concert to dramatically improve outcomes of topical glaucoma therapy.

D20-03 IS CHAMBER ANGLE IMAGING PREDICTIVE OF FUTURE ANGLE CLOSURE?
D.E. Grigera
Buenos Aires, Argentina

Objective: to update knowledge on the capacity of anterior segment imaging techniques for detecting signs leading to the recognition of individuals prone to AC.
Description: To predict angle closure (*i.e.,* to foretell if and when a given eye will suffer it) is not yet achievable. In the meantime, help from diverse technologies can improve our performance. Imaging studies of the anterior chamber comprise ultrasound biomicroscopy, anterior segment OCT and Scheimpflug photography. They all allow objective quantification of angles. When performed under dark conditions, they are useful for detecting appositional angle closure in eyes that may appear as open in white light gonioscopy. In eyes with a pupillary block configuration, signs like iris shortening, increased iris thickness, increased iris convexity and small iris-lens touch are of paramount importance. The mentioned techniques are also useful for the detection of plateau and pseudoplateau iris caused by multiple ciliary cysts. Widening of the anterior chamber after peripheral iridotomy is more readily detected with UBM and anterior segment OCT than with gonioscopy. No conclusive evidence has been obtained about the predictability of AC closure based on UBM examination, but contralateral eyes of individuals that had an AAC attack tend to have a more crowded anterior segment than those of healthy controls. Last but not least, the presence of minimal uveal effusions in a significant number of eyes with PACG and APAC is a recent discovery; its importance is yet to be clarified.

D20-04 AVOIDING SURGICAL COMPLICATIONS: HOW TO MINIMIZE TUBE-SHUNT PROBLEMS

R. Parrish
Miami, USA

Description: The goals of this didactic session are to discuss the specific techniques of the author to minimize the complications of tube-shunt surgery. Proper fixation of the device to the sclera to lessen the likelihood of postoperative diplopia, development of a sufficiently long and oblique corneoscleral tunnel for tube insertion into the anterior chamber to lessen immediate postoperative hypotony, and adequate coverage of the tube with glycerin preserved cornea to reduce late erosion of the device are three techniques the author will present in detail. Members of the audience should understand the rationale for these specific techniques and be able to incorporate them in their surgical practice if they chose to do so. Primary focus will include discussion of the Ahmed Glaucoma Valve and the Baerveldt Glaucoma Drainage Implant.

D20-05 THE IMPACT OF GLAUCOMA ON QUALITY OF LIFE: DRIVING, READING, MOBILITY

P. Ramulu
Baltimore, USA

Description: Glaucoma screening and treatment should be aimed at minimizing disability resulting from visual loss and maximizing quality of life. Here, we summarize data from clinical and epidemiological studies which demonstrate how, and at what stage, glaucoma produces disability and/or decreased quality of life.

Individuals with glaucoma in developed nations cite driving, mobility, and reading as their most important vision-related functions. The most common complaint among people with glaucoma is difficulty performing tasks at the extremes of lighting. Individuals with glaucoma also describe difficulty performing a broad range of important tasks including driving, walking, reading, and social interaction.

Vision-related quality of life instruments suggest that quality of life declines in glaucoma with progressive visual field loss, particularly with better-eye field loss. These instruments also suggest that glaucoma may impact quality of life even when only mild to moderate unilateral visual field loss is present. Glaucoma is noted to measurably affect task performance primarily when bilateral visual field loss is present. Individuals with bilateral glaucomatous field loss are more likely to stop driving than people without glaucoma, and the odds of driving cessation doubles for every 5 dB decline in the better-eye visual field. Those who continue to drive may have a higher rate of accidents. Individuals with bilateral glaucomatous field loss also walk slower, more frequently bump into objects, and have poor balance and a higher incidence of falls. Reading speed has not been noted to decline in glaucoma until visual field loss is severe enough to affect binocular visual acuity. The substantial difference in measured task performance and self-reported ability seen with different levels of better-eye field damage suggests that minimizing visual field loss in the better-seeing eye is associated with better functional outcomes. Further work is necessary to establish whether unilateral glaucoma has a significant impact on patients.

D20-06 AFTER THE IRIDOTOMY, HOW TO IMPROVE ANGLE CLOSURE OUTCOMES

R. Sihota
New Delhi, India

Description: Primary angle closure (PAC) is the earliest definitive form of PACG. PAC or subacute angle closure has a distinct clinical and anatomical profile as compared to acute and chronic angle-closure glaucoma. All such eyes should undergo an iridotomy to open up any part of the angle having iridocorneal apposition alone and not peripheral anteriorl synechiae. After an iridotomy, it could be expected that eyes with subacute or PAC would have a good long-term prognosis, however it has been seen that a third progress to an ocular hypertension, and about 10 % to a glaucomatous optic neuropathy. The long-term outcome of acute PACG eyes depends almost wholly on the time delay to an adequate control of IOP. Following an iridotomy, it has been reported that following an early control of the attack, an iridotomy alone was sufficient to control IOP in about 80 % of eyes, with only 12 % requiring surgery. Chronic PACG eyes after iridotomy continue to have a raised IOP because of trabecular damage, and need medical / surgical therapy to lower the IOP to 'targets' commensurate with existent neuropathy. The target may be lower than that required for POAG eyes, and about a third require surgery for the long-term control of progression.

11.15 – 12.00 a.m.

D21 GENETICS

D21.1 THE ROLE OF THE NITRIC OXIDE SYNTHASE 3 GENE IN PRIMARY OPEN-ANGLE GLAUCOMA: A POPULATION-BASED ASSESSMENT INCORPORATING ENVIRONMENTAL EXPOSURE DATA

L.R. Pasquale[1], J.L. Wiggs[1], S.E. Hankinson[1], B.A. Rosner[1], J.L. Haines[2], H.J. Kang[1]
[1]Harvard Medical School, Boston, USA, [2]Vanderbilt University, Nashville, USA

Purpose: Previous investigators found an association between nitric oxide synthase 3 gene (NOS3) variants and primary open-angle glaucoma (POAG). Altered NOS3 gene activity may contribute to glaucoma by influencing aqueous humor dynamics and ocular blood flow. We assessed the role of NOS3 gene variants in POAG pathogenesis.

Design: We genotyped participants at two functional single nucleotide polymorphisms (-786T>C: rs2070744 and Glu298Asp: rs1799983) and three tagging SNPs (rs7830; rs3918188; rs1800779) in NOS3 using a case-control sample nested within two prospective cohorts at risk for POAG.

Participants: Members of the Nurses' Health Study and Health Professionals' Follow-up Study (527 cases and 1543 matched controls).

Testing: We estimated cohort-specific relative risk (RR) for the association between NOS3 variants and POAG using conditional logistic regression. We pooled cohort-specific results using meta-analytical techniques, incorporating random effects. We also performed an analysis of NOS 3 haplotypes with pooled frequency of > 5%. Finally we assessed the interaction between NOS3 SNPs and post menopausal hor-

mone use in POAG, since circulating estrogen is known to regulate NOS3 activity.
Main outcome measures: RR of POAG and high-tension POAG.
Results: None of the NOS3 polymorphisms or haplotypes were significantly associated with POAG overall. For the tagging SNP rs1800779, the RR of high tension POAG was 1.13 (95% CI, 0.85, 1.52) for the AG genotype and 1.58 (95% CI, 0.97, 2.55) for the GG genotype with a significant trend (p = 0.02). For this SNP, although the p for heterogeneity was not significant, among women, the association with high tension POAG was stronger (RR = 1.87, 95% CI, 1.19, 2.94 for the comparison between the GG vs. AA genotype, p-trend = 0.01). Similarly, the pooled RR of high tension POAG was 1.47 (95% CI, 0.86, 2.51) for the CC genotype of the T-786C polymorphism compared with the TT genotype; however among women, the corresponding RR was 1.80 (95% CI, 1.14, 2.85) with a significant additive effect (p = 0.02) and among men, the RR was 1.02 (95% CI, 0.48, 2.17) without a significant trend (p = 0.89). In another SNP (rs3918188) that showed significantly different associations by gender (p-heterogeneity = 0.02), the RR of high tension POAG for the AA compared with the CC genotype was 0.48 (95% CI, 0.28, 0.82) among women (p-trend = 0.0008) but 1.48 (95% CI, 0.77, 2.84) among men (p-trend = 0.61). Four of the five NOS3 SNPs showed significant interactions with current use of postmenopausal hormones and high-tension POAG.
Conclusions: The associations between NOS3 gene variants and high-tension POAG, with suggestive stronger associations only among women and NOS3 variant interactions with postmenopausal hormones suggest that gender biology modifies the relation between NOS3 activity and POAG.
References:
1. Tunny TJ, et al. Clin Exp Pharmacol Physiol 1998; 25: 26-29. 2. Logan JF, et al. IOVS 2005; 46: 3221-3226. 3. Nathanson JA, McKee M. IOVS 1995; 36: 1765-1773. 4. Garthwaite G, et al. J Neurosc 2006; 26: 7730-7740. 5. Polak K, et al. Arch Ophthal 2007; 125: 494-498. 6. Feke GT, Pasquale LR. Ophthalmol 2008; 115: 246-252. 7. Chambliss KL, Shaul PW. Endocr Rev 2002; 23: 665-686.

D21-01 CYP1B1 HAPLOTYPES IN POAG AND PACG
S. Chakrabarthi
Hyderabad, India

Objective: To understand the involvement of the CYP1B1 gene in primary open-angle (POAG) and primary angle-closure glaucomas (PACG) and understand the origin of these mutations in the background of intragenic CYP1B1 haplotypes.
Description: The CYP1B1 gene has been implicated as a major candidate gene in primary congenital glaucoma (PCG) worldwide. Recent evidences have indicated its involvement in some cases of POAG. Through an extensive screening of CYP1B1, we demonstrated that glaucoma-associated CYP1B1 mutations occurred in a proportion of cases with POAG and PACG as well, and their mutation spectrum were quite similar to PCG. The frequency of CYP1B1 mutation was higher among POAG compared to PACG with a marked allelic heterogeneity and the Arg368His was the most prevalent mutation across both the phenotypes. Interestingly, these mutations in POAG and PACG occurred on a similar haplotype background as observed earlier in PCG, which is indicative of their common origin across multiple glaucoma phenotypes. These results provide convincing evidences on the potential role of CYP1B1 in POAG and PACG that need to be explored further.

D21-02 GENETIC RISK FACTORS FOR PSEUDOEXFOLIATION
J. Wiggs
Boston, USA

Objective and Description: Pseudoexfoliation syndrome (PXF) is a major cause of glaucoma throughout the world. LOXL1 has been associated with PXF in many populations including our study of a US clinic-based population with broad ethnic diversity. However, the risk haplotype of LOXL1 is also prevalent in control samples and is much higher than the disease prevalence in some populations. These findings suggest that additional genetic and/or environmental factors could be involved in this complex disorder. In this presentation, approaches to identify secondary factors will be discussed and the results of studies evaluating genes that are candidates for secondary factors, such as homocysteine6, will be presented.
(Grant support: National Eye Institute Grants R01 EY013882 and P30 EY014104, Research to Prevent Blindness and The Massachusetts Lions Eye Research Fund.)

D21-03 UPDATE ON POAG GENES
R.R. Allingham
Durham, USA

D21-04 FAMILIAL CAVITARY OPTIC DISK ANOMALIES
W. Alward
Iowa City, USA

Description: A large American family of Russian heritage has autosomal dominant optic disc anomalies characterized by marked excavation and abnormal vascularity. Three members of this family have demonstrated photographically-document progression of neural rim thinning, without elevated intraocular pressure. We believe that the genetic basis of this family's optic nerve anomaly may give us insight into non-pressure related optic nerve damage. This family's genetic defect links to chromosome 12 (LOD 4.07).

D21-05 GENES CONTRIBUTING TO LOW TENSION GLAUCOMA
C. Pang
Hong Kong, P.R. China

D21-06 CLINICS AND GENETICS OF THE MYOCILIN ASN480LYS GLAUCOMA MUTATION IN A FAMILY OF ANDEAN DESCENT
R. Perez Grossman
Lima, Peru

Objective: The attendee will be able to understand the genetics and clinics of this mutation and would be able to predict the development of the disease in positive cases as we found in the present study.
Description: The present session shows an Andean family with the Myocilin Asn480Lys mutation with the description of the clinical findings of the disease related to this mutation. We predict the disease in one family member who had the mutation and developed glaucoma in the follow-up.

10.30 – 12.00 p.m.

D22 AQUEOUS DRAINAGE DEVICES

D22-01
K. Barton
London, UK

D22-02
K. Singh
Stanford, USA

D22-03 HOW I CHOOSE A DRAINAGE DEVICE
V.P. Costa
Campinas, Brazil

Description: Choosing a drainage device depends on several factors, including availability, cost, target IOP, tolerance to medications, presence of a restrictive mechanism, type of glaucoma, severity of glaucomatous damage, presence of muscle imbalance, size of the globe, and other variables. The purpose of this lecture is to discuss the advantages and disadvantages of the available devices, helping the ophthalmologist to decide in different situations.

D22-04 UPDATE ON THE TUBE VS TRABECULECTOMY STUDY
S.J. Gedde
Miami, USA

Objective: To review results from the Tube Versus Trabeculectomy (TVT) Study.
Description: The TVT Study is a multicenter randomized clinical trial comparing the safety and efficacy of tube shunt surgery to trabeculectomy with mitomycin (MMC) in eyes with previous cataract and/or failed glaucoma surgery. Tube shunt surgery was more likely to maintain intraocular pressure (IOP) control and avoid persistent hypotony, reoperation for glaucoma, or loss of light perception vision than trabeculectomy with MMC during the first three years of follow-up. Both surgical procedures had similar IOP reduction and use of supplemental medical therapy at three years. The incidence of postoperative complications was higher after trabeculectomy with MMC relative to tube shunt surgery, but serious complications associated with vision loss and/or reoperation developed with similar frequency after both procedures. There was no significant difference in the rate of vision loss following trabeculectomy with MMC and tube shunt surgery after three years of follow-up. Cataract progression was common, but occurred with similar frequency with both surgical procedures.

D22-05 INDICATIONS FOR GLAUCOMA DRAINAGE DEVICE IMPLANTATION
B.T. Hutchinson
Boston, USA

D22-06 COMPLICATIONS OF DRAINAGE DEVICE IMPLANTATION
P. Netland
Memphis, USA

Description: Complications may occur during the early or late postoperative period after glaucoma drainage implant surgery. The type of implant may influence complications, with immediate post-operative hypotony more commonly observed after implantation of non-valved devices. Elevated intraocular pressure may occur during the postoperative period, usually due to tube obstruction or thickening of the capsule around the implant plate. Persistent elevation of intraocular pressure associated with a thickened capsule may be treated with medical therapy, surgical revision, additional implant, or adjunctive cyclophotocoagulation. Exposed drainage implant tubes may be treated with surgical revision. Other complications include hypotony, exposed drainage implant tube, corneal edema, and motility problems. Many of these complications associated with glaucoma drainage implant surgery may be prevented or treated.

COURSES

Thursday, July 9, 2009

03.30-4.30 p.m.

CO-01 GLAUCOMA EPIDEMIOLOGY: PREVALENCE AND DIAGNOSIS
D.S. Friedman (chair), P. Healey (chair), M. Araie, H. Quigley

Objective: This introduction will set the stage for the remaining talks by discussing the magnitude of POAG and the increasing prevalence as world populations age.
Description: Primary open-angle glaucoma (POAG) prevalence will increase worldwide as the global population ages. It is estimated that over 50 million people will have POAG in 2020 and nearly 8 million will be blind from the disease. Prevalence rates vary by group, with lower rates among Whites (about 2% over the age of 40) and higher rates among African-derived populations (about 6% over the age of 40). Reported prevalence rates of POAG in Asia vary by the country studied, but it is clear that while Chinese persons have lower rates than Whites, POAG still affects close to 1.5% of the population over 40. POAG is strongly age-related with rates as high as 25% for African-derived populations over 75. This session will review the global impact of POAG.

CO-02
Cancelled

CO-03 ELECTROPHYSIOLOGY AND GLAUCOMA DIAGNOSIS
S. Graham (chair), V. Porciatti (chair), C. Bowd, B.A. Fortune

Description and Objective: This course will cover the role of electrophysiological testing in glaucoma based on a review of evidence from both basic and clinical studies. The course will focus on the pattern electroretinogram (PERG) and multifocal visual evoked potential (mfVEP). We will describe the utility of these tests as a means for detecting and monitoring functional loss, including data from recent studies in early glaucoma, and outline some newer research areas. Emphasis will be placed on the diagnostic performance of each technique, as well as their strengths, weaknesses, and relationship to other diagnostic tests, rather than on their technical or procedural aspects.

CO-04 CONGENITAL AND INFANTILE GLAUCOMA
P. Khaw (chair), A.K. Mandal (chair), J. Brandt, Ch.L. Ho, E. Maul

Objective: At the conclusion of this course the attendees will have confidence in the diagnosis and management of congenital and infantile glaucoma.
Description: Congenital and infantile glaucoma is rare disease, but it occurs worldwide. This course will discuss the clinical features, diagnostic techniques, differential diagnosis and management of different forms of congenital and infantile glaucoma. During the last few years, there has been huge increase in the number of medical therapies for glaucoma. The surgical treatment of congenital and infantile glaucoma have improved significantly. This instruction course will be presented by different pediatric glaucoma specialists from different parts of the world and will give an integrated approach which will include medical, surgical, genetic and rehabilitation approaches for holistic care of the afflicted child and its family.

CO-05 DELIVERING GL IN THE DEVELOPING WORLD
F. Gomez Goyeneche (chair), L.W. Herndon Jr (chair), K. Ben Amor, G. Gazzard

Description: Glaucoma is the second leading cause of world blindness, yet it is not included in many international and national plans, due to a lack of standardized diagnostic criteria, complexity of diagnosis, impracticality and cost of therapy in many settings, and failure to demonstrate personal and societal benefit from treatment. This course will examine the challenges of delivery of glaucoma care to underserved areas where lack of basic infrastructure needs compound efforts to improve processes.

CO-06 LASER FOR OAG
S. Melamed (chair), M. Wand (chair), J. McAllister, J. Alvarado, L.J. Katz, M. Latina, G.D. McLaren

CO-07 GLAUCOMA SURGERY – BASICS
F. El-Sayyad (chair), R. Ramakrishnan (chair), L.B. Cantor, Y. Kuwayama, C. Mattox, C. Migdal

Description: This course is designed to provide a review of the techniques of various glaucoma surgeries including trabeculectomy with special emphasis on the ideal use of adjunctive antimetabolites and how to avoid and to manage the complications of the procedure. Also an update on glaucoma drainage implants with the management of the unique complications related to tube surgery will be covered. Surgical techniques will be stressed in this update course with a heavy emphasis on surgical video presentations. A panel discussion with questions and answers will conclude the session.

CO-08 GLAUCOMA BIOSTATISTICS
L. Rossetti (chair), N. Congdon, W.J. Feuer, S.L.M. Mansberger

Objective: To review and explain statistical techniques and principles particularly relevant to appropriate statistical analysis of glaucoma studies and interpretation of manuscripts.
Description: Topics will include interpretation of p-values and confidence intervals; study planning, sample size, and statistical power; analysis of data from both eyes of patients; the impact of measurement reproducibility on imaging studies; diagnostic testing, sensitivity, specificity, and ROC curves; pitfalls/analytical considerations for clinical follow-up studies.

04.45-5.45 p.m.

CO-09 CLINICAL TRIALS & EVIDENCE BASED GLAUCOMA
A.L. Coleman (chair), K. Singh (chair), S. Miglior, R. Parikh, R. Wilson

Objective: To review the essential components of clinical trials that are needed in order to use their results as evidence in evidence-based medicine. Study designs, analyses, and results from published clinical trials will be used as examples.
Description: I. Introduction: Review of evidence-based medicine pyramid, Dr. Singh (5 min); II. Randomization. (a) Role of randomization with unknown confounders. (b) Interpreting Table 1, which shows baseline characteristics, Dr. Coleman (5 min); III. Follow-up. (a) Differential loss to follow-up. (b) Detection biases, Dr. Miglior (10 min); IV. Analysis. (a) Once randomized, always analyzed. (b) Limited role for intention-to-treat analyses, Dr. Parikh (10 min); V. Interpretation of results. (a) Clinical versus statistical relevance. (b) Generalizability, Dr. Wilson (10 min); VI. Questions/Panel Discussion (15 min); VII. Conclusion, Drs. Coleman (1 min).

CO-10 NEW TONOMETRY, CCT
J. Brandt (chair), L. Pillunat (chair), R.L. Fellman, J. Liu, A. Sit, E. Leuenberger

Description: Over the last decade, ophthalmologists have come to recognize that our techiques to measure intraocular pressure (IOP) are far less precise and accurate than previously thought. In large part this has been due to renewed interest in central corneal thickness (CCT) brought on by clinical trials that demonstrated significant artifact in Goldmann Applanation Tonometry (GAT). The GAT is no longer on a pedestal as a 'gold standard' instrument. This course will review the principals behind tonometry, new research into diurnal patterns and the future of new tonometry techniques, 24-hour IOP monitoring and the role of CCT as both a tonometry artifact and as a glaucoma risk factor. We will end with case studies of patients in which problems with tonometry play a role in diagnosis and management.

CO-11 OPTIC DISC PHOTOGRAPHY
J.B. Jonas (chair), M.T. Nicolela (chair), H. Danesh Meyer, A. Tomidokoro

CO-12 GUIDELINES ON DIAGNOSIS AND TREATMENT OF ACG
W. Nolan (chair), T. Aung, M. He, N. Wang, T.-H. Wang, J. Zhao

Description: This course will cover examination techniques for diagnosis of primary angle closure including gonioscopy and recent advances in anterior segment imaging. The current classification of angle closure will be discussed, including what constitutes a narrow or occludable angle. Management of angle closure including laser iridotomy, laser iridoplasty, lens extraction and trabeculectomy will be discussed with an emphasis on the current evidence available supporting treatment options and areas of debate and controversy. The WGA consensus statements on diagnosis and treatment of angle closure will be presented as part of this course.

CO-13 LASER FOR ACG
P. RojanaPongpun (chair), C. Tham (chair), M.B.A. Agulto, J. Thygesen

Objective: At the conclusion of the course, the attendee should be able to effectively, safely, and confidently select and perform the appropriate laser procedures for ACG patients.
Description: The indications, techniques, results, and complications of important laser procedures in angle closure glaucoma (ACG) will be presented and discussed. The procedures include laser peripheral iridotomy, laser peripheral iridoplasty ± laser trabeculoplasty, laser suturelysis, and cyclophotocoagulation.

CO-14 OPTIMIZING TRABECULECTOMY OUTCOME
K. Barton (chair), F. Grehn (chair), Ch. Baudouin, P. Khaw, D.W Lu, L. Wang

Description: Trabeculectomy has been the gold standard for filtration surgery for many decades. Since its introduction trabeculectomy has involved in many respects: Technical details of surgery include conjunctival approach (fornix based versus limbus based), position of traction suture (muscle versus limbus), fixation of the scleral flap (adjustable and releasable sutures, laser suturlysis), and the risk-adapted use of antiproliferatives during operation. A major progress in outcome has been achieved by the concept of intensified postoperative care with extensive attention to wound healing processes and time adjusted modulation of wound healing with steroids, anti-VEGF inhibitors, and 5-Fluorouracil. Preoperative suppression of inflammation is also a major step towards favourable outcome. Bleb classification systems have been introduced to quantitatively describe the various signs of wound healing risks. A number of secondary interventions such as needling, bleb revision or transconjunctival suture techniques have also contributed to improve long-term outcomes.

CO-15 FILTERING SURGERY: IMPLANTS
J. Freedman (chair), G. Baerveldt, E. Dahan, A. Molteno, M. Sherwood, G. Trope

Description: The course will present six short didactic lectures, followed by a discussion period. Four lectures will deal with bleb function and physiology. These will include: the structure and permeability of capsules around Molteno3 implants, which will be compared with those around double plate Molteno implants. Implant design of Baerveldt implants as it relates to bleb function. The encysted bleb, what we can learn from the hypertensive phase. What to do if the bleb fails. The other two lectures will discuss tips and tricks with Ahmed implants, and the use of the Ex-Press shunt under a scleral flap, procedures and results over eight years, in normal and complicated cases.

CO-16 GLAUCOMA PATIENT ORGANIZATION (HOW TO ORGANIZE, INTERACT WITH GPO)
S.R. Christensen (chair), G.N. Lambrou (chair), B. Lindsell (chair), I. Goldberg, R. Ritch, D.J. Wright

Description: The climate of medical care for those who have glaucoma is fluid and ever-changing. As a result, many people believe that the needs of glaucoma patients often go unmet. There are many reasons for this including the continually-evolving concerns of the patients as well as the more significant demands on the time and talents of the physicians. A person who has been diagnosed with any illness or who has had surgery can feel bewildered, confused and alone. They need to appreciate that assistance will come from many

sides: professionals, doctors, family members, peers, friends and fellow patients. They must also be alerted to the vast number of resources that can be helpful to them as patients and/or to their caregivers. Many of these information sources will be covered during this session, including in-depth looks at: How to form, structure and operate a Patient Support Organization; Physician–Patient Communication; and Getting the Ophthalmologists More Involved.

Friday, July 10, 2009

04.00-5.00 p.m.

CO-17 GL HEALTH ECONOMICS
S. Kymes (chair), R. George

Description: Understanding the principles of conducting and evaluating health economic studies has become increasingly important to glaucoma specialists seeking to conduct practice and advise national decision makers. In this course we will provide an outline of the basics of economic evaluation, decision analysis, and the use of administrative claims data to conduct studies. After the session, participants should have a better understanding of how to read articles on economic evaluation, and how to construct such analyses. In this one-hour session, the chairs will be joined by Dr. Josh Stein, a glaucoma specialist from the University of Michigan and noted expert on the secondary analysis of administrative databases.

CO-18 HOW TO DETECT PROGRESSION AND USE IT TO MANAGE GLAUCOMA
B. Chauhan (chair), A. Heijl, (chair), D. Garway Heath, B.E. Prum, L. Zangwill, A. Boehm

Objective: The purpose of this course is to review methods to detect progression of glaucoma and discuss how these can be implemented practically in the routine management of patients.
Description: The objective in managing patients with glaucoma is to prevent functional visual impairment during their lifetime. To do this, one needs to know the stage of disease and the rate of progression. The ideal is to know the rate of progression of all our patients, but the financial cost of the necessary examinations and inconvenience and psychological impact on the patient means that we have to concentrate our resources on those at highest risk of functional visual impairment. To identify those at highest risk, it is necessary to risk profile patients on the basis of known risk factors for glaucoma and glaucoma progression. Greater resources need to be concentrated on patients likely to progress at the highest rates. Monitoring approaches need to be able to detect those progressing faster than anticipated by identifying progression 'events' (the 'safety net' approach). The course will discuss evidence from the literature (clinical trial and hospital-based data) for progression risk factors, outline the theoretical approaches for identifying progression (rate- and event-based approaches) and review published methods for detecting progression by analysis of visual field and imaging data. Barriers (such as variability, data quality, and lack of hardware and software support) to detecting progression will be considered, leading to a discussion of a practical approach in the real world.
Conclusions: (1) Measuring rates of progression is optimal for following patient progress; (2) Risk profiling identifies patients at highest risk of functional visual impairment; (3) Resources should be concentrated on those at highest risk; (4) Both visual function and imaging measurements are needed to identify all progressing patients; (5) Greater availability of hardware and software support is needed to make use of current technology.

CO-19 ADVANCED OPTIC NERVE IMAGING (HRT, GDX, OCT)
C.K.S. Leung (chair), J. Schuman (chair), R. Burk, M. Fingeret, H.G. Lemij, G. Wollstein

Description: Evaluation of the retinal nerve fiber layer (RNFL) and optic nerve head (ONH) is a key component in establishing the diagnosis of glaucoma and in progression assessment. With the advent of modern imaging technologies, objective and reproducible RNFL and ONH measurements have been made possible. This instruction course will cover the clinical applications of optical coherence tomography, confocal scanning laser ophthalmoscope and scanning laser polarimetry for glaucoma diagnosis and progression analysis. At the conclusion of this course, the attendees will be able to interpret the results of OCT, HRT and GDx for detecting glaucomatous change and understand the advantages and limitations of these instruments.

CO-20 SECONDARY ANGLE CLOSURE GLAUCOMA: DIAGNOSIS AND MANAGEMENT
G. Gazzard (chair), L. Vijaya (chair), S. Asawaphureekorn, Kiho Park, H. Sakai

Description: The course is intended to provide a overview of mechanisms and pathogenesis of secondary angle closure glaucoma and how these principles can help to guide its management. It emphasizes the role of ultrasound biomicroscopy in diagnosis and management decisions. We will cover the common clinical situations that can lead to secondary angle-closure glaucoma and outline the appropriate management approaches: (1) Lens disorders resulting in secondary angle closure including phacomorphic glaucoma; (2) Uveitic secondary angle closure; (3) Aqueous mis-direction syndrome; (4) Case presentations will be used to illustrate the main concepts with a review of recent literature and developments in current practice. Topics: 1. Mechanism, Pathogenesis & Principles of management of secondary angle-closure glaucoma, L. Vijaya; 2. Role of UBM in diagnosis and decision making, Hiroshi Sakai; 3. Management of lens induced glaucoma, S. Asawaphureekorn; 4. ASOCT and uveitic secondary angle closure glaucoma, Ki Ho Park; 5. Aqueous misdirection, Gus Gazzard.

CO-21 PRINCIPLES OF MEDICAL THERAPY IN GLAUCOMA PRACTICE
R. Fechtner (co-chair), S. Miglior (co-chair), M. Aquino, N. Aquino, Y. Lachkar, H. Tanihara, J. Thygesen

Description: The decision to treat glaucoma should be made jointly by physician and patient. Glaucoma is a chronic disease that is controlled, not cured. Medical therapy is often the initial and favoured approach to controlling IOP. Several modern classes of medications exist and there is no single approach appropriate for every patient. In this course, the

faculty will present various options for initial and adjunctive treatment of glaucoma as well as some of the obstacles to successful medical therapy. This information will help the ophthalmologist guide each patient to an appropriate choice for therapy of glaucoma.
Overview of topics and content: I. Introduction: Overview, goals of treatment; II. Why prostaglandins are initial therapy; III. Alternatives to prostaglandins as initial therapy; IV. Considerations for selecting adjunctive therapy; V. The role of fixed combinations; VI. What is maximum medical therapy?; VII. How can guidelines or practice patterns help?; VIII. Discussion & Summary.

CO-22 FILTERING SURGERY: PENETRATING / NONPENETRATING / IMPLANTS
D.K. Heuer (chair), R. Carassa, S.K. Fang, P. Netland, T. Shaarawy

Objective: To review newer glaucoma filtering procedures, including deep sclerectomy, viscocanalostomy, translimbal implants, and equatorial aqueous shunts, with an emphasis on evidence-based studies vis-à-vis trabeculectomy.
Description: Trabeculectomy has been the gold-standard glaucoma filtering procedure for a few decades; however, its lack of predictable IOP outcomes, high failure rates in some glaucomas, and not-infrequent complications have provoked the development innovative nonpenetrating approaches, translimbal implants, and equatorial shunts, to improve the predictability, success rate, and safety of glaucoma surgery.

CO-23 PEDIATRIC GLAUCOMA SURGERY
A.K. Mandal (chair), D. Walton (chair), T.C. Chen, Ch.L. Ho, P. Khaw

Objective: To review and share indications for surgery and personal glaucoma surgical techniques for treatment of childhood glaucoma.
Description: Congenital glaucoma is a surgical disease and surgery must be performed at an early age as possible. The surgical options include goniotomy, trabeculotomy, trabeculectomy or primary combined trabeculotomy and trabeculectomy. Antifibrotic therapy and glaucoma drainage implants may be considered in refractory cases. Cycloablative procedures may be deserved as the last option. In these course experts from different part of the world will present the techniques and results of different options available.

CO-24 ELECTRONIC MEDICAL RECORDS
M. Lim (chair), C. Mattox (chair), J. Schuman

Objective: The audience will learn about the goals, implementation, and practical use of an electronic medical record and electronic prescribing in a large institution, focusing on the glaucoma practice. U.S. government requirements and incentives will be reviewed.
Introduction: (1) Goals for EMR and E-prescribing; (2) Government requirements; (3) Government incentives.
Electronic Medical Record: Implementation Pearls for Ophthalmology: (1) Choosing an EMR in a large institution; (2) Components of the EMR interface; (3) Baby steps: Preparing for the roll out; (4) Physician and staff training; (5) Productivity impact; (6) Pearls after two years of EMR documentation.
Handling ophthalmic images: (1) Imaging data flow and orders; (2) Imaging review and interpretation; (3) Image storage and archiving.
Electronic prescribing: (1) Selecting vendor and approach; (2) Roll-out; (3) Pearls; (4) Advantages and disadvantages.

05.15-6.15 p.m.

CO-25 EXPERIMENTAL MODELS IN GLAUCOMA
S. John (chair), F. Grus (chair), M. Honjo, M.B. Wax, L. Wheeler

Description: Glaucomatous vision loss results from injury to retinal ganglion cells and their axons, which make up the optic nerve. Experimental models are essential for characterizing pathological processes that contribute to glaucoma and for assessing treatment. This course will discuss different glaucoma models that involve high intraocular pressure, ranging from rodents to primates. Additionally the utilization of models of retinal ganglion cell death induced by NMDA, ischemia reperfusion and autoimmunity will be presented. Data from individual groups and different concepts of pathogenesis will be discussed, including roles of autoimmunity and axon damage.

CO-26 GONIOSCOPY AND IMAGING FOR CHAMBER ANGLE EVALUATION
T. Dada (chair), P.T.K. Chew, C.K.S. Leung, C. Hartleben, G. Marchini

Objective: To provide an overview of the anterior segment imaging techniques available for glaucoma diagnosis and treatment.
Description: The course will highlight the clinical utility of Gonioscopy as the gold standard for diagnosis of glaucoma, highlight limitations and fallacies of the procedure. Anterior segment imaging using ultrasound biomicroscopy and optical coherence tomography will be discussed in detail. Indications for performing imaging, operator technique, biometric measurements of the angle, imaging to elucidate the mechanisms of primary and secondary angle closure glaucoma, and monitoring of glaucoma surgery in the post operative period will be some of the key features included. A comparative evaluation of anterior segment imaging techniques will also be presented. *Comparative evaluation of Anterior segment imaging techniques:* Evaluation of the anterior chamber angle is imperative to determine the risk of angle closure. Although gonioscopy provides semi-quantitative assessment of the angle width, precise measurement of the angle is only possible with ultrasound biomicroscopy (UBM) or anterior segment optical coherence tomography (OCT). Two systems of anterior segment OCT have been recently introduced for imaging the anterior segment: (1) the Slit Lamp OCT (SLOCT, Heidelberg Engineering, GmbH, Dossenheim, Germany) and (2) the Visante OCT (Carl Zeiss Meditec, Dublin, CA, USA). Both anterior segment OCT instruments were designed based on low coherence interferometry using a superluminescent diode with wavelength of 1310nm. In contrast to UBM, anterior segment OCT allows non-contact imaging of the anterior chamber angle at specific meridians in a sitting position. Without the need of positioning a scanning probe at a close distance to the globe, better control of accommodation and pupil size is attainable with anterior segment OCT.

CO-27 ASSESSMENT OF BLOODFLOW IN GLAUCOMA
M. Araie (chair), A. Harris (chair), G. Michelson, L. Schmetterer, L. Kagemann, A. Tomidokoro

Description: The main topics covered in this course are: I. Discuss and understand the importance of studying ocular blood flow in glaucoma; II. Discuss the methodologies to evaluate ocular blood flow in glaucoma.The pros and cons of each method will be discussed; III. Discuss and understand the concept of abnormal blood flow regulation in glaucoma patients, focusing on daytime as well as nocturnal and diurnal studies; IV. Discuss and understand the studies evaluating the relationship between ocular blood flow, visual function and optic nerve structure in glaucoma patients; V. The future of ocular blood flow in the glaucoma clinic.

CO-28 MAXIMUM MEDICAL THERAPY
M. Diestelhorst (chair), G. Holló (chair), A. Brooks, S. Gandolfi, A. Hommer, G. Schwartz

Objective: To present a complex knowledge on maximal medical therapy of glaucoma.
Description: This course summarizes the information on complex glaucoma medication including additivity of the individual drugs, determination of optimal combinations, influence of maximal medical therapy on compliance and ocular surface as well as the side effects of the complex IOP lowering treatment. The course also presents the view of the European Glaucoma Society on maximal medical therapy.

CO-29 NEUROPROTECTION AND APOPTOSIS OF RETINAL GANGLION CELLS RELATED TO GLAUCOMA
N. Gupta (chair), K.R.G. Martin (chair), M.F. Cordeiro, M. Schwartz, J.C. Tsai

Objectives: 1. To provide the latest information on mechanisms of retinal ganglion cell death in glaucoma. 2. To review new models used to test glaucoma neuroprotection. 3. To discuss the latest information from neuroprotection clinical trials, clinical measures of neuroprotection success, future considerations and applications to glaucoma patient care.
Description: This 1-hour forum will provide ophthalmologists with the newest information regarding the science underlying retinal ganglion cell damage and protection, pre-clinical imaging studies, the latest knowledge gained from clinical trials in neuroprotection, and their relevance to caring for patients with glaucoma.
Topics and Speakers: I. Immunity, Cell Death and Renewal in Glaucoma, Michal Schwarz; II. Imaging Retinal Ganglion Cell Injury and Death, Francesca Cordeiro; III. Opportunities & Challenges for Neuroprotection in Clinical Practice, James Tsai. Each talk will be approximately 15 minutes, followed by 15 minutes of active discussion time with the audience.

CO-30 DECISION MAKING AFTER FAILED TRABECULECTOMY
R. Carassa (chair), S.J. Gedde (chair), K. Barton, Y.M. Buys, K. Ishida, D.S. Minckler

Objective: This course will discuss the preoperative assessment and surgical options for managing medically uncontrolled glaucoma in eyes that have had previously failed filtering surgery.
Description: The indications for glaucoma surgery will be discussed, along with the important aspects of the preoperative evaluation. The results a multicenter randomized clinical trial comparing trabeculectomy and tube shunt surgery will be reviewed. Use of cyclodestructive procedures and newer surgical approaches for managing glaucoma will be discussed.

CO-31 CYCLOPHOTOCOAGULATION – WHY, WHEN AND HOW?
P. Bloom (chair), S. Lin (chair), F.S. Mikelberg, B. Shields, R. Susanna

Objective: To educate the general ophthalmologist or subspecialist in the techniques of transscleral and endoscopic cyclophotocoagulation; and to provide an update of the histopathology and indications for each procedure.
Description: The role of cyclophotocoagulation has evolved recently to include use as a primary surgical therapy. Endoscopic cyclophotocoagulation has sparked interest as a potentially rapid glaucoma procedure often in combination with cataract surgery, with the possibility of fewer complications as compared to filtering surgeries. Even transscleral cyclophotocoagulation has been utilized as a primary procedure. The histopathological and vascular effects of each approach (endoscopic and transscleral) are different in severity.

CO-32 ANTI-VEGF THERAPY FOR GLAUCOMA
E. Blumenthal, J.B. Jonas, M. Kahook, J.R. Piltz-Seymour, T. Wong

Objective: To discuss the pathogenesis of neovascular glaucoma and the possibility to treat it using the Anti-VEGF drugs in combination with other procedures such as panretinal laser coagulation; to discuss the timing of the Anti-VEGF treatment; to discuss the use of Anti-VEGF drugs for filtering surgery in combination with the use of anti-metabolites.
Description: The course will give an overview on the use of Anti-VEGF drugs for the treatment of neovascular glaucoma and as adjunctive therapy in glaucoma surgery.

Saturday, July 11, 2009

01.30-2.30 p.m.

CO-33 UNDERSTANDING THE GENETIC BASIS OF GLAUCOMA: ITS ROLE IN CLINICAL PRACTICE
W. Alward (chair), J. Wiggs (chair), R.R. Allingham, S. Chakrabarthi,J. Craig, D. Mackey, C. Pang, S. Bhattacharija

Description: Advances in genetics and genomics over the past decade have provided insight into the molecular processes underlying many ophthalmic disorders, including glaucoma. These discoveries are valuable to the scientific community but also to physicians, as newly revealed genetic information is increasingly used to improve the quality of health care. A number of genetic factors have been shown to contribute to glaucoma, making it possible to use genetic information to establish a diagnosis and in some cases a prognosis for patients affected with the disease. This course will review the known genes responsible for glaucoma and how this genetic information can be used in the clinical setting.

CO-34 ADVANCES IN PSYCHOPHYSICAL TESTING FOR GLAUCOMA PATIENTS
R. Harwerth (chair), Ch.A. Johnson (chair), M. Fingeret, J.G. Flanagan, A. Iwase, R.L. Stamper

Objective: To provide a theoretical and practical understanding of newer technologies for functional testing in glaucoma.
Description: The course will present new findings on the role of functional testing for the diagnosis and assessment of progression of glaucoma. The specific areas to be covered include: (1) Flicker defined form as a new test of visual function in glaucoma; (2) Frequency doubling technology in the screening and management of glaucoma; (3) Clinical implications of the new psychophysical tests, including FDT, SWAP, and HEP; (4) An assessment of psychophysical and electrophysiological testing of visual function in clinical practice.

CO-35 STEREOSCOPIC OPTIC DISC VIEWING: TOP TEN PITFALLS IN IDENTIFYING GLAUCOMA DAMAGE AND PROGRESSION
A. Zalta

Objective: While viewing stereoscopic images, physicians will learn to identify glaucomatous disc damage and progression and differentiate glaucomatous from non-glaucomatous optic disc pathology.
Description: Participants will wear red-blue glasses to view three-dimensional PowerPoint projections of stereoscopic optic disc images. The ten most common pitfalls in identifying glaucomatous disc damage, including optic disc swelling, optic disc atrophy, and optic disc anomalies (disc proper, peripapillary, and vascular) will be viewed, discussed, and correlated with visual field loss. Special emphasis will be placed on classic glaucomatous disc changes and serial stereoscopic images of progressive glaucomatous disc damage over time.

CO-36 MANAGEMENT OF GLAUCOMA IN PRESENCE OF OTHER OCULAR DISEASE
M. Helal (chair), R. Mills (chair), G. Tomita, A.D. Beck, J.A.A. Giaconi, M. Irkec, B. Mani

Objective: To enable the participants to formulate a strategy for care of cases of glaucoma associated with ocular disease and to gain familiarity with the current options for management of such cases.
Description: This course will present current strategies for managing glaucoma associated with concurrent ocular diseases: retinal, corneal, uveitis, and pediatric syndromes. Time has been reserved for questions and answers.

CO-38 FILTERING SURGERY: NOVEL TECHNIQUES
I. Ahmed (chair), F. Lerner (chair), F. El-Sayyad, S.D. Vold

In the last years, several advances have been made in order to improve both safety and efficacy of glaucoma surgical procedures. In this course, novel techniques for glaucoma surgery will be presented and discussed by international experts in the field.

CO-39 MANAGING CATARACT AND GLAUCOMA
D. Lam (chair), B. Shingleton (chair), A.S. Crandall, M. Sherwood

Topics: I. Issues. (1) Common problems encountered by anterior segment surgeon; (2) Risks of surgery increased; (3) Post-operative complications higher; (4) Decision making potentially complicated by medication; (5) Intolerance, laser issues in the phakic and pseudophakic eye, target IOP; (6) IOL choice/spectacle independence with new IOL technology. II. Surgical approaches. (1) Cataract surgery alone; (2) Combined cataract and glaucoma surgery; (3) Glaucoma operation first/cataract operation later; (4) Glaucoma surgery in the pseudophakic eye.

SYMPOSIA

Thursday, July 9

2.00-3.00 p.m.

S01 EARLY DETECTION
H.G. Lemij (chair), N. Pfeiffer (chair), D. Garway-Heath, Ch.A. Johnson, F. Medeiros

Outline: Early detection of glaucoma is important in order to study the natural and treated course of the disease, gain insight into possible progression and to appropriately target treatment at affected individuals. This session will present functional and morphological tests for early detection and insights into their relationship. The session will be concluded by a panel discussion about state-of-the-art detection of glaucoma.

S01.1 ANCESTRY DIFFERENCES IN THE SPATIAL DISTRIBUTION OF VISUAL FIELD DAMAGE OBSERVED IN HEALTHY EYES IN THE AFRICAN DESCENT AND GLAUCOMA EVALUATION STUDY (ADAGES)
L. Racette[1], M. Liebmann[2], A. Girkin[3], M. Zangwill[1], S. Jain[4], M. Becerra[4], A. Medeiros[1], C. Bowd[1], R.N. Weinreb[1], A. Sample[1]
[1]Hamilton Glaucoma Center – UCSD, La Jolla, CA, USA, [2]New York Eye and Ear Infirmary, New York, USA, [3]University of Alabama – Dept. of Ophthalmology, Birmingham, USA, [4]Department of Family and Preventive Medicine – UCSD, La Jolla, USA

Purpose: People of African descent (AD) are disproportionately affected by primary open-angle glaucoma. Results from the African Descent and Glaucoma Evaluation Study (ADAGES) have shown worse performance on several parameters of visual function tests in the healthy eyes of people of AD. We hypothesized that if the ancestry differences we previously reported are signs of early disease, they should be distributed along a glaucoma-like pattern (such as an arcuate pattern). The purpose of the present study is to determine whether the small but significant differences in visual function between the healthy eyes of people of AD and ED are signs of early disease.
Design: Cross-sectional observational study.
Participants: Three hundred ninety-three AD and 367 ED healthy participants selected from the ADAGES and the Diagnostic Innovations in Glaucoma Study (DIGS). Participants had normal appearance of the optic disc on stereophotographs and intra-ocular pressure < 22 mmHg. Visual field data were not used for classification and as a result 158 participants had confirmed SAP defects.
Methods: Most participants had two reliable 24-2 tests on Standard Automated Perimetry (SAP) using the Swedish Interactive Thresholding Algorithm (SITA) and Short-Wavelength Automated Perimetry (SWAP-SITA) in each eye, all within a 3-month window.
Main outcome measure: The threshold values, total deviation (TD) values and pattern deviation (PD) values were compared between the AD and ED groups at each of the 52 test locations for each test type. T-tests comparing the AD and ED groups were performed at each location for each test type.
Results: Performance was worse in the AD group compared to the ED group at most visual field locations (the ancestry differences were non-significant in the few locations where performance was better for the AD group). Significant differences between the AD and ED groups were observed at several visual field locations and were distributed along an arcuate-like pattern. No significant differences between the AD and ED groups were observed centrally. This trend of the spatial distribution of the ancestry differences in visual function was similar for the threshold values, TD values and PD values, and that for both SAP and SWAP. This trend was observed when all participants were included and also when participants with confirmed SAP defects were excluded.
Conclusions: The spatial distribution of the ancestry differences in visual function follows a glaucoma-like pattern. This suggests that the small differences in visual function observed between people of AD and ED in the ADAGES may be a sign of early disease.
References:
1. Cedrone C, Mancino R, Cerulli A, Cesareo M, Nucci C. Epidemiology of primary glaucoma: prevalence, incidence, and blinding effects. Prog Brain Res 2008; 173: 3-14. 2. Girkin CA. Primary open-angle glaucoma in African Americans. Int Ophthalmol Clin 2004; 44: 43-60. 3. Racette L, Wilson MR, Zangwill LM, Weinreb RN, Sample PA. Primary open-angle glaucoma in blacks: a review. Surv Ophthalmol 2003; 48: 295-313. 4. Sample PA, Girkin CA, Zangwill LM, et al. The African Descent and Glaucoma Evaluation Study (ADAGES): 1. Design and Baseline Data. Arch Ophthalmol (In Press). 5. Racette L, Liebmann JM, Girkin CA, et al. African Descent and Glaucoma Evaluation Study (ADAGES): 3. Ancestry differences in visual function in healthy eyes. Arch Ophthalmol (In submission.)

S02 GLAUCOMA & MYOPIA
K. Singh (chair), J.C. Tsai (chair)

Objective: to discuss special considerations of the management of glaucoma in myopia.
Synopsis: The monitoring of the status of the optic nerve and visual field is frequently difficult in the presence of myopia, and there are special considerations for avoiding complications in surgery in such eyes. The management of glaucoma in patients with myopia is often more difficult, beginning with the assessment of the optic nerve and visual field. The optic nerve in high myopia is often quite large, with a rather flat contour and spread out tissue that is hard to assess. However, the presence or absence of laminar dots in the nervehead can identify areas of damage. Imagining with Optical Coherence Tomography may be thwarted by the absence of retinal pigment epithelium in areas of peripapillary atrophy. Visual field defects from myopic degeneration may compromise the ability to monitor glaucomatous damage.
Filtration surgery in highly myopic eyes is often more difficult, due to a relatively thin sclera near the limbus which may make creating a scleral flap with a controlled resistance challenging, and the decreased scleral rigidity of such eyes

makes intraoperative estimation of the intraoperative pressure more difficult. One must also be more careful in administering the peribulbar block, due to an increased risk of scleral perforation. The use of a 25-g sharp needle through the inferotemporal conjunctiva and parallel to the globe is safer in my hands in this regard than would be the use of a blunt 23-g needle through the lid.

S03 GLOBAL ECONOMIC RECESSION – HOW CAN HEALTH ECONOMICS HELP US

G. Schwartz (chair), A. Tuulonen (chair), S. Kymes, S.A. Obstbaum, R. Thomas

Outline: The gap between therapeutic possibilities and resources available is broadening all the time. How can we make our eye care systems more cost-effective? By changing the system and/or making the existing system work better? Every professional who makes decisions about individual and groups of patients is a decision-maker in health care. As it is especially the cumulative effect of small changes in clinical practices (*e.g.*, adding new diagnostic tests or therapy) that has a massive impact on the healthcare budgets, clinicians need to weigh not only their benefits and risks but should also consider the costs. What do we need to know for proper application of evidence-based health care?

S04 EXFOLIATION SYNDROME AND EXFOLIATIVE GLAUCOMA

A.G. Konstas (chair), R. Ritch (chair), G.P. Condon, F. Jonasson, U. Schlötzer-Schrehardt

Objective: Overview of treatment of exfoliative glaucoma (XFG).

Synopsis: New clinical and biological insights have increased the importance of accurate diagnosis and appropriate management of XFG. It is well documented that XFG has a more serious clinical course and worse prognosis than primary open-angle glaucoma. There is a significantly higher frequency and severity of optic nerve damage at the time of diagnosis, more severe clinical course and more frequent necessity for surgical intervention. Information emerging has indicated the importance of adequate 24-hour IOP control in the management of XFG. A brief account of the 24-hour response of XFG with new antiglaucoma medications will be provided. There is limited controlled data on the specific treatment response of XFG with medical, laser and surgical therapy. It is conceivable that in XFG medications are efficacious, but simply the final IOP reached may be inadequate to arrest progression in this glaucoma. More aggressive medical therapy with earlier use of fixed combinations is needed in XFG. A brief review on the success of laser and surgery in XFG is given. Today there is not enough information available to guide clinicians which should be the appropriate target pressure, which is the most suitable first line and stepwise therapy for XFG.

Outline: 1. Ocular and systemic findings, R. Ritch; 2. The LOXL1 gene and its potential clinical, F. Jonasson; 3. Pathobiology of exfoliation syndrome, U. Schlötzer-Schrehardt; 4. Treatment of exfoliative glaucoma, A. Konstas; 5. Cataract surgery in exfoliation syndrome, G. Condon; 6. Panel discussion.

S05 UPDATE ON CONSENSUS REPORTS

R.N. Weinreb (chair)

Presenters: 1. Structure and Function in the Management of Glaucoma, F. Medeiros; 2. Intraocular Pressure, A. Sit; 3. Screening of OAG and ACG, P. Healey; 4. Surgery of Open-Angle Glaucoma, T. Wells.

S06 GLAUCOMA DISABILITY

R. Varma (chair), A. Viswanathan (chair), A.L. Coleman, H.D. Jampel, G. Spaeth

S06.1 DRIVING CESSATION AND DRIVING LIMITATION IN GLAUCOMA: THE SALISBURY EYE EVALUATION PROJECT

Y. Ramulu, K. West, B. Munoz, D. Jampel, S. Friedman
Wilmer Eye Institute, Johns Hopkins, Baltimore, USA

Objective: To examine whether glaucoma is associated with driving limitation or cessation.

Design: Cross-sectional analysis within a longitudinal, population-based cohort study.

Participants and controls: One thousand one-hundred thirty-five ever-drivers between the ages of 73 and 93 years, including 70 subjects with unilateral and 68 subjects with bilateral, glaucoma.

Methods: All subjects reported their driving habits during each of 4 study rounds. During the fourth and final study round, subjects were systematically assessed for the presence of glaucoma.

Main outcome measures: Self-reported driving cessation or driving limitation, including cessation of night driving, annual mileage below 3,000, or cessation of driving in unfamiliar areas.

Results: Fifteen percent of subjects without glaucoma were no longer driving by the end of the cohort study compared to 21% of unilateral glaucoma subjects ($p = 0.2$) and 41% of bilateral glaucoma subjects ($p < 0.001$). Multivariable regression analysis showed that bilateral (odds ratio [OR] = 2.6, $p = 0.002$), but not unilateral (OR = 1.5, $p = 0.3$), glaucoma subjects were more likely to no longer be driving when compared to subjects without glaucoma. The odds that bilateral glaucoma subjects were no longer driving doubled for every 5 dB of visual field (VF) worsening in the better-eye ($p < 0.001$). Driving cessation within the previous 2 years was analyzed using separate multiple regression models, and both bilateral (OR = 3.6, $p = 0.004$) and unilateral (OR = 2.4, $p = 0.06$) glaucoma subjects were more likely to stop driving over this period when compared to subjects without glaucoma. Driving cessation associated with bilateral glaucoma was present in 0.82% of the population, or 1 in every 122 individuals. Multivariable ordinal logistic regression models demonstrated that subjects with glaucoma did not report more driving limitations than subjects without glaucoma. However, bilateral glaucoma subjects did attribute more driving limitations to difficulties with their vision than subjects without glaucoma (OR = 2.2, $p = 0.02$). Depressive symptoms were noted more frequently in non-drivers than drivers in both univariate analyses (13.7% vs. 5.8%, $p < 0.001$) and multivariable models (OR = 2.6, $p < 0.001$).

Conclusions: Bilateral, and possibly unilateral, glaucoma is associated with significantly higher rates of driving cessation amongst the elderly. The substantial difference in driving patterns seen with different degrees of better-eye VF damage suggests that minimizing VF loss in the better-seeing eye is associated with better functional outcomes. Our findings are consistent with previous work demonstrating that glaucoma

patients more frequently complain of difficulty driving and have higher crash rates than age-matched controls. While driving cessation may alleviate the fear of driving and increase both patient and societal safety, it also decreases independence, resulting in social isolation, depression, and a greater likelihood of nursing home admission. Thus, preventing glaucoma from progressing to more advanced stages could have a major impact on the quality of life in aging populations.

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S07 LOW-PRESSURE GLAUCOMA

T. Krupin (chair) K. Sugiyama (chair), P. Tanna, D.S. Greenfield, J.M. Liebmann

Open-angle glaucoma, a slowly progressive neurodegeneration of retinal ganglion cells and their axons, is clinically characterized by a specific pattern of optic nerve and visual field damage. Normal-tension glaucoma (LTG) is subgroup in which untreated intraocular pressure (IOP) is in the statistically normal (mean 15.9±2.9 mmHg) range, usually £21 mmHg. LPG represents 20% to 39% of patients with open-angle glaucoma in the United States and Europe. Symposium objectives include when to evaluate for non-glaucoma causes for the vision loss, the pathogenesis and systemic evaluation of LTG, the value of IOP-lowering treatment, and potential treatment beyond IOP reduction.

S08 GLAUCOMA MANAGEMENT NON-INDUSTRIALIZED WORLD

R. Thomas (chair), N. Wang (chair), J. Standefer, K. Ben Amor, P. Foster, N. Congdon, E. Maul, T. Shaarawy, R. Sihota

Outline: 1. Introduction, Ravi Thomas; 2. Is the pattern of disease different?, Paul Foster; 3. Diagnosis: Should the approach be different?, E. Maul; 4. Treatment: Should the approach be different?, Out of Africa, Tarek Sharaawy; 5. Role of NGO's in Glaucoma care, Khaled Ben Amor; 6. Training, J. Standefer; 7. Audience Interaction & Votes; 8. Solutions and Conclusion, Ningli Wang.

S09 INTEGRATIVE EYE CARE FOR GLAUCOMA

R. Ritch (chair), L. Ventura (chair), M. Schwartz, K.F. So, C. Zhang, M. Wax

Outline: This session will focus on a multi-systems approach to glaucoma with an emphasis on immunological and vascular mechanisms of disease. The field of psychoneuroimmunology will be introduced. The influence of emotional stress on hormonal, immunological, and vascular factors in relation to glaucoma will be discussed. Topics: 1. Psychoneuroimmunology in Glaucoma, Lori Ventura; 2. Lymphocytes and Glaucoma, Michal Schwartz; 3. Immune regulatory pathways relevant to glaucoma, Marty Wax; 4. Cytokines and Glaucoma, Chun Zhang; 5. Wolfberry in Glaucoma, Kwok Fai So; 6. Curcumin as an anti-inflammatory in Glaucoma, Robert Ritch.

S10 INNOVATIVE APPROACHES FOR PROTECTING THE RETINEL GANGLION CELLS

H. Quigley (chair), H. Verbin-Levkovitch (chair), K.R.G. Martin, S. Thanos, C. Grosskreutz

Panel: P. Kaufman, L. Levin, G. Tezel, J. Lindsey

Outline: All past approaches to protecting ganglion cells from death in glaucoma have used either intraocular pressure (IOP) lowering or approaches to pharmacologically or genetically mitigate the injury once it has occurred. It has been shown by biomechanical, engineering analysis that the effect of the IOP on axons is dominated by the response of the sclera to the stress of IOP, its wall tension. There is increasing evidence that the stiffness of the cornea and sclera can be altered chemically and safely in vivo, potentially affecting not only glaucoma, but myopia and keratoconus.

Objective and Synopsis: Protecting the retinal ganglion cells and optic nerve is the most significant goal in treating glaucoma. In this symposium we will discuss innovative therapeutic approaches for protecting the retinal ganglion cells. The involvement of mitochondrial dysfunction in glaucoma and ways to prevent it will be discussed. Axonal degeneration is a key event in glaucoma- how to arrest it and how to lead to axonal regeneration are important topics to be discussed in this session. The potential treatment with stem cells as therapeutic vectors or replacement therapy will be presented. Finally, altering the sclera to treat glaucoma is additional novel therapeutic approach that will be discussed and conclude this symposium.

S11 MEETING THE CHALLENGE OF PREVENTING BLINDNESS FROM OPEN-ANGLE GLAUCOMA IN PEOPLE OF AFRICAN HERITAGE

E.J. Higginbotham (chair), L. Pasquale (chair), R. Bourne, C. Okeke, D.S. Friedman, M. Hauser, R. Wilson

Objective: Direct attention to glaucoma in people of African descent and discuss strategies to reduce visual disability in this population.

Synopsis: 1. Race versus ethnicity ancestry: Does it matter?, Eve Higginbotham; 2. Case presentation, Constance O. (Nduaguba) Okeke; 3. The epidemiology of open-angle glaucoma in people of African descent, Rupert Bourne; 4. Managing glaucoma on the African Continent, Adeyinka Ashaye; 5. What do randomized clinical trials tell us about managing glaucoma in people of African origin?, David S. Friedman; 6. Challenges finding the genes for POAG in people of African origin, Michael Hauser; 7. Synopsis of the problem and future directions, M.R. Wilson III.

FREE-PAPER SESSION – BASIC SCIENCE

FPBS1 DETECTION OF LONGITUDINAL CHANGE IN EXPERIMENTAL GLAUCOMA USING THREE DIMENSIONAL (3-D) SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY (SD-OCT) OPTIC NERVE HEAD (ONH) VOLUMES

N.G. Strouthidis, B. Fortune, H. Yang, I.A. Sigal, C.F. Burgoyne
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Purpose: To assess deep ONH and retinal nerve fiber layer (RNFL) thickness changes in non-human primate experimental glaucoma using longitudinal 3-D SD-OCT volumes.
Design: Experimental study.
Participants: Five rhesus macaque monkeys.
Methods: Baseline SD-OCT imaging was performed in both eyes prior to the commencement of trabecular meshwork laser ablation to induce elevated IOP in a single eye of each subject. Following laser treatment, SD-OCT imaging was performed in both eyes every 1-3 weeks. All SD-OCT volumes were acquired under isoflurane anesthesia, 30 minutes after manometrically lowering IOP to 10 mmHg. Images were centered on the ONH and utilized a 15º, 290 B-scan X 768 A-Scan horizontal grid pattern with 9 repetitions per B-scan. For each eye, the baseline and the most recent follow-up volume were analyzed. Using custom software, a single operator delineated key anatomical landmarks in 40 radial interpolated B-scans generated from each SD-OCT volume. The following landmarks were delineated: the internal limiting membrane (ILM), the posterior surface of the RNFL, the Bruch's Membrane/retinal pigment epithelium complex and its internal termination – the neural canal opening (NCO) – and the anterior surface of the lamina cribrosa. Parameter values were analyzed using a two-way ANOVA to determine the significance of the interaction between time and treatment group (*i.e.*, glaucoma versus control).
Main outcome measures: Peripapillary RNFL thickness (distance between the ILM and the posterior surface of the RNFL at a radius of 280 pixels from the NCO centroid), NCO area, prelaminar thickness (distance between the ILM and the anterior laminar surface) and anterior lamina cribrosa surface height (relative to the NCO reference plane).
Results: Post-laser follow up duration ranged from 4.7 to 12.2 months (mean ± SD, 9.7 ± 2.9 months) and mean post-laser IOP ranged from 18.1 to 26.9 mmHg (22.1 ± 3.5 mmHg) in the glaucoma eyes and from 10.4 to 12.1 mmHg (11.1 ± 0.8 mmHg) in the control eyes. A significant effect of experimental glaucoma over time was found for the anterior laminar surface height ($p = 0.001$), prelaminar thickness ($p = 0.03$) and RNFL thickness ($p = 0.03$). In the glaucomatous eyes, RNFL thickness changed from baseline by a maximum of -53.9 % and a minimum of 2.8 %, compared to -1.4 to 0.5 % in control eyes. Anterior laminar surface height moved posteriorly relative to the NCO in all five glaucoma eyes. The range of median surface height movement was 38.3 to 191.5 % in the glaucoma eyes, compared to -9.2 to 2.8 % in control eyes. The median prelaminar thickness changed by a maximum of -65.4 % and a minimum of 1.9 % in glaucoma eyes, compared to 1.4 to 10.4 % in control eyes. There was no significant effect of glaucoma over time for NCO area ($p = 0.11$), the range of changes observed for NCO area was -2.0 to 2.5 % in glaucoma eyes and -2.4 to 5.3 % in control eyes.
Conclusions: This study demonstrates the ability of 3-D SD-OCT imaging to detect longitudinal RNFL and deep ONH changes in experimental glaucoma. Prelaminar thickness and anterior lamina position may constitute novel parameters for clinical detection of glaucomatous progression using SD-OCT.
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FPBS2 LAMINA CRIBROSA AND PERIPAPILLARY SCLERA HISTOMORPHOMETRY IN NORMAL AND ADVANCED GLAUCOMATOUS CHINESE EYES WITH NORMAL AND ELONGATED AXIAL LENGTH

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Purpose: To measure laminar and peripapillary scleral architecture in normal and glaucomatous Chinese eyes with normal and elongated axial length.
Design: The retrospective histomorphometric study.
Participants and controls: The histomorphometric investigation included a Normal Group (non-axially elongated eyes) of 40 human globes (mean age: 41.3 years; range: 15-68 years) enucleated due to a malignant choroidal melanoma, a Glaucomatous Group (non-axially elongated eyes) of 55 eyes (age: 43.3 years; range: 12-88 years) enucleated due to painful secondary angle-closure glaucoma, and a group of 26 glaucomatous globes (Glaucomatous Elongated Axial Length Group) (age: 29.0 years; range: 12-60 years) with an axial length > 27.5 mm. Anterior-posterior histological sections were morphometrically evaluated.
Main outcome measure: Lamina cribrosa thickness and peripapillary sclera thickness
Results: The lamina cribrosa was significantly ($P < 0.001$) thicker in the Normal Group than in the Glaucomatous Group, in which it was significantly ($P < 0.001$) thicker than in the Glaucomatous Elongated Length Group. The lamina cribrosa thickness decreased significantly with increasing axial length ($P < 0.001$) and presence of glaucoma ($p < 0.001$). Peripapillary scleral thickness close to the optic nerve scleral canal and just outside of the optic nerve meninges decreased significantly with increasing axial length ($P = 0.04$ and $P = 0.02$, respectively). Peripapillary scleral thickness did not vary significantly between the Glaucomatous group and the Normal Group. The distance between the intraocular space and cere-

brospinal fluid space was ($p < 0.001$) shorter in the two glaucomatous groups than in the Normal group.

Conclusions: Lamina cribrosa thickness and peripapillary sclera thickness decreased significantly with axial length, in addition to a glaucoma-related thinning of the lamina cribrosa. Within non-axially elongated eyes, the peripapillary sclera thickness did not vary significantly between glaucomatous eyes and normal eyes.

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FPBS3 HYDRODYNAMIC AND MORPHOLOGICAL CHARACTERISTICS AFTER Y27632 TREATMENT IN BOVINE, MONKEY AND HUMAN EYES

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Purpose: To investigate the effect of Y-27632, a rho-kinase inhibitor, on outflow facility (C), the hydrodynamic patterns of outflow, and the morphology of the inner wall (IW) and juxtacanalicular tissue (JCT) in bovine, monkey and human eyes.

Design and Methods: Twelve enucleated bovine eyes, 4 pairs of monkey eyes and 4 pairs of human eyes were perfused at 15 mmHg with Dulbecco's PBS containing 5.5 mM glucose (GPBS) to establish a baseline C. Seven bovine eyes, 4 monkey eyes and 4 human eyes were perfused with GPBS+50 µM Y27632 for 30 min while 5 bovine eyes, 4 monkey eyes and 4 human eyes were perfused with GPBS only as a control. All eyes were perfused with fluorescent microspheres (0.5 µm; 0.002%) to label the hydrodynamic patterns of outflow before perfusion-fixation. Confocal images of frontal sections were taken along the (IW) of Schlemm's canal (SC) (or aqueous plexus in bovine eyes, AP). The total length (TL) and the tracer-decorated length (L) of the IW were measured, and the average percent effective filtration length (PEFL = L/TL) was calculated. Sections with SC (or AP) were examined by light and electron microscopy. The TL of the IW and the length exhibiting separation (SL) in the JCT were measured. The average percent separation length (PLS = SL/TL) was calculated.

Results: After Y27632 treatment, C increased 58% [0.83 ± 0.25 vs 0.04 ± 0.14 µl/min/mmHg, $p = 0.03$] in bovine eyes, 115% [0.59 ± 0.11 vs 0.18 ± 0.05 µl/min/mmHg, $p = 0.03$] in monkey eyes, but remained unchanged in human eyes (0.02 ± 0.01 vs 0.02 ± 0.03 µl/min/mmHg, $p = 0.98$) compared to controls. Segmental distribution of tracer was seen in the TM, with tracer concentrated near collector channel ostia in all three species. A more uniform pattern and extensive tracer labeling was seen along the IW in Y27632 treated bovine and monkey eyes but not in human eyes compared to controls. After Y27632 treatment, the PEFL was 2-fold larger than controls (58.3 ± 6.5% vs 22.1 ± 6.1%, $p = 0.002$) in bovine eyes, 3.4-fold larger than controls (82.5 ± 1.2% vs 24.2 ± 4.2%, $p < 0.001$) in monkey eyes, but no significant difference in human eyes (47.4 ± 6.5% vs 39.0 ± 12.5%, $p = 0.41$). Light microscopy revealed significant separation between the IW and JCT in Y27632 treated bovine and monkey eyes compared to controls. PSL was 2.8-fold larger than controls (59.3 ± 3.6% vs 20.8 ± 2.0%, $P < 0.001$) in bovine and 2.2-fold larger than controls (75.2 ± 4.0% vs 33.5 ± 5.3%, $p = 0.001$) in monkey eyes. No discernable separations between the IW and JCT or within the JCT were found in Y27632 and control human eyes.

Conclusions: Y27632 significantly increases C by redistributing aqueous outflow through a larger and looser area of the JCT in bovine and monkey eyes, but not in human eyes under the same experimental condition. The increase in C coincides with an increase in available area for aqueous outflow and greater separation in the JCT, which are likely driven by morphologic changes associated with a decrease in cell-cell and cell-matrix connections in the JCT. Our data suggest an enhanced connectivity between the IW and JCT exists in human eyes, which may withstand the hydrodynamic forces driving separation between the IW and JCT. Strategies targeting JCT/IW or JCT/JCT connectivity in human eyes may be promising anti-glaucoma therapies to decrease outflow resistance and thus IOP.

FPBS4 GENOMIC (EPIGENETIC) DNA METHYLATION IN PATIENTS WITH OPEN-ANGLE GLAUCOMA

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Purpose: DNA methylation occurs by transfer of a methyl group to cytosine residues in the dinucleotide sequence CpG. The extent of DNA methylation positively correlates with the extent of gene inactivation. The disruption of the heritable methylation patterns in DNA can lead to alterations in chromatin structure and alterations in gene expression promoting

chronic diseases. The present study was performed to investigate whether there is an altered global DNA methylation in patients with open-angle glaucoma.
Design: Prospective case-control study.
Participants and controls: Fifty-nine patients with primary open-angle glaucoma (POAG, age: 68 (SD 8) years), 54 patients with secondary open-angle glaucoma due to pseudoexfoliation syndrome (PEXG, age: 72 (SD 8) years), and 53 patients with cataract as controls (age: 69 (SD 11) years) were included.
Methods: Total DNA was extracted from frozen EDTA-blood using QIAmp DNA Blood Mini Kit (Qiagen). Global methylation status [DNA methylation in %, 1-(HpaII/MspI)] was measured according to Pogribny *et al*. (1999) with a modified non-radioactive assay. Statistics: Comparisons were made using the Mann-Whitney-Test (2-tailed) and the results are presented as means (SD). A p-value of less than 0.05 was considered significant.
Main outcome measure: Genomic DNA methylation (%).
Results: There was a significantly elevated genomic DNA methylation (in %) 1-(HpaII/MspI) in peripheral mononuclear cells in patients with POAG (68%, SD 18; U = 868, Z = -2.79, p = 0.005), but not in PEXG (55%, SD 17; U = 1049, Z = -0.57, p = 0.57) when compared with healthy controls (55%, SD 24). Thus, the difference between POAG and PEXG was exactly 13% of methylated HpaII/MspI restriction sites.
Conclusions: Since methylation of DNA is an important epigenetic factor in regulation of gene expression these findings may have important implications for a possible subsequent derangement of epigenetic control in patients with POAG. Further studies including gene-specific analyses are needed to clarify the differences between POAG and PEXG.
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FPBS5 NEW INSIGHTS INTO AQUEOUS HUMOR OUTFLOW FROM THE LASER-INDUCED GLAUCOMA MONKEY MODEL

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Purpose: To investigate the relationship between decreased outflow facility and changes in hydrodynamic aqueous humor outflow patterns and morphology in cynomolgus monkey eyes with unilateral chronically elevated intraocular pressure (IOP).
Design and Methods: Argon laser photocoagulation burns to the trabecular meshwork (TM) were made in one eye of each monkey (N = 3), leaving the contralateral eye as a normotensive control. IOPs were followed by pneumatonometry during a follow up period of 16 to 70 months. Outflow facility was measured by fluorophotometry before sacrifice. To label the hydrodynamic patterns of outflow, the eyes were enucleated and perfused with fluorescent microspheres (0.5 µm; 0.002%) at the last pressure measured before death minus 7 mmHg. The eyes were perfusion-fixed at the same pressure. Confocal images were taken along the inner wall (IW) of the Schlemm's canal (SC). The total length (TL) and the filtration length (FL) of the IW decorated by tracers were measured in frontal sections. The average percent effective filtration length (PEFL = FL/TL) was calculated for each eye. Sections exhibiting SC were processed and examined under light and electron microscopy.
Results: The average IOP was significantly higher in laser-treated eyes (61.3 ± 4.2 mmHg) than controls (22.7 ± 4.0 mmHg, P = 0.0003). The average outflow facility was 13-fold lower in laser-treated eyes (0.03 ± 0.02 µl/min/mmHg) than controls (0.39 ± 0.17 µl/min/mmHg, P = 0.02). By confocal microscopy, in control eyes, SC was open and a segmental distribution of microspheres was found in the TM with a greater concentration near the collector channel ostia. Much less tracer labeling was seen along SC in laser-treated eyes than control eyes. The average PEFL in controls (47.5 ± 10.8%) was 6-fold larger than in laser-treated eyes (8.4 ± 4.8%, P = 0.01). The mean distance between the IW and outer wall of SC was 5-fold wider in control eyes (18.99 ± 6.03 µm) than in laser-treated eyes (3.47 ± 0.33 µm, p = 0.01). By light microscopy, there was extensive pigmentation throughout the TM, denser extracellular matrix in the JCT region, and most of SC collapsed with focal herniations of the IW and JCT protruding into the collector channel ostia in laser-treated eyes. By electron microscopy, few or no microspheres were observed in laser-treated areas and in the areas with SC collapse. More microspheres were observed near the collector channel ostia area in non-lasered areas.
Conclusions: In the laser-induced glaucoma model, laser damage results in a reduction in the available area for outflow across the IW of SC which contributes to the decrease in outflow facility and thus elevation of the IOP. Constriction of SC, caused by the chronic elevation of IOP, further decreases the available area for outflow across the IW which decreases outflow facility and increases IOP even more in a vicious cycle. This study suggests that the available area for aqueous humor outflow across the IW of SC is a crucial factor in regulating outflow resistance and maintaining IOP.

FPBS6 A GLUCOCORTICOID-INDUCIBLE MMP1 GENE THERAPY VECTOR LOWERS IOP IN A SHEEP MODEL OF STEROID-INDUCED OCULAR HYPERTENSION

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Objective: Glucocorticoid (GC) treatment leads to increased ECM deposition in the trabecular meshwork and to elevated IOP in 40% of patients. Our goal was to design a GC-inducible viral vector overexpressing matrix metalloproteinase protein 1 (MMP1) to counteract ECM deposition only in the presence of the steroid. To investigate the vector's efficacy and toxicity in vitro and in living animals.
Design and Methods: Human wild-type MMP1 and a cata-

lytic site mutant mutMMP1 were cloned downstream a GC response element fused to a TATA-like promoter. The expression cassettes were inserted into adenoviral vectors to produce AdhGRE.MMP1 and AdhGRE.mutMMP1. An empty vector, AdNull, was also used. For in vitro, HTM cells were infected with the vectors in the presence or absence of 0.1 μM DEX. MMP1 levels (protein and mRNA) were analyzed by WB, ELISA and q-PCR. Activity of secreted MMP1 was analyzed with collagen degradation assays. For in vivo, we used our recently developed ovine model of steroid-induced ocular hypertension. Elevated IOP was induced by prednisolone drops 3 times per day. Vectors were applied by a 30 μl single dose intracameral injection. Two groups of sheep (n = 3 and n = 6) were treated as follows. In the first group, 3 eyes had IOP induced prior injection of AdhGRE. MMP1; 2 eyes received the vector 24 h prior to the corticosteroid treatment and one eye received just the prednisolone. In the second group, three days after prednisolone treatment, 6 OS eyes were injected with AdhGRE.MMP1, AdhGRE. mutMMP1 and Ad Null (two each). IOP was measured with a Perkins tonometer and converted to mmHg with a calibration curve. Inflammation was monitored by visual inspection of the eyes.

Results: In vitro, DEX-treated HTM cells showed a decreased MMP1 expression compared to untreated controls. However, DEX-treated cells infected with AdGRE.MMP1 secreted high levels of MMP1 (20X protein and 200X mRNA), overriding the reduction and boosting its expression. DEX-treated cells infected with AdhGRE.mutMMP1 showed also high MMP1 mRNA and protein levels, confirming the functional activity of the GRE element. However, while the secreted wild-type MMP1 had 90% higher activity than untreated-infected controls, the secreted mutMMP1 had no activity, confirming the constructs functional state. In vivo, injection of AdhGRE. MMP1 into the 3 eyes which IOP was already elevated (24-30 mmHg), reduced the pressure to 10-13 mmHg in 48 h. This lowering effect lasted 12-15 days. In the 2 eyes with normal IOP, pre-injection of the virus prevented the IOP increase for 12-15 days, despite the continuous corticosteroid application. A robust increase in IOP was observed in the eye receiving only the steroid. In the second group, the OS eyes injected with AdhGRE.mutMMP1 and AdNull showed the same high IOP as their OD eyes. Instead, the two OS eyes injected with the wild-type vector reduced IOP from 26 to 9-11 mmHg which lasted for 2 weeks. There were no signs of ocular inflammation, or discomfort to the animals.

Conclusions: We have developed a novel glucocorticoid-inducible vector system, which overexpresses MMP1 only in the presence of DEX. A single dose of this gene therapy vector can both prevent the increase in IOP normally produced by corticosteroid in the sheep model, and reverse the IOP increase previously elicited by the corticosteroid. The mutant and null vectors had no effect. This tightly regulated gene transfer approach could be of great advantage for the potential gene therapy treatment of steroid glaucoma.

FPBS7 SEARCH FOR SECONDARY GENETIC FACTORS FOR PSEUDOEXFOLIATION GLAUCOMA

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Purpose: Pseudoexfoliation syndrome (PXF) is a major cause of glaucoma throughout the world. LOXL1 has been associated with PXF in many populations including our study of a U.S. clinic-based population with broad ethnic diversity. However, the risk haplotype of LOXL1 is also prevalent in control samples and is much higher than the disease prevalence in some populations. These findings suggest that additional genetic and/or environmental factors could be involved in this complex disorder. In the present study, we evaluated seven functional and positional candidate genes for association with PXF.

Methods: Five genes (MTHFR, MTR, MTRR, MTHFD1 and CBS) that are critical components of the homocysteine metabolism pathway, one gene (ELN) that functionally interacts with LOXL1, and one gene (MYO5B) that is located at the significant linkage locus for PXF were selected. Twenty-five tag SNPs which captured the majority of alleles in these genes were genotyped in 194 Caucasian patients with PXF and 132 controls. Single-SNP and haplotype association were analyzed using the chi-squared test. Interaction effects between these genes and LOXL1 were analyzed using logistic regression.

Results: One SNP (rs8006686) in MTHFD1 showed a nominally significant association with PXF ($p = 0.015$, OR = 2.23). However this SNP, and the other 24 SNPs tested were no longer significantly associated with PXF after correcting for multiple testings (Bonferroni corrected $p > 0.37$). After controlling for the effects of age and the LOXL1 SNPs, none of the tested SNPs were associated with PXF ($p > 0.08$). Haplotype analysis showed no association between all these genes and PXF ($p > 0.23$). Logistic regression modeling revealed no interaction effects between these genes and LOXL1 ($p > 0.06$).

Conclusions: Our results suggest that these genes are not major risk factors for PXF in Caucasian populations. Further studies are required to identify secondary genetic factors that contribute to pseudoexfoliation and associated glaucoma.

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FPCS1 COMPARISON OF STEREO DISC PHOTOS AND ALTERNATION FLICKER USING A NOVEL MATCHING TECHNOLOGY FOR DETECTING GLAUCOMATOUS CHANGES IN THE OPTIC DISC

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Purpose: To compare agreement of a novel automated alternation flicker technology (AF) and stereophotograph (SP) inspection for detection of progressive glaucomatous optic neuropathy.
Design: Comparative study of diagnostic evaluation technologies.
Participants: Glaucoma patients meeting eligibility criteria were retrospectively recruited. All subjects had a minimum of 36 months follow-up, standard automated perimetry (24-2) every 4 months and annual stereoscopic disc photography.
Methods: Four experienced graders (RR, DSG, NR, TK) assessed SP for optic nerve head (ONH) progression, disc hemorrhage (DH), or blood vessel (BV) movement using predefined criteria. At a separate session, the graders evaluated the photos using AF applying the same criteria. The order of eyes and visits were randomized. Visual field progression was assessed using regression analysis and defined as a slope < or = -1 dB/year for inner points (-2 dB/year for outer points) significant at P < 5%.
Main outcome measure: Progressive glaucomatous optic neuropathy as identified by AF and SP inspection.
Results: Forty eyes of 20 patients were included. Using SP, the overall agreement (kappa ± SE) among graders for ONH change was 0.19 ± 0.06, for DH was 0.78 ± 0.06 and for BV movement was -0.04 ± 0.06. Using AF, the overall agreement among graders for ONH change was 0.28 ± 0.06, for DH was 0.43 ± 0.06 and for BV movement was 0.22 ± 0.06. The agreement among graders was not significantly different using SP or AF (p = 0.29) for ONH change but was significantly (p < 0.001) better using SP for DH and significantly (p = 0.002) better using AF for BV movement. The overall agreement between visual field progression and disc progression using SP (0.10 ± 0.05) and AF analysis (0.19 ± 0.05) was similar (p = 0.20). Using AF progression detection was significantly associated with BV movement for 3-graders (p = 0.004 to p < 0.001).
Conclusion: Assessment of glaucomatous optic disc progression using AF and SP techniques are similar for detection of ONH change.
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FPCS2 RE-TRAINING ON THE ASSESSMENT OF OPTIC NERVE HEAD PHOTOGRAPHS FOR THE GLAUCOMA DIAGNOSIS

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Purpose: To evaluate the effect of re-education of ophthalmologists and residents in ophthalmology in subjective classification of optic nerve head photographs (ONH photos).
Design: Prospective 2-phase assessment of OHN photos.
Participants: Doctors attending an international glaucoma meeting at Malmö University Hospital (Malmö, Sweden) in March 2008 were asked to participate. ONH photos taken with the same fundus camera, were retrieved from an existing database of glaucoma patients and healthy subjects. Glaucoma patients had reproducible glaucomatous visual field defects. Healthy subjects were randomly selected from the city of Malmö, Sweden and had undergone a thorough ophthalmic examination.
Methods: We created a web-based form containing 201 ONH photos of 73 glaucoma patients and 128 healthy individuals. The participants evaluated 50 randomly selected ONH photos each at two different occasions separated by a lecture in glaucoma diagnosis based on evaluation of ONHs. The one-hour lecture was performed by one of the authors (AB) and was focusing in particular on the evaluation of optic disc size, neuroretinal rim, retinal nerve fiber layer, parapapillary atrophy, and disc hemorrhages based on ONH photos from glaucoma patients and healthy individuals. The web form automatically and randomly selected a subset of 50 photos from the larger dataset of 201 photos at the time for the first log in, thus an individual mix of photos was created for each participant. This individual subset of ONH photos was used in both phase 1 and 2, but in different randomized order. The photos were classified into three different categories: glaucomatous, healthy or uncertain. All results were anonymously processed.
Main outcome measure: Sensitivity, specificity, and number of uncertain classifications obtained during phases 1 and 2.
Results: Eighty-nine specialists and 7 residents in ophthalmology participated. In phase 1 mean sensitivity was 69.6% (ranging from 21.4% to 100%), and mean specificity was 68.4% (ranging from 9.1% to 100%). In phase 2 mean sensitivity increased to 79.8% (ranging from 25.0% to 100%), specificity was unchanged – mean 68,1% (ranging from 11.1% to 100%). The number of uncertain classifications decreased from 21.8% in phase 1 to 13.0% in phase 2. The improvement in sensitivity was significant (paired t-test p < 0.0001); the individual mean improvement was 10.1%.
Conclusions: The diagnostic classification of ONH photos improved after re-training. The number of uncertain classifi-

cations decreased considerably and the sensitivity increased with 10% on average, while specificity remained at the same level. Our results propose a positive effect of a short training lecture in ONH assessment for glaucoma.

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FPCS3 OPTIC DISC MORPHOLOGY USING HRT VERSUS CLINICAL EXAMINATION

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Objective or purpose: To compare the results of disc assessment using clinical methods and the Heidelberg Retinal Tomograph (HRT).

Design: This was a population based survey of 3,280 (78.7% response) persons.

Participants: The Singapore Malay Eye Study examined 3,280 adults aged between 40-80 years of ethnic Malay. Of these, 2948 persons (89.9%) had acceptable HRT II images and clinical examination.

Methods: Participant underwent standardized ophthalmic assessments between 2004 and 2006. Optic disc was evaluated using a +78D lens, at x16 magnification, with measuring graticule (Haag-Streit, Switzerland) during dilated funduscopy. Participants also underwent HRT II measurements. The intraclass correlation coefficient (ICC) was used to assess the agreement of the two methods.

Main outcome measure: VCDR derived from direct ophthalmoscopy and from HRT II instrument.

Results: Direct ophthalmoscopy had a moderate correlation with HRT II instrument in term of VCDR measurement (ICC = 0.44-0.68, P = 0.001).

Conclusions: VCDR measurements derived from HRT II may not be interchangeable with those derived from direct ophthalmoscopy.

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FPCS4 PRE-PERIMETRIC DETECTION OF GLAUCOMA: A BLUE-ON-YELLOW MULTIFOCAL VEP STUDY

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Purpose: To determine the ability of blue-on-yellow (BonY) multifocal VEPs (mfVEP) to identify functional loss in pre-perimetric glaucoma.

Design: Prospective case series.

Participants: Thirty patients with at least one glaucomatous optic disc (as adjudged by 2 glaucoma specialists) AND bilaterally normal, reliable and repeatable achromatic Humphrey visual fields (HVF) were recruited. Cataract or other ocular abnormality were excluded.

Method: BonY mfVEP testing was performed on all participants. A defect was defined as a cluster of at least 3 abnormal points on the amplitude asymmetry deviation plot with 2 segments P < 2% and 1 segment P < 1%, or 2 zones with P < 0.5%. Latency was analyzed based on sectors with similar waveforms. MfVEP was followed by dilated optic disc stereophotography and optical coherence tomography (OCT, fast RNFL protocol,5). Optic disc photographs were assessed by 2 independent examiners in a masked fashion. Abnormal rim regions were identified on photographs and the worst affected eye and region in each patient was noted.

Main outcome measures: MfVEP amplitude asymmetry and latency values were analyzed and compared topographically with findings of photographic disc assessment. Average retinal nerve fiber layer (RNFL) thickness, RNFL asymmetry and sectors with RNFL thinning on OCT were compared between patients with and without mfVEP defects.

Results: Fourteen (46.7%) patients demonstrated significant abnormality on amplitude asymmetry deviation plots of BonY mfVEP. In all 14 cases, the defect was monocular and corresponded to the eye with the worse disc. In 13 out of 14 patients, the defect also corresponded to the location of the worst affected rim. Average RNFL thickness of eyes with mfVEP defects was 81.2 ± 9.9 microns, significantly lower than that of patients without defects (90 ± 10.5 microns, p = 0.035). Mean asymmetry of RNFL (better minus worse eye) was also significantly higher for patients with mfVEP defects, compared to those without (9.0 ± 6.4 microns vs 3.0 ± 7 microns, p = 0.03). Average latency of both eyes of glaucomatous patients was delayed compared to controls with no difference in latency between worse and better eyes of glaucoma patients. There was no association of latency delay with either the location of disc changes or mfVEP amplitude defects.

Conclusion: Amplitude asymmetry of blue-on-yellow mfVEP appears to be a promising tool to identify functional loss in pre-perimetric glaucoma.

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FPCS5 PREVALENCE OF GLAUCOMA AND OCULAR HYPERTENSION IN A RURAL ADULT CHINESE POPULATION: THE HANDAN EYE STUDY

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Objective: This study was designed to estimate age- and gender-specific prevalence of glaucoma in a rural population of Northern China.

Design: Population-based, cross-sectional study.

Participants: Between October 2006 and October 2007, 6,830 Han Chinese aged 30+ years were enrolled in rural Yongnian County in Handan, northern China.

Methods: Clustered samples of adults aged 30+ years residing in 13 residential villages in Yongnian County of Handan, Hebei Province were randomly selected and invited to participate the Handan Eye Study. All participants completed an ophthalmologic examination, including measurement of intraocular pressure (IOP) and slit-lamp examination. Gonioscopy was performed on all subjects with limbal anterior chamber depth of 40% or less as well as on 1 in 10 subjects who were systematically sampled and all glaucoma suspects. Visual fields were also obtained on one in 10 and all suspects. Digital color stereoscopic photographs of the optic nerve head were obtained with the Canon CR-DGi (Canon, Tokyo, Japan) non-mydriatic retinal camera by rotating the camera 5 degrees between images. Glaucoma was defined according to the World Glaucoma Association criteria.

Main outcome measures: Prevalence of Primary open-angle glaucoma and ocular hypertension.

Results: Of the 6830 participants (90.4% of those intended) who underwent a complete ophthalmologic examination at the hospital or village based clinc, 111 (1.6%) had primary open-angle glaucoma (POAG). The prevalence of POAG was in 1.7% (95% CI, 1.4% -2.0%) in those aged 40 years and over, increasing to 2.6% (95% CI, 2.3% -3.0%) in those aged 50 years and over. POAG prevalence increased with age ($p = 0.001$) and women had a higher prevalence than men 1.9 % versus 1.3% ($p = 0.044$). The prevalence of ocular hypertension was 2.1% (95% CI, 1.8%-2.5%). The mean IOP of persons with OAG was 16.3 ± 3.5 mmHg and 91% of them presented with an IOP < 21 mmHg.

Conclusion: The prevalence of POAG in this rural population is about 1.7% in aged 40 years and over, and 2.6% in aged 50 years and over, which is higher than previously reported in Chinese urban populations. The vast majority of POAG cases presented with an IOP < 21 mmHg. Given the rapid aging of China's population, POAG is likely to become a large public health problem.

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FPCS6 CHANGES IN MEAN DEVIATION IN PEOPLE WITH GLAUCOMA – A DECISION ANALYTIC MODEL FROM THE CIGTS, OHTS, AND AGIS TRIALS (COA CHANGES IN MD MODEL)

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Introduction: The challenge of conducting longitudinal population based studies leads to a limited understanding of the rate of change in mean deviation (MD) in people with glaucoma. We pooled patient level data from three studies representing a range of glaucoma damage: the Collaborative Initial Glaucoma Treatment Study (CIGTS), Ocular Hypertension Treatment Study (OHTS), and Advanced Glaucoma Intervention Study (AGIS). Here we report the preliminary results describing the change in mean deviation over seven years predicted by the model.

Participants and Design: We constructed a Markov model using MD data from study participants: 607 (CIGTS), 1,619 (OHTS) and 590 (AGIS). The model was constructed with transition probabilities for each visit/MD combination over 7 years. We assessed the difference in MD from baseline to the 7 year visit for four simulated participants with starting MDs of -1 dB, -4 dB, -10 dB, and -20 dB. We report the result for the right eye only. For the model MD was characterized in integers. 'Change' is a difference of 1 dB between visits. 'Improvement' is a 'less negative' MD score. 'Worse' is a 'more negative' MD score.

Main outcome measure: Difference in mean deviation from the baseline visit to seven years. ***Results:*** There was a difference in the rate of change over 7 years between those with -1 dB and -4 dB compared to those with -10 dB and -20 dB. At year 7, the participants with baseline MD scores of -1 dB or -4 dB were more likely to have the same or improved MD scores than the participants with baseline MD of -10 dB or -20 dB (65% vs. 35%) Those with baseline MD of -10 dB

or -20 dB were more likely to have a worse MD in year 7 than an improved score. Almost 1/3 of those with a baseline MD score of -10 dB or -20 dB had a worsening of MD of 3 dB or more.
Conclusions: Further validation of the model, including calibration, is necessary, but initial results seem to replicate those seen in other studies. Our model for changes in MD could serve as a versatile tool for evaluation of the effectiveness of interventions to prevent glaucoma progression.
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FPCS7 STRUCTURE-FUNCTION RELATIONSHIP BETWEEN SPECTRAL-DOMAIN OPTICAL COHERENCE TOMOGRAPHY (SD-OCT) PARAMETERS AND PATTERN ELECTRORETINOGRAM (PERG) RECORDINGS IN GLAUCOMATOUS EYES
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Purpose: To examine the relationship between SD-OCT measurements of retinal nerve fiber layer (RNFL) thickness, optic disc features and macular thickness and PERG amplitude responses.
Design: Cross-sectional study.
Participants: Sixty-six glaucoma patients (mean age = 67.8 years, SD = 12.5 years) enrolled in the UCSD Diagnostic Innovations in Glaucoma Study (DIGS).
Methods: RTVue SD-OCT (Optovue, Fremont, CA) measurements using ONH and GCC imaging protocols and PERG (Glaid PERGLA, Lace Elettronica, Pisa, Italy) recordings were obtained on the same day. The worst eye based on standard automated perimetry mean deviation (MD = -2.77 dB, SD = 3.32 dB) was chosen for the analysis.
Main outcome measure: The strength of the association (R^2) between SD-OCT RNFL thickness (µm), neuroretinal rim area (mm^2) and rim volume (mm^3), macular ganglion cell complex (GCC) thickness (µm), macular thickness (µm), macular outer retinal thickness (*i.e.*, macular thickness minus GCC thickness) (µm) and PERG amplitude (µV).
Results: A significant association was found between GCC thickness, RNFL thickness, macular thickness and PERG amplitude ($R^2 = 0.23$, $R^2 = 0.21$ and $R^2 = 0.11$, respectively, all $p \leq 0.007$). Associations with other parameters, such as rim area and rim volume, were not significant (all $p > 0.180$). In multivariate analysis, after adjusting for age and IOP taken at the time of testing, the association remained significant for GCC and average RNFL thickness ($p \leq 0.004$).
Conclusions: As expected, because PERG response relies on a centrally presented stimulus and the response likely is the result of retinal ganglion cells activation, the structure-function relationship is strongest between GCC thickness and PERG amplitude. However, the modest association found suggests that other factors may be involved in the origin of PERG responses. The lack of association found between optic disc features and PERG amplitudes may confirm this hypothesis.
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FPCS8 COMPUTERIZED IMAGING AND MEASUREMENT OF EPISCLERAL VENOUS PRESSURE
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See abstract D17.01 on page 22.

POSTER ABSTRACTS

1. GENERAL ASPECTS

1.1. General aspects: Epidemiology

P001 GLAUCOMA SURVEY IN ISRAEL

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Objective: To assess treatment patterns, detect IOP levels among treated patients and risk factors other than IOP in glaucoma patients in Israel.
Design: Ophthalmologists were asked to record data about their glaucoma patients according to a questionnaire. Parameters assessed included: sex, age, risk factors and systemic diseases, IOP levels at diagnosis and during follow up, C/D ratio at diagnosis, last updated visual fields results, current anti-glaucoma treatment and the presence of diabetic retinopathy.
Results: The survey results were collected from data of 907 patients. Family history of glaucoma was found in 15% of patients. Hypertension was the most frequent systemic disease (40%). Diabetes was found in 22% of patients and the prevalence of diabetic retinopathy was 7.4%. Myopia was the most common risk factor (22%). There was no significant difference in glaucoma prevalence between men and women. Ninety-seven percent of glaucoma patients were above 45 years old; 87% were diagnosed as POAG and 13% NTG; 35% of patients had normal visual fields at diagnosis. Men suffered more glaucoma damage than women (36% *vs* 31%, p = 0.0419). Increased damage was significantly correlated with age and longer duration of disease. Greater damage was found in men compared to women, significant for C/D above 0.6 or 0.8. IOP reduction of 30% or more with medical therapy was achieved in 64% of patients and was greater in eyes with larger C/D ratio. Although 95% of eyes achieved IOP < 21 mmHg with medical therapy, visual fields deterioration was observed in 31% of patients and was correlated with higher IOP and smaller IOP reduction. Increasing age was significantly correlated with VF loss (P < 0.001). Monotherapy was the modality of treatment in only 38% of patients. Thirteen percent of patients were treated with combination therapy in 1 bottle; 49% of patients were treated with more than 1 bottle and 14% of patients were treated with more than 2 bottles.
Conclusions: Our survey describes the epidemiology of glaucoma in Israel, highlights important risk factors, concomitant systemic diseases and medical treatment modalities. In addition it shows the natural progression of the disease and the effect of medical therapy on progression rate.
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P002 EFFECT OF PHYSICIAN FEES ON GLAUCOMA PROCEDURE RATES IN CANADA

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Purpose: Our previous work identified wide variability in glaucoma laser and surgical procedure rates among Canadian provinces, suggesting that non-clinical factors may influence procedure rates. The present study was designed to investigate the influence of physician fees on procedure rates.
Study design: Population-based study.
Methods: Canadian provincial health insurance databases were accessed to obtain yearly procedure totals for laser trabeculoplasty, trabeculectomy and glaucoma drainage device (GDD) implantation, as well as provincial physician fees for these procedures from 1992 to 2007. An age-stratified glaucoma prevalence model was applied to provincial population census data to estimate the number of individuals with glaucoma. Regression analyses were performed to evaluate the influence of fees on procedure rates. First, we examined the effects of differences in remuneration between provinces and across time points. Second, for each type of procedure, we examined the effects of differences in the relative remuneration compared to other glaucoma procedures.
Results: During the study period we found that temporal trends in procedure rates varied widely among provinces. From 1992 to 2007 the changes in provincial trabeculoplasty rates ranged from a decrease of 98% to an increase of 380%, the change in trabeculectomy rates ranged from a decrease of 72% to an increase of 42%, and the change in GDD implantation rates ranged from a decrease of 32% to an increase of 1292%. Physician fees also varied widely between provinces. For example, in 2007 provincial physician fees varied from $125 to $663 for trabeculoplasty, $370 to $748 for trabeculectomy and $426 to $956 for GDD implantation. Multivariable linear regression modeling demonstrated that for every $100 increase in fee, 10.5 more trabeculoplasties (p = 0.08), 1.2 fewer trabeculectomies (p = 0.19) and 0.02 more GDD implantations (p = 0.92) were performed per 1000 persons with glaucoma. Multivariable linear regression models examining the relative fee of each procedure compared to the other procedures in the same province did not find any association between relative remuneration and procedure rate.

Conclusion: Physician remuneration fees did not influence glaucoma procedure rates in Canada during the study period.

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P003 SYSTEMIC ASSOCIATIONS OF INTRAOCULAR PRESSURE IN CHILDREN

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Objective or purpose: Several large studies have demonstrated relationships between obesity, blood pressure, and variations in intraocular pressure (IOP) in adults, but the validity of these associations may be limited by confounding by systemic comorbidities. The aim of this study was to assess these relationships in a cohort of healthy schoolchildren.

Design: Prospective observational cross-sectional study.

Participants: This study was on a subset of healthy schoolchildren enrolled in the Singapore Cohort Study of the Risk Factors of Myopia (SCORM).

Methods: Four hundred eight Chinese children (213 male (52.2%); mean age 9.70 ± 0.80 years) were included in the study. IOP was measured using air-puff tonometry. Height and weight were measured according to standard protocols. Systolic and diastolic blood pressures were measured with an automated sphygmomanometer with the appropriate cuff size and the average of 3 readings was taken. Obesity and overweight status were defined according to internationally standardized age and gender specific cut-off values.

Main outcome measures: IOP, BMI, obesity status and blood pressure.

Results: IOP values from the right and left eyes were highly correlated ($r = 0.75$, $p<0.001$) and the right eye was arbitrarily used for analysis. The mean IOP was 16.7 ± 2.6mmHg. IOP did not differ significantly by gender ($p = 0.19$) or between obese, overweight or normal children ($p = 0.15$). In multivariate analyses with IOP as the dependent variable and age, gender, BMI or obesity status, systolic and diastolic blood pressure as covariates, IOP was not significantly associated with BMI, obesity or blood pressure.

Conclusions: In contrast to adults, obesity, BMI and blood pressure were not significantly associated with variation in IOP in children. These findings may be important in the assessment of glaucoma risk.

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P004 EVALUATION OF INTRAOCULAR PRESSURE IN NON GLAUCOMATOUS INDIVIDUALS ABOVE THE AGE OF FORTY FROM ARABIAN PENINSULA: A HOSPITAL BASED STUDY

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Purpose: To evaluate the intraocular pressure (IOP) in non-glaucomatous individuals from the Arabian Peninsula above the age of forty, attending the ophthalmology clinic Al Ain Hospital, UAE.

Design: Cross-sectional study.

Participants: Individuals above the age of forty from the Arabian Peninsula (UAE, Oman, Yemen and Saudi Arabia), attending the ophthalmology clinic and proven to be non-glaucomatous.

Methods: IOP was measured with Goldmann applanation tonometry, slit lamp examination of the anterior segment, fundus examination, gonioscopy.

Main outcome measures: Three hundred ninety-six individuals were included. IOP ranged from 4 to 25 mmHg, mean IOP was 14.83 ± 3.22.

Results: After correction of the data by excluding 2SDs from the mean, 776 eyes belonging to 388 individuals were included, of which 258 were female and 130 were male. Figure 1 shows the IOP distribution curve which is slightly skewed to the right as found in other studies. Mean IOP was 14.83 ± 3.22 and it was found to be significantly lower in males (14.11 ± 3.37) than in females (15.19 ± 3.08) with P value 0.002 (Table 1, 2). There was no significant difference between IOP in different age groups.

Conclusion: The mean IOP in individuals from the Arabian Peninsulas above the age of forty was 14.83 ± 3.22. The mean IOP was significantly lower in males than in females, but there was no significant difference between different age groups. These findings were not consistent with other studies.

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P005 PREVALENCE OF ANGLE-CLOSURE DISEASE IN A KOREAN POPULATION: THE NAMIL STUDY REPORT

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Purpose: To estimate the prevalence of primary angle-closure suspect (PACS), primary angle-closure (PAC), and primary angle-closure glaucoma (PACG) in a Korean population as a part of the Namil Study.
Design: Population-based epidemiological survey.
Participants: Of 1,909 persons over 40 years of age residing in Namil district, Chungnam province, Korea, 1,539 persons participated in the study.
Methods: Each subject underwent full screening tests for the detection of glaucoma including an interview, Goldmann applanation tonometry, slit-lamp biomicroscopy, refraction, a van Herick test, fundus photography, corneal thickness measurement with ultrasound pachymetry, a visual field test using frequency-doubling technology, gonioscopy, and ocular biometry using IOL master. If the findings were suspicious or equivocal, visual field tests with Humphrey field analyzer as well as optical coherence tomography and scanning laser polarimetry were performed for confirmation of the diagnosis. A diagnosis of PACS (posterior trabecular meshwork not visible by gonioscopy in > 3 quarters of the angle circumference), PAC (PACS plus elevated IOP, peripheral anterior synechiae, iris distortion, and/or glaukomflecken), or PACG (PAC plus optic nerve/visual field damage) was made based on the gonioscopy, optic disc appearance, perimetry, and imaging tests.
Main outcome measure: The prevalence of PACS, PAC and PACG were measured.
Results: Of 1,909 persons over 40 years of age residing in Namil district, Chungnam province, Korea, 1,539 persons participated in the study. Estimated prevalences of PACS, PAC, and PACG were 2.1%, 0.5% and 0.5% respectively.
Conclusions: Prevalences were 2.1%, 0.5%, and 0.5%, respectively, for PACS, PAC, and PACG in subjects over 40 years from Namil, Korea.
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P006 PREVALENCE AND RISK FACTORS FOR PRIMARY OPEN-ANGLE GLAUCOMA IN A RURAL NORTHEAST CHINA POPULATION: A POPULATION BASED SURVEY IN BIN DISTRICT, HARBIN

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Purpose: To estimate the prevalence of primary angle-closure glaucoma (PACG), primary angle closure (PAC) and primary angle-closure suspect (PACS) and associated risk factors for PACG in a rural population in northeast China.
Methods: A population based survey was conducted within Bin district, Harbin of northeast China. Glaucoma was diagnosed using International Society of Geographical and Epidemiological Ophthalmology (ISGEO) criteria. All the subjects underwent a complete ophthalmic examination.
Results: Four thousand and nine hundred fifty-six (86.01%) of 5762 subjects aged 40 years or older were examined. The mean IOP of right eyes was 13.99 mmHg. The VCDR of right eyes was 0.3130; left eyes, 0.3123. The prevalence of PACG, PAC and PACS were 1.57% (95% CI, 1.469-1.671), 1.33% (95% CI, 1.236-1.424) and 4.68% (95% CI, 4.541-4.819) respectively. In all PACG subjects, 42 (53.84%) participants in either eye had elevated IOP > 21 mmHg, and 37 (47.44%) participants had been treated by laser or surgical iridectomy or trabeculectomy. Sixty-four subjects (82.05%) had vision impairment to varying degrees. On multivariate analysis, old age, family history of PACG, migraine, quantity of fluid intake each time, constipation and intraocular pressure were regarded as significant independent risk factors.
Conclusions: PACG was a disease of highly prevalence and low treatment rate which was symptomatic in rural northeast China. Old age, family history of PACG, migraine, quantity of fluid intake each time, constipation and intraocular pressure remained as significant independent risk factors for PACG.
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P007 THE PREVALENCE AND INCIDENCE OF OPTIC DISC HEMORRHAGE IN NORMAL-TENSION GLAUCOMA AND PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: To investigate and compare the prevalences and incidences of optic disc hemorrhages (DH) in normal tension glaucoma (NTG) and primary open-angle glaucoma (POAG).
Design: Retrospective, cohort study.
Participants: Seven hundred and eighteen eyes of 384 patients with NTG and 351 eyes of 203 patients with POAG.
Methods: Patients underwent consecutive disc examinations at least quarterly for at least one year between 1992 and 2007.
Main outcome measures: The prevalences of DHs, gender predominances among patients with DH, and cumulative incidences and incidence rates. NTG and POAG were compared with respect to all parameters.
Results: The NTG group had a significantly higher prevalence of DH than the POAG group ($P < 0.05$). The prevalence ratios of POAG and NTG in the present study were up to three times higher than in previous studies. No significant difference in gender ratios was found between patients that did or did not develop DH for both types of OAG ($P > 0.05$, respectively). Cumulative incidences of DHs over a year of follow-up were 23.10% and 15.13% in the NTG and POAG groups, respectively, and the corresponding 3-year cumulative incidences were 32.85% and 20.42%.
Conclusion: The POAG group had higher prevalences and incidences of DH than those reported previously. DHs were found to develop independent of gender.
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P008 PREVALENCE OF PRIMARY OPEN-ANGLE GLAUCOMA IN CENTRAL SOUTH KOREA, THE NAMIL STUDY

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Purpose: To assess the prevalence of primary open-angle glaucoma (POAG) in the Namil-myon area in central south Korea.
Design: A cross-sectional epidemiologic study in a defined population.
Participants: Residents aged 40 years or older in Namil-myon, a rural agricultural area, in central south Korea.
Intervention: Each subject underwent a screening examination, comprised of an interview and ophthalmic examinations including visual acuity measurement, autorefraction, anterior segment evaluation by IOL mater, slit lamp examination, Goldmann applanation tonometry, binocular optic disc evaluation, fundus photography, pachymetry, gonioscopy, and a screening visual field test using frequency doubling technology. When glaucoma was suspected, the subjects were referred for definitive examinations. For the definitive examination, visual field test using Humphrey Field Analyzer 30-2 SITA Standard program, and retinal nerve fiber layer analysis using optical coherence tomography (Stratus OCT) or scanning laser polarimeter (GDx VCC) were performed. A diagnosis of glaucoma was made based on optic disc shape, retinal nerve fiber layer appearance, perimetric results and other ocular findings.
Main outcome measures: Prevalence of POAG, mean intraocular pressure, and mean central corneal thickness.
Results: Of 1909 eligible residents, 1532 (80.3%) participated in the study. Seventy-two glaucoma patients were found (4.7%) and 7 subjects were classified as ocular hypertension (0.5%). The prevalence of the POAG in the population aged 40 years or older was 3.9%; the prevalence of POAG with intraocular pressure of 21 mmHg or less was 3.1% and the prevalence for POAG with intraocular pressure of 22 mmHg or more was 0.8%. The average intraocular pressure for all subjects was 13.6 ± 3.0 mmHg in the right eye and 13.4 ± 2.9 mmHg in the left eye. The mean central corneal thickness of the subjects was 530 ± 32 μm in both eyes.
Conclusions: The prevalence of POAG in Namil-myon area in central south Korea was 3.9%. In 80% patients with POAG, the intraocular pressure was 21 mmHg or less.
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P009 SYSTEMIC ARTERIAL HYPERTENSION AND GLAUCOMA IN A POPULATION-BASED STUDY FROM SOUTH BRAZIL

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Purpose: Vascular factors have been investigated in the pathogenesis of open-angle glaucoma (OAG), particularly the blood pressure (BP) levels and perfusion pressure (PP) at the optic nerve head. The purpose of the current study is to investigate the association between systemic arterial hypertension (SAH) and glaucoma in a population-based study from South Region of Brazil.
Design: Cross-sectional observational population-based study.
Participants: Subjects older than 40 years of age living in two districts from Piraquara City, Brazil.
Methods: All participants underwent a screening examination that included a medical interview, blood pressure (BP) measurements, slit-lamp examination, Goldmann tonometry and fundoscopy. Glaucoma was diagnosed based on the ISGEO classification. SAH was diagnosed in subjects in treatment for BP control, and new diagnoses were based on American Society of Hypertension classification. Diabetes (DM) was diagnose in subjects in treatment for glycemia control, and new diagnoses were based on glycemia levels > 200mg/dl. Diastolic perfusion pressure (DPP) was defined as the difference between diastolic BP and IOP. To assess the relation between SAH vs glaucoma and intra-ocular pressure (IOP) vs BP, multivariate analyses were performed, using age, race, gender, IOP, glaucoma, and diabetes as independent variables. Odds ratio were calculated with logistic regression analyses.
Main outcomes measure: Diagnosis of glaucoma and SAH, intraocular pressure, systemic arterial pressure, perfusion pressure.
Results: A total of 1636 subjects were examined (76.5% participation rate); 71% of the study population self-reported their race as White, and 24% as non-White (most Black and mixed - Black/White). Glaucoma was found in 56 subjects (3.4%, 95% CI 2.5-4.3), and SAH was diagnosed in 960 subjects (58.7%, 95% CI, 56.2-61.1). Glaucoma prevalence among in the SAH group was 3.85% (37), and in the non-SAH group was 2.8% (19) (p = 0.31 - chi square test). SAH was not associated with glaucoma (odds ratio [OR] 0.72, 95% CI 0.40-1.25). Subjects with DPP < 50 mmHg showed an odds ratio of 3.98 (95% CI, 1.02-13.24) when compared to subjects with DPP > 65 mmHg. Among normal subjects (no glaucoma), multivariate analysis showed that systolic BP, diabetes, age, and race were significantly correlated to IOP (r^2 = 0,025, p < .001, p = .001, p = .003, p = .017, p = .027, respectively).
Conclusion: In this population-based study from the South Region of Brazil, SAH was not significantly associated to glaucoma, but BP was independently correlated with IOP. There was an inverted association between low DPP and glaucoma.
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P010 AWARENESS OF DISEASE: A COMPARISON BETWEEN GLAUCOMA, SYSTEMIC ARTERIAL HYPERTENSION, AND DIABETES IN A POPULATION-BASED STUDY FROM SOUTH OF BRAZIL

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Purpose: Glaucoma is usually an asymptomatic disease that leads to non-reversible damage of the optic nerve head, and it represents the second leading cause of blindness worldwide. In spite of that, previous epidemiological studies have observed that the number of subjects with undiagnosed glaucoma remains quite high, even in developed countries. The purpose of the current study is to compare the awareness of glaucoma, systemic arterial hypertension (SAH), and diabetes in a population-based study of the South region of Brazil.
Design: Cross-sectional observational population-based study.
Participants: Subjects older than 40 years of age living in two districts from Piraquara City, Brazil.
Methods: Subjects over 40 years of age underwent a screening examination which included medical interview, BP measurements, capillary blood glucose measurements, slit-lamp exam, tonometry, and fundoscopy. Glaucoma was diagnosed based on the presence of structural and functional damage, as proposed by the ISGEO classification. SAH was diagnosed in subjects with previous diagnosis of SAH in treatment for BP control. New SAH cases were diagnosed in subjects with a mean systolic BP ≥ 140 mmHg and/or mean diastolic BP ≥ 90 mmHg. Diabetes (DM) was diagnosed in subjects with previous diagnosis of diabetes in treatment for glycemia control. New diabetes cases were diagnosed in subjects with capillary blood glucose levels > 200mg/dl.
Results: A total of 1636 subjects were examined (76.5% participation rate). Primary glaucoma was found in 56 subjects (crude prevalence of primary glaucoma: 3.2%; 95% CI, 2.3-4.0), and SAH prevalence was diagnosed in 960 subjects (crude prevalence: 58.7%; 95% CI 56.2-61.1), and DM was diagnosed in 178 subjects (crude prevalence: 10.9%; 95% CI 9.4-12.4). Six (11.5%) primary glaucoma cases had

previous diagnosis of the disease, while 700 (42.8%) SAH cases and 161 (90.4%) diabetes cases were aware of their disease ($p < .001$, chi-square test).
Conclusion: This population-based study from the South Region of Brazil observed high rates of previously undiagnosed glaucoma which were considerably higher than the rates of previously undiagnosed SAH and diabetes. This information needs to be taken into consideration in daily clinical practice by general ophthalmologists. The low level of previous glaucoma diagnosis represents a public health problem that must be tackled in order to reduce the burden of blindness in developing countries.
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P011 GLAUCOMA STUDY IN ATOMIC BOMB SURVIVORS

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Purpose: The Tajimi Glaucoma Study is so far the only population-based glaucoma prevalence study in Japan. We initiated the second largest population-based glaucoma prevalence study in A-bomb survivors in Hiroshima and Nagasaki in 2006. This study is to report the final results.
Design: A cross-sectional epidemiologic study in a defined population.
Participants: Atomic bomb survivors (3546 dose-available subjects) in Hiroshima and Nagasaki.
Methods: All atomic bomb survivors were screened with an FDT Visual Field Screener, tonometry by a non-contact tonometer and a non-mydriatic fundus camera. Subjects who showed abnormal findings on the above examinations were referred to the University Hospitals in Hiroshima and Nagasaki. For the second examinations, subjects underwent stereo fundus photo, slit lamp examination, gonioscopy, applanation tonometry, and the Humphrey visual field test (SITA standard 30-2). The diagnostic methods followed the Tajimi glaucoma study in Japan. All subjects were over 62 years old.
Main outcome measures: Prevalence of glaucoma, and relationship between radiation dose and prevalence of glaucoma.
Results: Two thousand six hundred-thirteen subjects underwent a screening test between October 2006 and September 2008. Three hundred seventy-six subjects (17.3%) were diagnosed with glaucoma. The prevalence of primary open-angle glaucoma was 2.7%, normal-tension glaucoma was 12.8%, ocular hypertension was 1.4%, and primary angle-closure glaucoma was 1.4%. The prevalence of normal-tension glaucoma had a positive dose relationship with radiation dose.
Conclusions: The prevalence of angle-closure glaucoma was the same as in the Tajimi study; however, the prevalence of normal-tension glaucoma in our study was higher than in the Tajimi glaucoma study. Radiation dose had a positive effect on the prevalence of normal-tension glaucoma.
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P012 THE PREVALENCE OF PRIMARY ANGLE-CLOSURE GLAUCOMA AND PRIMARY ANGLE CLOSURE IN A RURAL ADULT CHINESE POPULATION: THE HANDAN EYE STUDY

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Objective: To determine the age- and gender-specific prevalence of primary angle closure, primary angle-closure suspects, and primary angle-closure glaucoma in a rural Chinese population.
Design: Population-based, cross-sectional study.
Participants: Six thousand eight hundred thirty (90.4%) of 7557 Han Chinese aged over 30 years participated in the study between October 2006 and October. They were examined in rural Yongnian County, Handan, northern China.
Methods: Clustered samples of adults aged over 30 years residing in 13 residential villages in the Yongnian County of Handan, Hebei Province were randomly selected and invited to participate in the Handan Eye Study. All participants had a complete ophthalmologic examination, including measurement of intraocular pressure (IOP), and slit-lamp examination. Limbal anterior chamber depth (LACD) was measured on all subjects and those with LACD < 40% had gonioscopy. In addition, gonioscopy was performed on 1 in 10 subjects who were systematically selected and on all glaucoma suspects (as was visual field). Digital color non-simultaneous stereoscopic photographs of optic nerve head were obtained with the Canon CR-DGi (Canon, Tokyo, Japan) non-mydriatic retinal camera by rotating the camera 5 degrees between images. Glaucoma was defined according to the recommendations of the World Glaucoma Association.
Main outcome measures: The prevalence of primary angle closure, primary angle-closure suspects and primary angle-closure glaucoma.
Results: Forty-one cases (0.6%) were diagnosed as primary angle-closure glaucoma. The adjusted prevalence was in 0.7% (95% CI, 0.5%-0.9%) in aged 40 years and over, and 1.1% (95% CI, 0.8%-1.3%). The rate was significantly higher

in older than in younger persons (p = 0.001). Women had a higher prevalence of both than men, 0.8% versus 0.4% in PACG, but this was not statistically significant (p = 0.087). The prevalence of PAC and PACs in aged 40 years and over were 1.5% (95% CI, 1.3%-1.8%), and 8.2% (95% CI, 7.6%-8.9%). Both rates increased with age (p < 0.001) and women had a remarkably higher rate men (p < 0.001).

Conclusion: The prevalence of PACG in this rural population is about 0.7% in aged 40 years and over, and 1.1% in aged 50 years and over, similar to rates reported in urban areas in China.

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P013 DOES REDEFINING OF HIGH INTRAOCULAR PRESSURE (IOP) ACCORDING TO IOP DISTRIBUTION CHANGE PREVALENCE OF NORMAL TENSION GLAUCOMA IN KOREA?

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Purpose: The prevalence of normal-tension glaucoma (NTG) in Korea is higher than that in Western or other Asian countries. The purpose of this study is to assess whether the redefinition of high IOP according to population distribution of IOP can change the prevalence of NTG in Korea as in Western or other Asian countries except Japan.

Design: A cross-sectional epidemiologic study in a defined population.

Participants: All residents aged 40 years or older in Namilmyon, a rural agricultural area, in Korea.

Intervention: All subject recruited underwent an interview and comprehensive ophthalmic examinations including visual acuity measurement, autorefraction, anterior segment evaluation by IOL mater, slit lamp examination, Goldmann applanation tonometry, binocular optic disc evaluation, fundus photography, pachymetry, gonioscopy, and a screening visual field test using frequency doubling technology.

Main outcome measure: Prevalence of POAG and NTG, mean IOP, and mean central corneal thickness (CCT).

Results: The prevalence of the POAG in the population aged 40 years or older was 3.9%, and the majority of POAG (79.5% of POAG) was normal-tension glaucoma. The average IOP for all participants were 13.6 ± 3.0 mmHg in the right eye and 13.4 ± 2.9 mmHg in the left eye. The high set of 2 standard deviation in IOP distribution (97.5 percentile) was 19 mmHg in both eyes. When this value was applied to definition of high IOP, the prevalence of NTG decreased to 2.6% of all participants (66.7% of POAG). However, its prevalence seemed to be still higher than the reported values of other countries except Japan. The cause of higher prevalence of NTG (3.1%, 76& of POAG) in Korea may not be due to different IOP distributions comparing to other countries.

Conclusions: The lower mean IOP and different IOP distributions in Korea may not be the reason why prevalence of NTG is higher than in Western and other Asian countries except Japan.

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P014 OCULAR AND SYSTEMIC FACTORS AND CORNEA BIOMECHANICAL CHARACTERISTICS IN AN ADULT CHINESE POPULATION: THE HANDAN EYE STUDY

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Purpose: To evaluate corneal biomechanical characteristics measured with the Reichert Ocular Response Analyzer (ORA) in an adult Chinese population to assess whether these measures were influenced by secondary factors.

Methods: Participants were selected from the Handan Eye Study (n = 1222) and were aged 30 years and older. Corneal hysteresis (CH) and corneal resistance factor (CRF) were evaluated with ORA. Central corneal thickness (CCT), corneal curvature, spherical equivalents, axial lengths, and blood pressure values were all measured. Both univariate and multiple regression analyses evaluated the associations of CH, CRF, and other relevant factors.

Results: The mean [SD] age of the entire study population was 49.95 [11.54] years (range, 30-87 years). The mean [SD] CH and CRF values were 10.53 [1.66] mmHg and 10.24 [1.71] mmHg, respectively. Mean [SD] CH values were 10.48 [1.65] mmHg in men and 10.54 [1.65] mmHg in women (p = 0.295), and mean [SD] CRF values were 10.15 [1.73] mmHg in men and 10.26 [1.67] mmHg in women (p = 0.64). CH was significantly associated with CCT, corneal curvature and age

($p < 0.05$) on multiple regression analysis, and CRF was significantly associated with CCT, corneal curvature and age ($p < 0.05$). No significant correlations were seen with other factors, including age, gender, systolic blood pressure, diastolic blood pressure, spherical equivalents, and axial lengths.

Conclusions: CH and CRF values approached 10 mmHg in this adult Chinese population. Both values were positively associated with CCT and corneal curvature, and negatively associated with age.

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P015 ASSESSMENT OF THE STUDENT SIGHT SAVERS PROGRAM METHODS FOR GLAUCOMA SCREENING

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Purpose: To assess methods used for glaucoma screening in the Student Sight Savers Program (SSSP), an initiative of the Friends of the Congressional Glaucoma Caucus Foundation that has screened individuals for glaucoma in the United States since 2001.

Methods: A prospective, case-control, clinic-based study (total N=70) was conducted to study the SSSP screening method in patients with primary open-angle glaucoma and age- and sex-matched normal controls. Primary outcome measures were sensitivity, specificity, and positive predictive power for both low- and high-prevalence populations.

Results: Sensitivity and specificity values of the individual tests were 48.6% and 68.6% for family history of glaucoma, 22.1% and 78.6% for IOP, and 58.1% and 98.6% for frequency doubling technology (FDT) visual field ($P = 0.03$, chi-square). Specificity of FDT was significantly better than IOP ($P < 0.001$) and the questionnaire ($P < 0.01$) by z-test. When analyzing the overall screening criteria (positive screen was ≥1 positive in the three tests), the sensitivity increased to 88.6% with reduction in specificity to 57.1%. The positive predictive power (PPP) for high-prevalence population was low for the overall screening criteria (15.4%) and highest for FDT as an individual (34.0%) or combined (41.0% to 45.3%) test. The medical student education and community awareness aspects of the program were not assessed.

Conclusions: Of different methods used in the SSSP, FDT was the best single screening test, demonstrating high specificity but only moderate sensitivity. Use of multiple screening criteria resulted in slightly increased sensitivity and PPP over FDT, but decreased specificity.

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P015.1 THE PREVALENCE OF PRIMARY OPEN-ANGLE GLAUCOMA AND SECONDARY GLAUCOMA IN A RURAL ISLAND IN SOUTHWEST JAPAN

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Purpose: To determine the prevalence of primary open-angle glaucoma (POAG) and secondary glaucoma (SG) in Kumejima island in southwest Japan.

Design: Population-based epidemiological survey.

Participants: A random sample of residents 40 years or older from Kumejima island, Japan.

Intervention: Each subject underwent ophthalmic examination including slit-lamp examination, applanation tonometry, gonioscopy, fundus photography, and visual field testing. Glaucoma and its suspect were diagnosed according to the ISGEO classification scheme.

Main outcome measure: Prevalences of POAG and SG.

Results: Of all 4682 eligible people, 3762 (81.2%) participated in the study. Estimated prevalence of POAG, POAG-suspect, SG and SG suspect was 3.98 (95% confidence interval, 3.4-4.7)%, 2.58 (2.1-3.1)%, 0.74 (0.5-1.1)%, and 0.29 (0.2-0.5)%, respectively. Of 150 POAG patients, 123 (82%) patients had IOP equal or less than 21 mmHg and classified as normal-tension glaucoma (NTG). Of 28 SG subjects, 14 (50%) were exfoliation glaucoma. Prevalence of NTG in 40-49, 50-59, 60-69, 70-79, and 80 years or older was 1.37 (0.8-2.3)%, 2.09 (1.3-3.3)%, 4.22 (2.9-6.1)%, 4.12 (3.0-5.7)%, and 6.61 (4.6-9.3)%, respectively.

Conclusions: In a rural southwest island of Japan, although prevalence of primary angle-closure glaucoma has been reported to be noticeably higher than that in central Japan, prevalence of POAG and SG was similar to those in central Japan. NTG was the most prevalent type of glaucoma and was age dependent, same as in central Japan.

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1.3.General Aspects: Pathogenesis

P016 NEITHER HELICOBACTER PYLORI INFECTION, NOR CAGA-BEARING STRAINS ARE ASSOCIATED WITH GLAUCOMA

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Background and Purpose: Accumulating evidence indicates that a variety of infections contribute to the pathogenesis of glaucoma, but there is controversy concerning the impact of Helicobacter pylori infection in glaucoma.
Methods: We evaluated seropositivity to H pylori and to its cytotoxin-associated gene A (CagA) product in a, prospective, population-based study. Patients with various types of glaucoma were compared to a control group consisted of patients with cataract.
Results: H. pylori infection and CagA seropositivity were detected in 36/57 (63/2%) and 26/51 (51%) glaucoma patients respectively, compared with 22/36 (61.1%) and 19/36 (52%) control patients respectively (P = not significant). Similar rates of H. pylori infection and CagA positive strain were in all glaucoma sub-groups and non of them was statistically differed from that of controls.
Conclusions: No H. pylori infection nor seropositivity for virulent CagA-bearing H. pylori strains have significant relationship with glaucoma occurrence of any type.
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P017 LEVEL OF PLASMA VEGF-A165B, A C-TERMINAL SPLICE VARIANT OF VEGF-A165, ARE ELEVATED IN GLAUCOMA WITH POAG AND NTG

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Vascular endothelial growth factor (VEGF) is well known for its role in normal and pathologic neovascularization. However, recent studies indicate that VEGF-A is an important neuroprotectant in the nervous system including retinal ganglion cells. To understand the relationship between glaucoma progression and the alteration of plasma VEGF-A isoforms level, we here investigated both plasma levels of angiogenic VEGF-A165 and antiangiogenic VEGF-A165b in glaucoma with POAG and NTG. We obtained plasma from 20 POAG (mean age 45.1 ± 8.7) and 20 NTG (mean age 46.7 ± 10.0). The control group of twenty individuals not diagnosed with glaucoma consisted of ten without a known pathology (mean age 49.7 ± 7.4) and ten patients with diabetic retinopathy (mean age 54.5 ± 7.8). Using VEGF-A isoform-specific enzyme-linked immunosorbent assay, we measured plasma levels of VEGF-A165 and VEGF-A165b. The plasma VEGF-A levels were significantly increased in patients with POAG (mean 161.0 pg/ml) and NTG (mean 194.9 pg/ml) compared to those in healthy controls (mean 18.3 pg/ml). And plasma VEGF165b levels were elevated in patients with POAG (2.98-fold) and NTG (3.34-fold) compared to those in DMR patients, although there are a little difference between plasma VEGF-A levels of glaucoma and DMR patients. In glaucoma with POAG and NTG, elevated plasma VEGF-A levels were occurred as a result of the increasing of VEGF165b levels, not VEGF165 levels. Besides previously reported antiangiogenic effect of VEGF165b, we speculate that the elevation of VEGF-A165b contribute to the pathogenesis or neuroprotection in glaucoma.
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P018 REDUCED OPTIC RADIATION VOLUME MEASURED BY DTI IS CORRELATED WITH ARTERIAL HYPERTENSION IN NORMAL-TENSION GLAUCOMA

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Objective: Arterial hypertension is known to cause cerebral microangiopathy, which may induce glaucomatous optic atrophy. The extent of systemic effects on the optic radiation (OR) volume in primary open angle glaucoma (POAG) and particularly, its subgroup normal tension glaucoma (NTG) is not clear. We examined the correlation of arterial hypertension with the damage of the optic radiation volume in both groups in relation to the presence of arterial hypertensive disease.
Design: Prospective observational study. Participants and controls: Twenty-one patients with POAG without suspicion for NTG and 11 patients diagnosed with NTG (age 58±12 years and 59±13 years, respectively, p = 0.63) were randomly selected from the glaucoma consultation hours.
Methods: Subjects were examined by T2-weighted magnetic resonance imaging (MRI) for cerebral microangiopathy and by diffusion tensor imaging (DTI) for a rarefied optic radiation. No stroke or cerebral tumor was diagnosed in the MRI. The optic radiation in the DTI was manually outlined and the volume was calculated and compared to age-adjusted controls.
Main outcome measure: Volume of the optic radiation in DTI images.

Results: Expectedly, in both groups the presence of arterial hypertension was correlated with the presence of cerebral microangiopathy (Kendall-tau-b for both groups $p < 0.001$). In NTG patients the volume of the optic radiation correlated with the presence of arterial hypertension (Kendall-tau-b -0.520, $p = 0.013$ for both OR). Likewise, the optic radiation volume correlated with the microangiopathy stage (Kendall-tau-b for right OR: -0.501, $p < 0.001$ and left OR: -0.691, $p = 0.003$). In POAG patients without NTG this correlations were absent. Notably, the mean of the reduced optic radiation volume was not different between POAG patients (right OR: 87 ± 16 % and left OR: 86 ± 17%) and NTG patients (right OR: 86 ± 16% and left OR: 86 ± 7%).
Conclusion: The presence of arterial hypertension and the stage of microangiopathy are more important for the reduction of the optic radiation volume in NTG patients than in POAG patients without NTG. In the latter group other mechanisms may prevail, which cause the same degree of optic radiation damage.
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P019 NITRIC OXIDE IN GLAUCOMA PROGRESS

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Objective: It has been postulated that nitric oxide (NO) plays an important role in ganglion cells damage in glaucoma. The purpose was: to study the dynamic of NO-production in glaucoma progress.
Methods: The products of NO (NO_2) has been measured in aqueous humor and lachrymal fluid in 10 patients with early glaucoma and in 25 patients with advanced glaucoma and in 10 patients with cataract as a control.
Results: In early glaucoma NO_2 concentration was 9,9 ± 1,8 nmol/ml and 16,1 ± 3,5 nmol/ml respectively in aqueous humor and lachrymal fluid, in advanced glaucoma it was reduced significantly: 0,12 ± 0,05 nmol/ml and 0,23 ± 0,09 nmol/ml in aqueous humor and lachrymal fluid, while in cataract patients it was 5,3 ± 1,2 nmol/ml and 9,3 ± 2,3 nmol/ml respectively.
Conclusions: Both high production of NO in early glaucoma and its reduction in advanced stage of the disease may contribute to the mechanism of ganglion cells damage due to peroxynitrite formation in early glaucoma and ischemic mechanisms in advanced stages.
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P020 SCREENING FOR OCCLUDABLE ANGLES IN SOUTHERN PART OF JAPAN: EVALUATION OF SCANNING PERIPHERAL ANTERIOR CHAMBER DEPTH ANALYZER

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Purpose:
To evaluate the distribution of central anterior chamber depth (CACD) and peripheral anterior chamber depth (PACD) using scanning peripheral anterior chamber depth analyzer (SPAC) in a population in a southern island of Japan and to compare SPAC with gonioscopy in identifying people with occludable angles (OAs).
Design: Population-based cross-sectional study.
Participants: Phakic subjects aged 40 years or older in Kumejima Town, Japan.
Methods: All subjects underwent examination with SPAC and gonioscopy was performed by ophthalmologists masked to the SPAC findings. The area under the curve (AUC) was generated to assess the performance of these tests in detecting people with OAs.
Main outcome measure: Eyes were classified as having OAs by gonioscopy if the trabecular meshwork could be seen for ≦ 3 quadrants of the angle circumference.
Results: Reliable ACD measurements were obtained using SPAC from 2960 participants. The prevalence of OAs in the right eye by gonioscopy was 12.9% (384 subjects). The CACD and PACD grade averaged 3.0 ± 0.5 mm and 7.6 ± 2.2 (mean ± standard deviation), and was smaller in occludable angles (2.6 ± 0.4 mm, 5.4 ± 1.8) than open angles (3.1 ± 0.4 mm, 7.9 ± 2.0) respectively ($P < 0.001$). The AUC for the SPAC using a numeric grade equal or less than 6, peripheral anterior chamber angle measured from 3 points and CACD by SPAC were 0.82 (95% CI, 0.80-0.84), 0.64 (95%

CI, 0.61-0.67) and 0.81 (95% CI, 0.79-0.83), respectively. The sensitivity using a cutoff with SPAC grade equal or less than 6 and at a cutoff of 2.95mm for CACD were 75.5% and 82.6%, with specificity 76.0% and 65.1%,respectively. The sensitivity of SPAC using categoric grades S or P and a combined grade of grades of < 5 and categoric grades S or P was 55.9 % and 56.5%, with a specificity 84.6% and 84.1%, respectively.

Conclusions: The low ability of detecting OAs found with the SPAC may limit the usefulness of this device in screening for subjects in Kumejima town.

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1.4. General aspects: Quality of Life

see also P572

P021 GLAUCOMA CLUB, A BENEFICIAL MODEL IN PUBLIC HEALTH CARE

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Purpose: To assess knowledge of glaucoma as well as its influencing factors in patients from the Shanghai Glaucoma Club and also in general outpatients, and to evaluate the educational effect on glaucoma patients of this club.

Design: The Shanghai Glaucoma Club is an organization composed of glaucoma patients and ophthalmologists, founded in February 1997, with the aim of providing better health education and improving quality of life. Several lectures and interactions between doctors and patients are being held in this club every two months. To welcome the first World Glaucoma Day (March 6th, 2008), we designed this investigation at the ten years' anniversary of the Shanghai Glaucoma Club.

Participants and controls: Three hundred glaucoma patients (143 males and 157 females) were randomly selected from 443 Shanghai Glaucoma Club members, and 314 controls (147 males and 167 females) were recruited from the waiting room at the glaucoma clinic.

Methods: All participants were investigated by a questionnaire containing a total of 20 questions pertaining to three aspects of content. The first part was 'level of cognition about glaucoma', the second part was 'compliance of medicine usage and follow-up', and the third was 'life style and habit'. Answers were graded on each question and scores were summed up separately for each part and also as a total. Differences of scores and influencing effects were analyzed using multivariate linear regression (stepwise) between two groups.

Main outcome measure: Analyze the median age, types of glaucoma, educational level, average total score and partial score between the two groups.

Results: The median age of general glaucoma patients was 57 (36-68) years old and that of patients in the Club was 67 (58-73) years old. The average total score of general glaucoma patients was 19.6 ± 5.4 and that of patients in the Club was 23.8 ± 4.0 ($t = -11.14$, $P < 0.01$). Multivariate linear regression (stepwise) was used to adjust the effects of age, diagnosis and educational level. The Club group still got 3.73 points more than general patients with statistically significance ($t = 8.14$, $P < 0.01$). The Club was shown to be the strongest positive factor influencing patients' cognition. Patients in the Shanghai Glaucoma Club understood the nature and course of glaucoma significantly better than general glaucoma patients ($t = 10.97$, $P < 0.01$) and lived healthier lives ($t = 7.55$, $P < 0.01$). Except for the Club, the level of education background was found to be positively, and age negatively correlated with the total score. Types of glaucoma also played a significant role in knowledge of the disease. Primary glaucoma patients demonstrated better cognition of their disease than secondary glaucoma patients.

Conclusions: Serious deficiencies in the basic knowledge of glaucoma between two groups were demonstrated. The patients in the Shanghai Glaucoma Club presented with much better cognition of glaucoma and self management than general glaucoma outpatients. Glaucoma club is an effective form to improve patients' knowledge of disease and compliance to medication. The Shanghai Glaucoma Club Model (SGC Model) may be a reference to be generalized in public health care.

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P022 DOES EVERY BIT OF VISUAL FIELD LOSS COUNT?

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Objective: To investigate whether visual field loss impacts health-related quality-of-life (HRQOL) equally at all levels of visual field loss from primary open-angle glaucoma (POAG).

Design: Cross-sectional study.

Participants: Five hundred thirty-one ocular hypertension (OHT) and POAG patients from seven Dutch eye clinics, with disease severities ranging from untreated OHT to end-stage POAG.

Methods: Participants completed a questionnaire at home, containing a generic HRQOL instrument (Health Utilities Index mark 3 (HUI 3)), and the National Eye Institute Visual Functioning Questionnaire (NEI VFQ-25). Medical information was collected from files and visual field information from automated perimeters. The severity of visual field loss was classified based on Mean Deviation (MD) from the Humphrey Field Analyzer. A subset of participants completed a time trade-off (TTO) interview at home. Multiple linear regression analyses were performed with the HRQOL scores as the dependent and MD as an independent variable. Regression models accounted for relevant covariates. MD values for the better and the worse eye were entered into the models separately, and were treated as either continuous variables or categorical variables.

Main outcome measures: Multiple linear regression coefficients.
Results: The median age of the participants was 71 years. Median MD in the better eye ranged from 0.0 dB in untreated OHT to -13.8 dB in end-stage POAG, and in the worse eye from -0.4 dB to -28.4 dB respectively. The average HUI3 utility decreased from 0.78 in untreated OHT to 0.54 in end-stage POAG. The average VFQ-score decreased from 88 to 53, and TTO utility decreased from 1.00 to 0.79. Lower MD in both better and worse eye was significantly associated with lower HRQOL after adjusting for age, gender, visual acuity, medication side-effects, and laser trabeculoplasty or glaucoma surgery in the treatment history. The regression coefficients for MD in the better and worse eye for VFQ-scores were 0.96/dB (95% CI: 0.66; 1.26) and 0.23/dB (95% CI: 0.01; 0.44) respectively when MD values were entered as a continuous variable. However, when MD values were entered as categorical variables (in 5 dB strata), only the regression coefficients for better eye strata with MD -20 dB and lower were significantly different from 0. In HUI3 regression with categorical MD values, only better eye strata with MD -25 dB and lower were significantly different from 0. In terms of model fit and variance explained neither one of the models was better than the other. Still, the conclusions from both models have contradicting implications in clinical practice in terms of the intensity of treatment in early stages of glaucoma.
Conclusions: Visual field loss affects both disease-specific and generic HRQOL, but the impact may be lower in early stages, and higher in advanced stages of glaucoma.
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P023 DRY EYE RELATED QUALITY OF LIFE IN GLAUCOMA PATIENTS
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Purpose: To verify the presence of dry eye syndrome (DES) in treated glaucoma patients and to analyze DES's impact on the patients' quality of life (QL) versus the control group.
Design: Observational cross-sectional study.
Participants/controls: Sixty-one patients were enrolled at a clinical practice. Patients were divided into three groups by number of glaucoma drops instilled pro die (G1 = 1 drop/die, G2 = 2drops/die, G3 = 3 drops/die). A control group of 20 subjects was also selected (G0).
Methods: All subjects were submitted to a complete ocular examination (including tear function and ocular surface status) and completed the 25-item NEI-VFQ, GSS questionnaire and OSDI. DES was defined as presence of punctatae keratitis and decreased BUT. Statistical analysis was performed applying the Kruskal-Wallis ANOVA and Mann-Whitney U Tests (to compare median values between groups) as well as the ≦ 2 and Fisher's test (to verify significant differences).
Results: Forty percent of G3 and 39% of G2 patients presented DES versus 11% of G1 and 5% of G0 ($p = 0.01$). QL was significantly influenced and altered (NEI-VFQ 25 total mean and GSS total mean and symptoms average; $p = 0.0085$, $p = 0.006$ and $p = 0.03$, respectively). OSDI pointed out differences by group: 26% of G2 and 15% of G3 presented moderate OSDI; and 15% of G3 and 8.7% of G2 severe OSDI ($p > 0.05$).
Conclusion: Topically treated glaucoma patients present DES more often than a similar control group ($p = 0.01$). The presence of DES negatively influences the patient's QL. The glaucoma patients's ocular surface status should be evaluated regularly to ensure the timely detection and treatment of pathological signs on the ocular surface.
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P024 QUALITY OF LIFE IN GLAUCOMA PATIENTS
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Purpose: To determine the relationship betweeen visual field

defects and their impact on quality of life in glaucoma patients.
Design: Case-control study.
Participants and controls: Forty consecutive glaucoma patients with a minimal of one year follow-up and 29 age-matched normal controls that presented to the outpatient clinic.
Methods: Glaucoma patients and normal controls underwent complete ophthalmic examination including Humphrey 24-2 SITA Standard visual field tests. The patients were grouped as having mild, moderate, and severe visual field defects according to Hodapp classification. Glaucoma Quality of Life -15 (GQL-15) questionnaire was used to analyze the impact of glaucoma on quality of life.
Main outcome measures: Questionnaire responses, visual field defect severity.
Results: The average age of 40 glaucoma patients and 29 controls was 59.6 ± 12.6 and 56.5 ± 8.1, respectively. Twenty glaucoma patients (50%) had mild, 15 (37.5%) had moderate, and 5 (12.5%) had severe visual field defects. Average GQL-15 questionnaire values were 77.1 ± 10.46, 55.6 ± 9, 38.9 ± 9.6 in the mild, moderate, and severe visual field defect groups respectively. Average GQL-15 values of the control group (93.1 ± 4.8) was statistically significantly better than all glaucoma subgroups (p = 0.00, p = 0.00, p = 0.00, p = 0.00). Among daily activities, peripheral vision was the most severely effected activity, followed by central and near vision, dark adaptation and glare, and outdoor mobility. GQL-15 scores in these subgroups were statistically significantly lower than control group (p = 0.00, p = 0.00, p = 0.00, p = 0.00). Statistically significant correlations were obtained between scores of GQL-15 and age (r = 0.32), level of education (r = 0.35), and duration of glaucoma (r = -0.59).
Conclusion: GQL-15 questionnaire, which has good performance as a measure of quality of life in glaucoma patients, indicates higher burden of glaucoma with increasing extent of visual field defect.
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P025 AN ANALYSIS OF ANXIETY AND DEPRESSION OF PRIMARY ANGLE-CLOSURE GLAUCOMA (PACG) PATIENTS

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Objectives: To evaluate anxiety and depression status in primary angle-closure glaucoma patients and analyze the potential affecting factors of these patients.
Methods: Sixty PACG patients were collected who were finally diagnosed in an outpatient department in two hospitals from June 2008 to September, 2008. The personal information and case history were asked. Hospital Anxiety and Depression Scale (HADS) and Glaucoma Quality of Life-15 (GQL-15) questionnaires were applied, and the affecting factors of anxiety and depression were analyzed.
Results: There are 22 patients showing anxiety (36.7%) and 16 patients depression patients (26.7%) in these PACG patients, 8 cases have both positive anxiety and depression. Anxiety score is positively correlated with depression score ($P < 0.05$). Anxiety and depression score is also positively correlated with GQL-15 summary score of mean age and course ($P < 0.05$),and negatively correlated with income ($P < 0.05$).There is no correlation with sex and education ($P > 0.05$).
Conclusions: There are high anxiety and depression rates in PACG patients. Anxiety score is positively correlated with depression score. GQL-15 summary score mean income, age and course affect anxiety and depression score in PACG patients.
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P026 EVALUATION OF RELATIONSHIP BETWEEN QUALITY OF VISION AND VISUAL FUNCTION IN GLAUCOMA PATIENTS

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Purpose: To evaluate the possible correlation between quality of vision (QOV) and visual function in glaucoma patients.
Design: Prospective, consecutive and non-comparative case series.
Participants:.Two hundred Japanese glaucoma patients.
Methods: The relationship between QOV and visual functions were investigated in 200 Japanese glaucoma patients. QOV was assessed using the Japanese version of the 25-item National Eye Institute Visual Function Questionnaire (VFQ-25).
Main outcome measures: Single linear regression analysis was applied to assess the relationship between the scores of the VFQ-25 questionnaire and the visual functions. Thresholds of mean deviation value glaucoma patients begin to feel some difficulty in their lives were also evaluated using chi-square test.

Results/Conclusions: Significant correlations were observed between QOV and loss of visual functions. Threshold mean deviation values were observed in the early stages of visual field defect.

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P027 THE CORRELATION OF VISUAL FIELD STAGING SYSTEMS IN GLAUCOMA WITH THE ACTIVITIES OF DAILY LIVING

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Purpose: To compare the correlations between various visual field (VF) staging systems in glaucoma with the ability of glaucoma patients to perform the activities of daily living.
Design: Observational, cross-sectional study.
Participants: One hundred ninety-four patients with various types of glaucoma.
Methods: Patients were evaluated using monocular and binocular VFs and the Assessment of Disability Related to Vision (ADREV), a novel performance-based measure of visual functioning which is comprised of 9 visual tasks of everyday life. VF printouts were scored according to several commonly used clinical staging systems for glaucoma. Spearman correlations of the ADREV scores with VF scores were calculated.
Main outcome measures: Degree of visual field loss as measured in terms of Mean Defect on Standard White on white perimetry, integrated visual field score, Esterman score and the ADREV score.
Results: The total ADREV scores were most highly correlated with mean defect in the better eye ($r = 0.68$, $p < 0.0001$), the integrated visual field score ($r = -0.65$, $p < 0.0001$), and the Esterman score ($r = 0.66$, $p < 0.0001$).
Conclusions: Mean defect in the better eye and binocular VF scores are significant indicators of glaucoma patients' ability to perform certain visual tasks. However, the correlations between field loss and performance in daily life are not light. Here is a remarkable variability of ability to perform miscellaneous tasks, regardless of the amount of the level of vision.

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P028 REPRODUCIBILITY AND CLINICAL USEFULNESS OF ASSESSMENT OF ABILITY RELATED TO VISION (AARV)

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Purpose: To determine the clinical usefulness of a refined third-generation instrument – the Assessment of Ability Related to Vision (AARV) in establishing the amount of disability, charting the detrimental effects of progressive disease, and establishing the beneficial effects of treatment.
Design: Prospective observational exploratory investigation.
Participants: One hundred and six patients with bilateral unstable glaucoma and twenty patients who appear to be normal have been enrolled for the study.
Methods: AARV testing was administered to each patient, and then repeated once within the following week: thus, the test was performed two times within one week. The results of these initial tests were then used to determine the test-retest reliability of the AARV. In addition, during one of these two administrations, two independent raters graded the same patient's performance at the same time to determine inter-rater reliability of the AARV. Each time AARV was administered, standard clinical data was obtained, including visual acuity, contrast sensitivity, and Humphrey Visual Field Testing. At each session evaluation of Quality of Life using the NEI-VFQ 25 was determined. The AARV, clinical tests and NEI-VFQ 25 was repeated again after six months and after twelve months. At the first session each day, the order of testing was quality of life, AARV, visual acuity, contrast sensitivity and Humphrey Visual Field. At the second testing the order was reversed. The study will be completed in 2 months.
Main outcome measures: The test-retest and inter-rater reproducibility of the measurements will be determined using standard statistical techniques, for each day and for each of the subsequent days. The reproducibility of AARV and the standard clinical data will be compared. Correlations between results on the tests and the standard clinical data will be made.
Results: Preliminary analysis suggests good reproducibility.
Conclusion: AARV is a good tool to measure performance benefits to patients following specific treatments which they receive.

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P029 RELATIONSHIPS OF STANDARD VISION TESTS WITH QUALITY OF LIFE IN GLAUCOMA PATIENTS

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Purpose: To determine which aspects of vision most influence glaucoma patients' vision-specific quality of life.
Design: Observational, cross-sectional study.
Participants: One hundred ninety-four glaucoma patients with a full range of glaucomatous visual loss were selected from the Glaucoma Service of Wills Eye Institute.
Methods: Subjects were evaluated clinically by visual acuity, contrast sensitivity, visual field, stereopsis, the Disc Damage Likelihood Scale, and intraocular pressure. Subjects were evaluated subjectively by the 25-item National Eye Institute Visual Functioning Questionnaire (NEI-VFQ-25). Statistical analysis was performed on the entire study population and on groups of subjects based on severity of glaucomatous visual field and disc damage.
Main outcome measures: Spearman rank correlation coefficient was performed on the study population as a whole comparing standard clinical tests with the NEI-VFQ-25. Linear regressions of the ranks of the total NEI-VFQ-25 scores were used to find the impact of a change in a clinical test score on the NEI-VFQ-25 score after taking other aspects of vision into consideration.
Results: The mean deviation of both eyes ($r = 0.56$, $p < 0.001$) and the Esterman binocular visual field ($r = 0.53$, $p < 0.001$) had the highest correlations with the NEI-VFQ-25.
Conclusions: There was a large amount of variation in responses to quality of life questions, even when patients had the same amount of visual field or disc damage.
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P030 RELATIONSHIPS IN GLAUCOMA PATIENTS BETWEEN (1) STANDARD VISION TESTS, (2) QUALITY OF LIFE, AND (3) ABILITY TO PERFORM DAILY ACTIVITIES

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Objective: To determine the relationships between three methods of assessing visual loss caused by glaucoma: 1. standard clinical tests of vision; 2. self-reported quality of life; and 3. the ability to perform activities of daily living.
Design: Observational, cross-sectional study.
Participants: One hundred ninety-four glaucoma patients with a full range of glaucomatous visual loss were selected from the Glaucoma Service of Wills Eye Institute.
Methods: Subjects were evaluated clinically by visual acuity, contrast sensitivity, visual field, stereopsis, the Disc Damage Likelihood Scale, and intraocular pressure. Subjects were evaluated subjectively by the 25-item National Eye Institute's Visual Functioning Questionnaire (NEI-VFQ-25) and objectively by a performance-based measure of visual function, the Assessment of Disability Related to Vision (ADREV). Statistical analysis, including Spearman coefficients, was performed on the data from the clinical measures, NEI-VFQ-25, and ADREV.
Results: The clinical tests had higher correlations with ADREV than with the NEI-VFQ-25. There was a disconnect between how patients rated their own visual ability with how they performed when objectively tested.
Conclusions: ADREV provides valid estimates of how visual loss due to glaucoma affects the ability to perform activities of daily living. Performance-based testing and quality of life evaluations are both independently important measures of health, which are related, but by no means the same.
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P030.1 IMPORTANCE OF VISUAL ACUITY AND CONTRAST SENSITIVITY IN PATIENTS WITH GLAUCOMA

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Purpose: To determine which aspects of vision most influence the ability of patients with glaucoma to function.
Design: Observational, cross-sectional study.
Participants: One hundred ninety-four glaucoma patients with a full range of glaucomatous visual loss were selected from the Glaucoma Service of Wills Eye Institute.
Methods: Subjects were evaluated clinically with standard methods of assessing visual ability, specifically visual acuity, contrast sensitivity, visual field, stereopsis, the Disc Damage

Likelihood Scale, and intraocular pressure. Subjects were evaluated objectively by a comprehensive performance-based measure of visual function, the Assessment of Disability Related to Vision (ADREV). Statistical analyses, including Spearman coefficients and regression analysis, were performed on the data.
Main outcome measures: Correlations and linear regression analysis of the clinical tests and ADREV scores.
Results: Performance was most strongly associated with binocular visual acuity ($r = -0.79$, $p < 0.001$) and binocular contrast sensitivity ($r = 0.79$, $p < 0.001$). Correlations with monocular and binocular visual field at all levels of glaucoma severity were poorer.
Conclusions: The aspects of visual function which best predict the ability of a patient with glaucoma to perform activities of daily living are binocular visual acuity and contrast sensitivity.
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1.5. General aspects: Glaucomas as cause of blindness

P031 RISK FACTORS FOR POOR CENTRAL VISION FOLLOWING ACUTE PRIMARY ANGLE CLOSURE

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Purpose: Acute Primary Angle Closure (APAC) is a known sight-threatening ophthalmic emergency which is a significant cause of preventable glaucoma-related blindness. Our objective is to look at the visual outcome and the risk factors for poor visual outcome following APAC.
Methods: Case notes of 139 consecutive patients presenting with APAC at the Birmingham and Midland Eye Centre, UK were examined. Visual acuity at presentation, at final visit, demographic data, and reasons for poor visual outcome at final visit are reported.
Results: One hundred fifty eyes of 139 patients had APAC. Mean age at presentation was 67.5 years range (31-96), with mean follow of 30.7 ± 18.5 months. There were 96 females (69%), 43 men (31%). One hundred ten cases were Caucasians (79.1%), 19 Indian Asians (13.7%), 4 African Caribbean (2.9%), and 3 unidentified (2.3%). Presenting visual acuity was ≤ 6/18 in 128 eyes (85.3%), and at final visit visual acuity was ≤ 6/18 in 46 eyes (30.6%). In eyes with poor final visual acuity at final follow up, 16 eyes had cataract (34.8%), 10 (21.7%) had glaucomatous optic neuropathy, 6 (13%) had age related macular disease (ARMD), 5 (10.8%) had central retinal vein occlusion (CRVO), 3 eyes were amblyopic (6.5%), 2 had corneal pathology (4.3%), 1 had traumatic macular pathology (2.1%), and cause was not reported in 3 eyes (6.5%). 20 (13.3%) eyes achieved very poor final visual outcome ≤ 6/60, 12 (12.5%) were females and 8 (11.5%) males.
Conclusion: The majority of the eyes treated for APAC in our series have achieved good final visual acuity. The main risk factors for poor visual acuity were cataract, ARMD, and CRVO. Gender was not a significant risk factor for very poor central vision following APAC.
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P032 VISUAL IMPAIRMENT IN PATIENTS WITH OPEN-ANGLE GLAUCOMA

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Purpose: To estimate the frequencies of visual impairment in patients with open-angle glaucoma at a university hospital in Sweden.
Design: Retrospective case notes study.
Participants: All patients with a diagnosis of open-angle glaucoma, who visited the Eye Department of Malm University Hospital, Sweden, between June 1, 2004 and May 31, 2006.
Methods: Retrospective study of patient records. Patients with primary open-angle glaucoma, pigmentary glaucoma, normal tension glaucoma or pseudoexfoliation glaucoma were included. We recorded visual acuity, visual field data (usually HFA SITA Standard 30-2 tests), type of glaucoma, age and presence of visual impairment up to the last visit of the study period. Glaucoma patients had repeatable visual field defects (GHT Outside Normal Limits) compatible with

glaucoma and not explained by other ocular or neurological disorders.
Main outcome measure: Visual impairment in one or both eyes with glaucoma as the major cause of impairment. Visual impairment was defined using WHO criteria; low vision: VA worse than 0.3 (20/70) and/or a constriction of the central visual field to less than 20 in its widest diameter; blindness: VA less than 0.05 (20/400) and/or a constriction of the central visual field to less than 10 in its widest diameter.
Results: A total of 1,912 patients were included with a mean age of 79 years (ranging from 30 to 100) at the last visit during the study period. Bilateral visual impairment, i.e. low vision and blindness, was present in 6.2% (119/1,912), and 4.2% (81/1,912), were bilaterally blind. Unilateral visual impairment was present in 25.1% (480/1,912), and 18.6% (355/1,912) were unilaterally blind. In total, 31.5% (603/1,912) of the patients had at least one eye with visual impairment from glaucoma, and 25.7% (491/1,912) had at least one blind eye from glaucoma. In Sweden, most glaucoma patients receive primary care in public health care. The majority of the patients in our catchment are seen at the University Hospital, and we believe that those patients are reasonably representative for all glaucoma patients in the area.
Conclusions: A considerable percentage of the patients had low vision or blindness in at least one eye. There is no shortage of ophthalmologists in Sweden, and health insurance is available to all. The reasons for our findings will be further studied.
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P033 VISUAL IMPAIRMENT AMONG GLAUCOMA PATIENTS IN LAGOS, NIGERIA

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Objective: To determine the prevalence of visual impairment among glaucoma patients in a busy glaucoma unit of a tertiary hospital in southwestern Nigeria.
Design: Hospital-based retrospective study.
Participants: All new cases of glaucoma seen between January and December 2008 of our glaucoma unit were included.
Methods: Case notes were retrieved and clinical data were extracted on biodata, presenting visual acuity, presenting intraocular presure, ophthalmoscopy findings, and visual field loss.
Main outcome measure: WHO definition of visual impairment and blindness with the best correction in the better eye was used. As VA < 6/18 - 6/60 - visual impairment, < 6/60 - 3/60 - severe visual impairment, < 3/60 - NPL - blindness, and visual field loss within 10 degree of fixation in a glaucoma patient, with characteristic VF pattern of glaucoma, such as arcuate shaped defects / scotomas, ring scotoma, and residual temporal island, consistent with the patient's disc changes.
Results: Three hundred thirty new cases of glaucoma were seen within the study period. One hundred ninety-seven males and 133 females (ratio 1.5: 1). Primary open-angle glaucoma was the most frequent diagnosis with 270 (81.8%) patients, 36 (10.9%) patients had secondary angle-closure glaucoma, 17 (5.2%) had secondary open-angle glaucoma, 5 (1.5%) presented as congenital glaucoma, while 2 (0.6%) were diagnosed as primary angle closure glaucoma. Visual acuity criteria showed that 89 (27.0%) patients had visual impairment, 38 (11.5%) had severe visual impairment, and 34 (10.4%) were blind. Visual field criteria, however, revealed that 192 (58.2%) of the patients were blind.
Conclusions: Visual impairment and blindness is high among glaucoma patients at the time of diagnosis. There is therefore an urgent need for aggressive public awareness campaign to ensure early detection.
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P034 UNDERSTANDING THE TRAJECTORY OF VISUAL ACUITY LOSS AMONG PATIENTS WHO GO BLIND FROM OPEN-ANGLE GLAUCOMA

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Purpose: To appreciate the trajectory of visual acuity (VA) decline in patients with advanced open-angle glaucoma (OAG) to better understand visual prognosis and impact of glaucoma surgery.
Methods: Retrospective chart review identified Kellogg Eye Center patients with advanced OAG with previously documented best-corrected VA 20/50 (LogMar 0.4) or better and who presently have best-corrected VA 20/200 (Log Mar 1.0) or worse in the same eye. VA loss due to other causes was excluded. The following information was collected from clinic visits: best-corrected VA, intraocular pressures (IOP), various visual field parameters, glaucoma medications, and surgical procedures. Kaplan-Meier survival analyses were performed and determined timing of VA decline from ≥ 20/50 to ≥ 20/200 and decline of ≥ 3 lines of Snellen VA.
Results: Twenty-seven patients experienced extensive VA

loss attributable to OAG. Mean age at VA ≥ 20/200 was 67.4 ± 13.5 years. Fifty-two percent were men and 81.5% were White. Mean VA at initial and final visits were LogMar 0.096 ± 0.11 and 1.82 ± 0.87, respectively. Average follow-up time was 19.9 ± 11.2 years. Mean IOP was 16.4 ± 3.7 mmHg, while VA was ≥ 20/50, 16.7 ± 7.2 mmHg during decline from 20/50 to 20/200, and 13.9 ± 4.6 mmHg after VA was ≤ 20/200. Kaplan-Meier survival curves demonstrated that approximately 50% of eyes declined to a VA of ≥ 20/200 in 5 years. Additionally, 25% experienced VA loss over 5-15 years. The remaining 25% experienced gradual loss of VA over 15 to 35 years. Twenty-fice percent of eyes declined ≥ 3 Snellen chart lines in ≤ 1 year period, 40% demonstrated this level of VA loss over 1-5 years, 20% over 6-10 years, and 15% developed this VA decline in ≥ 10 years. The 27 eyes were divided into linear (13 eyes) and non-linear (14 eyes) loss based on pattern of VA decline. There were no statistical differences in race, age, IOP, and initial and final VA between groups. VA loss occurred 5.9 ± 3.6 years and 0.87 ± 0.7 years for the linear and non-linear groups, respectively ($p < 0.05$). A gender difference was observed with 10/14 men vs 4/13 women in the non-linear vision loss group; 12/13 eyes in the linear group and 10/14 eyes in the non-linear group underwent ≥ 1 incisional glaucoma surgeries. Eyes in the linear group had 2.1 ± 1.2 incisional glaucoma surgeries vs 1.3 ± 0.8 in the non-linear group. Four of the 10 eyes in the non-linear group that underwent surgery had immediate post-operative irreversible vision loss associated with elevated IOP (2 eyes) or hypotony (2 eyes).

Conclusions: In this series approximately 50% of eyes that went blind from OAG experienced acute or subacute VA decline in ≤ 5 years. In a minority of patients the trajectory of VA loss was gradual over ≥ 10 years. Treatment with incisional glaucoma surgery was associated with gradual vision loss decline. These findings are important as they suggest loss of central visual acuity in OAG occurs over relatively short periods of time and aggressive treatment with incisional glaucoma surgeries may slow trajectory of VA decline.

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1.6. General aspects: Prevention and screening

see also P172

P035 A NOVEL APPROACH TO GLAUCOMA SCREENING AND EDUCATION IN NEPAL

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Objective: The objective of the research was to conduct opportunistic screening of glaucoma at outreach cataract screening clinics and to evaluate the role of free eye examinations, raising awareness and patient education programs in improving compliance to treatment.

Design: Novel approach to glaucoma screening and education in Nepal.

Participants: Subjects of several communities, glaucoma patients of the hospital.

Methods: A simple, age-based glaucoma screening algorithm was incorporated into three one-day cataract screening clinics. Using this algorithm, patients who were newly diagnosed with glaucoma were referred to TEC, where medication and surgery were provided free of charge through private donor funding. In addition, we describe two ongoing educational programs for increasing glaucoma awareness: an annual Glaucoma Awareness Week (which includes free screening, treatment, and counseling), and a repeating lecture series which generates new counselors.

Results: From 2004 to 2007 screening at the annual Glaucoma Awareness Week resulted in the diagnosis of 120 individuals with glaucoma, or 7.6% of total registrants. Attendance increased annually with a trend toward an increasing number of returning patients but a decreasing percentage of newly diagnosed patients, though the absolute numbers have remained relatively stable (range 21 to 38). Data from the three one-day screening clinics in 2006 show that approximately 2 to 4% of patients 50 years of age or older per clinic were newly diagnosed with POAG.

Conclusions: This multi-faceted approach appears to successfully identify individuals with glaucoma and provide treatment to those who would otherwise not be able to afford it. While more data is needed to validate this model, specifically regarding the effectiveness of educational activities, long-term visual outcomes, and medication compliance, it may serve as a useful framework for other developing countries with similarly limited resources.

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P036 STRUCTURE OF GLAUCOMA MORBIDITY AND OUR MANAGEMENT OF GLAUCOMA

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Purpose: To establish the structure of glaucoma morbidity regarding glaucoma patients passed in our office and to analyze their management

Methods: Three hundred and two consecutive glaucoma patients (91 men and 211 women, mean age 66.5 ± 11.6 years) were examined. Each patient was tested for intraocular pressure (IOP), anterior segment and fundus. Documents, regarding perimetry, gonioscopy, pachymetry and present medical therapy were taken into consideration. Recommendations of following management were given.

Results: The mean disease duration was 4.4 years (0-35 years). Seventy percent of our patients were women (men/women ratio 1:2.3). Family history of glaucoma was present in 67 patients (22%). Fifty one patients (17%) had diabetes and 174 (58%) systemic hypertension. Pseudoexfoliatins were found in 51 patients (17%). We observed the following distribution of glaucoma types: primary open-angle glaucoma (POAG) – 209 patients (69.2%); pseudoexfolative glaucoma (PxG) – 50 (16.6%); normal-tension glaucoma (NTG) – 15 (5%); primary angle-closure glaucoma – 9 (3%); pigmentary glaucoma – 6 (2%); juvenile glaucoma – 1 (0.3%); congenital glaucoma – 1 (0.3); secondary glaucoma – 11 (3.6%). The stages of glaucoma were established as follows: initial – 41%; evolutive – 20%; progressive – 19%; terminal – 8%. Ten percent were with ocular hypertension or suspect glaucoma and 2% had no glaucoma. The most frequently used antiglaucomatous local medications were prostaglandins (45%) followed by beta blockers (35%). IOP ≧ 20 mmHg under treatment was found in 173 (29%) eyes and IOP ≧ 18 mm HG - in 261 (43%)eyes. In 104 glaucoma patients (34%) the terapeutic strategy was changed.

Conclusion: Our results suggest highest percent of POAG – 70% of all our patients; relatively low percent of PxG – 17% and unexpectedly low percent of NTG. In more than 1/3 of patients the medical therapy was changed or operative treatment was recommended.

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P037 THE SPECTRAL INDEX, A PARAMETER OF THE OPHTHALMIC ARTERY BLOOD FLOW, IN RESPONSE TO COLD STIMULATION

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Objective: The spectral index (SI) is a parameter, which we previously have derived from the harmonic content of the blood flow velocity envelope of the ophthalmic artery. We have shown that SI changes in dependency on the baseline blood pressure (bBP). To investigate the response to sympathetic neural activity in arterial hypertension we have now examined SI during sympathetic activation by cold stimulation in dependency on bBP.

Design: Interventional case-control study.

Participants and controls: Ten men and 12 women with normal baseline blood pressure (age, 60.5 ± 4.6 yrs and 61.9 ± 7.2 yrs; p = ns) and age-adjusted men and women with increased baseline blood pressure were recruited from a population-based glaucoma project.

Methods: Subjects underwent the cold pressor test including a periodical measurement of blood pressure and blood flow velocity in the ophthalmic artery, the latter by pulsed Doppler sonography. From this the course of the spectral index was calculated.

Main outcome measure: Spectral index of the ophthalmic artery.

Results: During cold stimulation, women with increased bBP had a significantly smaller absolute SI difference to baseline over time (300 s, AUC) (-10.81 ± 4.6 1/s) compared to age-adjusted men with increased bBP (SI difference -25.1 ± 16.5 1/s; p = 0.047). This difference was not seen between normotensive gender groups. Men, but not women, with increased bBP achieved their SI peak (105 ± 43 s; p = 0.003) and their systolic blood pressure peak (120 ± 40 s; p = 0.022) significantly earlier and had a sharper slope of SI (0.548 ± 0.326%/s; p = 0.003) compared to normotensive men (time to SI peak -31.8 ± 21.8 s; time to SBP peak 180 ± 57 s; SI slope -0.165 ± 0.133 %/s.

Conclusion: In women with increased bBP the sympathetic response of the ophthalmic artery to cold stimulation is more extensive than in men with increased bBP. In men with increased baseline blood pressure the reaction of the ophthalmic artery to cold stimulation is more impetuous compared to normotensive men.

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P038 EVALUATION OF RISK FACTORS FOR GLAUCOMA IN A GENERAL OPHTHALMOLOGY CLINIC

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Objective: To evaluate the occurrences and outcome of risk factors for glaucoma among adults presenting to an eye care centre for routine eye examination.
Design: A retrospective analysis of medical records.
Participants: Medical records of all 4022 new cases during the year 2008 were reviewed. Records of patients below 18 years age, those with a history of having used medications for glaucoma and those who did not register for complete eye examination were excluded from the analysis.
Methods of testing: Detailed ophthalmic history including history of systemic illnesses and known glaucoma in family members was noted. Patients underwent complete ophthalmic evaluation including refraction, orthoptic screening, external examination, slit-lamp biomicroscopy, applanation tonometry, gonioscopy in relevant cases and dilated-pupils indirect ophthalmoscopy. Automated perimetry and pachymetry were performed in glaucoma suspects. Many of these patients also underwent diurnal IOP fluctuation evaluation, RNFL thickness estimation by optical coherence tomography, dynamic contour tonometry and optic disc photography.
Main outcome measures: Suspicion of glaucoma was based on applanation IOP of ≥ 18 mmHg and/or C:D abnormalities.
Results: Preliminary pilot analyses suggest occurrences of risk factors in about 15% of the cases of whom about one-third were eventually diagnosed to have glaucoma. Nearly 33% of the newly-diagnosed glaucoma cases had diabetes, hypertension and/or positive family history of glaucoma. POAG was approximately thrice as common as narrow angle glaucoma. Complete analysis of all participants is ongoing.
Conclusions: The incidence of glaucoma suspects and/or previously-unknown glaucoma detected at routine eye check-ups seem to be significant. Adults with systemic illnesses and/or family history of glaucoma should have periodic screening for glaucoma. Recognition of risk factors, systematic documentation thereof and a high level of clinical suspicion shall go a long way in prevention of long-term consequences of glaucoma.
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P039 THE CLINICAL EVALUATION OF A RAPID, PUPIL-BASED ASSESSMENT OF RETINAL DAMAGE ASSOCIATED WITH GLAUCOMA

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Objective: Current strategies to screen potential patients with glaucoma require a constellation of tests to be performed in the primary care setting, such as determining the visual field, assessing the optic disc appearance and measuring the intraocular pressure. Asymmetric retinal damage around the horizontal meridian is a recognised feature of glaucoma. Pupillary responses to light stimuli can be measured and provide an objective test of visual function. A new device, the PLR60, has been designed to measure the pupillary light reflex (PLR) in response to a retinal stimulus to detect asymmetric retinal responses. This test has been trialled on both patients with glaucoma and controls to elicit its potential as a clinical diagnostic tool in the detection of glaucoma.
Methods: Thirty patients clinically diagnosed as having glaucoma were recruited to the study and tested using the PLR60 device. A control group of 30 healthy patients were also tested using the same protocol. The theory and techniques utilised by the PLR60 have been described previously.
Results: Of the 110 eyes with test outcomes, overall agreement between the PLR60 result and clinical diagnosis (glaucoma positive or negative) per eye was 84.7%. Sensitivity was 93.1% (95% confidence limits 77.2%-99.2%) and specificity was 76.7% (95% confidence limits 57.7%-90.1%). Average (SD) test times (min: sec) for both eyes were 3: 21 (0: 33) minutes for the Glaucoma group and 2:40 (0:35) minutes for the healthy group.
Conclusions: The results of this preliminary study suggest that the pupillary light reflex (PLR), as used in the Pupilmetrix™ PLR60 test is able to discriminate between patients with glaucomatous retinal defects and healthy individuals with a diagnostic accuracy that is potentially useful for glaucoma screening. It compares well with other tests of visual function. Test times were markedly quicker than with standard visual field testing.
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P040 ADDITIONAL YIELD OF AN OCULAR EXAMINATION PERFORMED AS A PART OF A SYSTEMIC HEALTH SCREENING CHECK-UP

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Objective: To assess the value of an ocular screening examination performed as a part of a systemic health check-up in the diagnosis of glaucoma and in identifying its risk factors in a predominantly South Asian population.
Design: Retrospective observational case series.
Participants: Eight hundred ninety-two patients who underwent an ocular and systemic evaluation in a tertiary hospital in Sri Lanka between July 2004 and August 2005.
Methods of testing: A Retrospective chart analysis of 892 patients who had undergone a systemic health check up between August 2004 and July 2005 in a tertiary hospital in Sri Lanka was performed. This included a comprehensive ocular examination, a complete systemic examination by a physician and a surgeon as well as routine blood chemistry. Univariate analysis was performed for age, gender, intraocular pressure, systolic and diastolic blood pressure, systolic and diastolic perfusion pressure, fasting blood sugar, serum cholesterol, serum triglycerides, and for diabetes, hypertension and hyperlipedemia and a number of other cardiovascular risk factors, as risk factors for glaucoma. A multvariate analysis was performed for those parameters found significant on univariate analysis.
Main outcome measures: Prevalence of primary open-angle glaucoma, ocular hypertension, angle-closure disease, glaucoma suspects and secondary glaucomas were determined. Risk factors for the development of glaucoma were assessed.
Results: Eight hundred ninety-two patients; 543 males, 349 females; mean age; 47.3 ± 12.3 (11-86) were examined. 72 (7.9%) of them were diagnosed to have primary open-angle glaucoma (POAG), ocular hypertension, angle-closure disease, secondary glaucoma or to be glaucoma suspects. There were 30 (3.3%) POAG, and 26 (2.9%) glaucoma suspects. Nine (1%) had been diagnosed to have glaucoma prior to examination. Increasing age (odds ratio 1.03; CI 1.01, 1.06) and increasing IOP (odds ratio 1.35- CI 1.26,1.49) were significant risk factors for glaucoma and glaucoma suspects on both univariate and multivariate analysis.
Conclusion: A comprehensive ocular examination is useful in identifying glaucoma in those undergoing a systemic screening examination.
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P041 ANALYSIS OF SHORT-TERM INTRAOCULAR PRESSURE (IOP) CHANGES IN PATIENTS AFTER RECEIVING INTRAVITREAL BEVACIZUMAB

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Objective: This study analyses short term intraocular pressure changes after giving intravitreal bevacizumab (Avastin) for duration up to half an hour by Goldmann applanation tonometry.
Design: A prospective series of patients undergone intravitreal injection of bevacizumab were investigated.
Participants: We accrued 52 patients with a mean age of 72 years: 46% were female, and 54% were male. Most patients (90%) were being treated for neovascular age-related macular degeneration.
Exclusion criteria: Known glaucoma patients, narrow angles, previous ocular surgery or lasers or injection, refractive error >±3D.
Methods: All patients received bevacizumab (0.05 cc) injected intravitreally in a standard manner. IOP was measured at baseline, 2, 5, 10 and 30 minutes after injection using Goldmann applanation tonometer.
Results: The mean IOP values at baseline, 2, 5, 10 and 30 minutes after injection were 16.0 mmHg, 34.4 mmHg, 28.7 mmHg, 20.8 mmHg, and 17.1 mmHg, respectively. Two patients had an IOP of 28 mmHg or higher at 30 minutes. IOP normalized within 2 hours without medical therapy in these patients, and none of the patients required glaucoma medication.
Conclusions: Intravitreal injection of bevacizumab appears to be safe with respect to short-term IOP changes. A rarely elevated IOP at 30 minutes after injection may occur, thus warning clinicians for checking IOP after injection as a precaution. Consequences of transient IOP elevations are unknown. Effect in glaucoma patients needs to be further studied in whom it may be more dangerous.
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P042 DETECTION OF DISC HEMORRHAGE BY TRAINED VERSUS UNTRAINED OBSERVERS

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Purpose: Disc hemorrhages (DH) are a feature of glaucoma and are associated with visual field (VF) progression. Despite their clinical relevance, DH are often undetected. We assessed the ability of a variety of observers to detect DH.
Design: Prospective, cross-sectional study.
Participants: Two non-medical observers, two comprehensive ophthalmogists, and a glaucoma specialist.
Methods: One hundred simultaneous stereo disc photographs of 100 glaucomatous eyes (30 eyes with DH) were digitized and randomized by an unmasked glaucoma specialist. A DH was defined as a splinter-like or flame-shaped hemorrhage on or within the retinal nerve fiber layer or neuroretinal rim, in the absence of other ocular disease that was no longer present on a subsequent disc photograph. Two investigators had no prior medical education experience and three were ophthalmologists. The two non-medical investigators underwent a 15-minute training session (using a separate set of photographs) before beginning photographic review. Each investigator, masked to the sequence of photos and number of DH, reviewed the set of photos twice, with a 15-minute break. A template with a map of the optic disc was used to record DH location by each observer.
Main outcome measures: Sensitivity and specificity for each observer during each session of disc photograph review.
Results: The observers took an average of 29 ± 11.5 and 21.0 ± 4.1 minutes to review the disc photographs during the first and second sessions, respectively. Sensitivity and specificity are described in the Table. Observer E had the best and a constant performance in the two sessions. Observers A and B showed the worst performance in the first session, but improved significantly in the second session. Observers C and D showed a slight improvement from the first to the second session. Observers A and B were consistent regarding the location of hemorrhage in 96% of cases that a hemorrhage was identified in both sessions. The other investigators were consistent in all cases.
Conclusions: It is possible to rapidly and easily train inexperienced personnel to detect glaucomatous disc hemorrhages. Sensitivity and specificity was remarkably high for inexperienced individuals with only cursory training. Repeat evaluation of photographs in separate sessions increases DH detection sensitivity (learning effect). Although high sensistivity is desirable when searching for DH, any should be interpreted cautiously due to the potential for decreased specificity. DH detection may prove useful in telemedicine screening for glaucoma or glaucoma progression and can be achieved with non-medical personnel.
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2.1. Anatomical structures in glaucoma: Conjunctiva

P043 THE EFFECTS OF THE ANTIGLAUCOMA MEDICATION IN THE TEAR FUNCTION AND OCULAR SURFACE

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Purpose: Different kinds of topical antiglaucomatous agents are used for prolonged durations by glaucoma patients before undergoing filtration surgery. Tear film and ocular surface can be altered by long-term locally applied ocular medications. The aim of this study was to determine the changes of tear film functions and ocular surface due to use of chronic antiglaucomatous medications.
Design: A prospective, case-controlled study.
Participants: Two hundred-sixteen eyes of 110 primary open-angle glaucoma or ocular hypertension on antiglaucomatous treatment patients seen at the Department of Ophthalmology, Ondokuz Mayis University Faculty of Medicine, from September 2007 through April 2008, and 70 eyes of 35 age- and sex-matched healthy control volunteers were studied in the study.
Methods: All subjects underwent routine ophthalmologic examinations, Schirmer test, tear film break-up time (BUT) analysis, and corneal surface fluorescein stains analysis.
Main outcome measure: Patients and control subjects were compared for tear function parameters and ocular surface.
Results: There was found no statistically significant difference between glaucoma and control groups in Schirmer's test and BUT ($P > 0.05$). Patients chronically using antiglaucomatous medications presented with significant higher fluorescein staining ($P < 0.05$).There were found significant relationship corneal fluorescein staining and used duration of antiglaucomatous agents ($P = 0.011$).
Conclusion: The long-term use of antiglaucoma medication doesn't affect the tear film functions, but it induces changes in cornea. Corneal changes may be related to the medication or duration of treatment, but may also be due to the preservatives used in the commercial product.
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surface alterations in chronic users antiglaucoma medications. Arq Bras Oftalmol 2008; 71: 18-21.

P044 IMPRESSION CYTOLOGY IN EYES WITH PSEUDOEXFOLIATIVE SYNDROME

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Objective: To observe the nature of conjunctival structure in eyes with pseudoexfoliative syndrome tested by impression cytology technique.
Design: Prospective, laboratory.
Participants: A total of 49 eyes with pseudoexfoliative syndrome without treating with any topical medication was evaluated.
Methods: Samples were taken on both inferonasal and superior bulber conjunctiva using 55 mm milliport filter paper in the same eye. Conjunctival changes graded from from grade 0 to 3 according to Nelson classification.
Main outcome measure: Conjunctival surface changes.
Results: In the inferonasal quadrant, 1 (2.04%) of the eyes had Grade 0; 3 (6,12%) eyes had Grade 1; 13 (26,5%) eyes had grade 2; and 32 (65,3%) eyes Grade 3 changes. In the superior bulber conjunctiva, none of the eyes had Grade 0; 8 (16,3%) eyes had Grade 1; 18 (36,7%) eyes had Grade 2; and 23 (46,9) eyes had Grade 3 changes. Fourteen (28,5%) samples of inferonasal and 17 (34.6%) samples of superior conjunctival structure showed more than one grading in the same 55-mm testing area, which indicates changes in mosaism. A total of 32 samples could only be graded according to epithelial cell changes, but the presence of goblet cells did not corralete with the related grading level. Fourteen (28,5%) samples of the inferonasal quadrant and 18 (36,7%) samples of the superior quadrant showed epithelial cell changes with goblet cell discorrelation.
Conclusions: Mosaism of impression cytology in some samples showed segmental involvement of conjunctival structure in pseudoexfoliative syndrome. Discorrelation of cytologic changes with presence and number of goblet cells cause difficulty in classification according to Nelson grading system, which was not reported before. Therefore it may be necessary to create a new staging system for patients with pseudoexfoliative syndrome.
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P045 EFFECTS OF ANTI-GLAUCOMA MEDICATIONS ON EXTRACELLULAR MATRIX METALLOPROTEINASE INDUCER (EMMPRIN) EXPRESSION BY CONJUNCTIVAL EPITHELIAL CELLS

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Objective: To analyze the expression of Extracellular Matrix Metalloproteinase Inducer (EMMPRIN) by conjunctival epithelial cells in patients treated for glaucoma.
Methods: A total of 26 patients were included in this study. Patients were divided into three groups: 10 patients had 2 or more topical antiglaucoma treatments (multitreatment group), 8 patients had only one treatment (monotherapy group), and 8 normal control subjects (control group). Impression cytology specimens were obtained from one eye of the patients and processed for flow cytometry analysis. Conjunctival epithelial cells were extracted and incubated with monoclonal antibodies against HLA-DR, EMMPRIN and their specific controls, to measure the expression of these two markers.
Results: HLA-DR expression was raised significantly in the multitreatment group compared to the monotherapy group and the control group. HLA-DR expression in the monotherapy group was also significantly overexpressed compared to the control group. Similar findings were observed with a significant increase of EMMPRIN expression in the multitreatment group and the monotherapy group compared to the control group. There was a statistically significant correlation between EMMPRIN and HLA-DR expression by conjunctival epithelial cells both in glaucoma patients and normal subjects.
Conclusion: This study demonstrates the overexpression of EMMPRIN and HLA-DR in the conjunctival epithelium of topically treated glaucoma patients. These results suggest that inflammatory reactions are combined to matrix metalloproteinases modulation in the conjunctiva of patients treated for glaucoma.
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P046 RELATIONSHIP BETWEEN CORNEAL BIOMECHANICAL FACTORS AND GLAUCOMA WITHIN THIN, INTERMEDIATE, AND THICK CENTRAL CORNEAL THICKNESS SUBGROUPS

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Purpose: While central corneal thickness (CCT) is proven as an important glaucoma risk factor, it remains that some people with thick corneas do and some with thin corneas do

not develop glaucoma. Whether corneal properties beyond geometric thickness are related to this circumstance remains unknown. This study was thus designed to explore (within thin, intermediate and thick CCT groups) whether clinically measurable corneal biomechanical properties differ between patients diagnosed with glaucoma and patients at risk for but not diagnosed with glaucoma.

Design: Prospective, cross-sectional study; mean values were computed for all variables from two consecutive clinic visits occurring within three months of one another.

Participants: Consecutive Albuquerque VA Medical Center eye clinic patients with a diagnosis of primary open-angle glaucoma (POAG), normal-pressure glaucoma (NPG), ocular hypertension (OH), or glaucoma suspect (GS). Glaucoma diagnosis required reproducible field loss and characteristic glaucomatous optic neuropathy; OH diagnosis required at least one statistically elevated IOP reading and no definitive glaucomatous optic neuropathy or field loss; GS diagnosis required an optic nerve appearance that was suspicious but not definitive for glaucoma and no visual field loss or statistically elevated IOP. One eye was randomly included from each subject, unless only one eye met criteria for glaucoma diagnosis in which case that eye was included.

Methods: All subjects had both eyes measured with bi-directional air-jet tonometry (ORA), dynamic contour tonometry (DCT), Goldmann applanation tonometry (GAT), and ultrasound pachymetry. After subjects were divided into 3 equal-sized CCT groups, corneal biomechanical variables were compared between subjects with and without diagnosed glaucoma within each CCT group. Studied biomechanical variables included instrument output parameters (corneal hysteresis [CH], corneal resistance factor [CRF], and ocular pulse amplitude [OPA]); and two computed factors (the averaged combination of CH and CRF [AVCHCRF = CH + CRF/2], and the difference between DCT-IOP and GAT-IOP [DCT-GAT]).

Main outcome measure: Differences in corneal biomechanical parameters between the POAG/NPG subjects and the OH/GS subjects within the thin, intermediate and thick CCT groups.

Results: One hundred sixty-five subjects (49 POAG, 16 NPG, 50 OH, 50 GS) were equally segregated into thin (445-535 um, n = 55), intermediate (538-566 um, n = 55), and thick (568-631 um, n = 55) CCT groups. In logistic regression analyses, AVCHCRF was the only variable that differentiated between subjects with and without glaucoma within each of the three CCT groups. Unlike the other studied biomechanical variables, AVCHCRF was not significantly correlated with IOP. AVCHCRF was correlated with CCT, however, and correspondingly, mean AVCHCRF values increased from thin to intermediate to thick CCT groups.

Conclusion: AVCHCRF was significantly lower in glaucoma patients versus patients at risk for glaucoma within all three CCT groups. This finding suggests that AVCHCRF may be a useful tool for glaucoma risk assessment, particularly after CCT-related risk is taken into account. Furthermore, because AVCHCRF values increase with increasing CCT, appropriate clinical utilization of this parameter will likely require consideration and integration of CCT status.

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P047 A PROSPECTIVE RANDOMIZED DOUBLE BLIND STUDY COMPARING THE EFFECT OF XALACOM AND COSOPT ON CENTRAL CORNEAL THICKNESS AND SPECULAR MICROSCOPY

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Objective: To compare the effect of Cosopt and Xalacom, two acceptable anti glaucoma medications, on the intraocular pressure, central corneal thickness (CCT) and endothelial cell count.

Design: Prospective randomized double-blind study.

Participants: Newly-diagnosed open-angle glaucoma patients.

Methods: We randomly assigned the patients to two study groups. Group A received Cosopt twice daily and Group B received Xalacom once daily. Baseline testing included a full ophthalmological examination including: intraocular pressure, CCT and endothelial cell counts prior to initiation of therapy. Identical periodic examinations were conducted after 1, 3, 6 and 12 months of continuous therapy.

Main outcome measure: CCT; endothelial cell count; intraocular pressure.

Results: Twenty patients completed the study. Ten patients received Cosopt and 10 patients received Xalacom. The mean age in both groups was 70.9 years. The mean reduction in the intraocular pressure in both groups was above 30% from baseline without a significant difference between the two groups. The CCT increased progressively in Group A from a baseline mean of 539.3 microns to a 12 months follow-up measurement of 549.4 microns (p = 0.019). In Group B, CCT decreased from an initial mean of 510.5 microns to a 12 month follow up measurement of 493.7 microns (p = 0.002). When we compared the change in CCT between both groups during follow up we found a significant difference (p < ,0.0001). Mean endothelial cell count decreased by 115.7 in group A and by 300.3 in Group B after 12 months therapy (p = 0.19).

Conclusions: We found a progressive change in CCT after one year of therapy in both groups. Cosopt therapy caused an increase in CCT while Xalacom therapy created a decrease in CCT. The change in CCT was neither correlated with the decrease in intraocular pressure nor with the change in endothelial cell count. This progressive change in CCT which we found after 1 year of treatment may become clinically significant after many years of ongoing ant glaucoma therapy. We therefore recommend that periodic CCT measurements should be routinely included as part of the standard glaucoma follow up.

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P048 CO-RELATION OF THE DIURNAL VARIATION IN CENTRAL CORNEAL THICKNESS AND DIURNAL VARIATION IN INTRAOCULAR PRESSURE IN PATIENTS OF PRIMARY OPEN-ANGLE GLAUCOMA IN A TERTIARY CARE INSTITUTE OF NORTH INDIA

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Objective: To access whether diurnal variation in intraocular pressure in glaucoma patients correlated with variation in central corneal thickness as measured by ultrasound pachymetry.
Design: Prospective non-randomized study.
Method: Central corneal thickness (CCT) and intraocular pressure (IOP) were measured by a single observer in 128 eyes of 64 patients with primary open-angle glaucoma (POAG) using ultrasonic pachymetry and Goldmann tonometer. Six measurements were made over a period of 24 hours at 9 am, 1 pm, 5 pm, 9 pm, 1 am and 5 am.
Main outcomes: Intraocular pressure and pachymetry.
Results: Mean IOP was 15.25 ± 3.45 mmHg at 9 am, 15.15 ± 3.08 mmHg at 1 pm, 15.35 ± 3.16 mmHg at 5 pm, 15.49 ± 3.47 at 9 pm, 15.68 ± 3.47 at 1 am, 16.51 ± 3.64 at 5 am. Mean CCT was 528.61 ± 36.14, 528.33 ± 36.14 um, 528.91 ± 35.321 um, 530.94 ± 36.40 um, 531.97 ± 36.79um, 533.90 ± 36.87 um at the respective six time points.
Conclusions: There was no significant diurnal variation in central corneal thickness in patients of POAG. The diurnal variation in IOP did not significantly correlated with diurnal variation in central corneal thickness. Therefore the diurnal variation of pachymetry is not important in the diagnosis and management of patients with POAG.
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P049 COMPARISON OF CENTRAL CORNEAL THICKNESS MEASUREMENTS USING THREE ULTRASOUND PACHYMETERS

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Purpose: To compare central corneal thickness (CCT) measurements obtained with three ultrasound pachymeters.
Design: Experimental study.
Participants: Thirty-six eyes of 36 healthy volunteers.
Methods: CCT was measured in 36 eyes of 36 healthy volunteers with three different ultrasound pachymeters (300P Pacscan Pachymeter, Sonomed Inc., NY, USA; UP-1000 Ultrasonic pachymeter, Nidek Co., Ltd., Japan; Pacline pachymeter, Optikon, Ophthalmic Equipment, Roma, Italy). In each eye, 5 separate, sequential measurements were performed with each pachymetry device. All measurements were performed in the same order by the same clinician on one visit.
Main outcome measure: Comparison of CCT measurements obtained with three ultrasound pachymeters.
Results: The mean CCT measured with the Pacscan, UP-1000 and Pacline was 554.63 ± 33.56 µ, 552.90 ± 37.05 µ and 558.29 ± 36.13 µ, respectively. The mean CCTs with UP-1000 were significantly smaller than the other ultrasound measurements. The mean difference between UP-1000 and Pacscan was 6.16µ (95% CI, 2.7-9.5, P = ,000) and UP-1000 and Pacline was 6.47µ (95% CI 1.7-11.15; P = 0.004). There was no significant difference between Pacline and Pacscan (0.306µ, 95% CI 3.5-4.1; P = 1.000).There were significant linear correlations between UP-1000 and Pacscan (Pearson's correlations coefficient r = 0,976, P < 0.000), UP-1000 and Pacline (r = 0.981, P < 0.000), Pacline and Pacscan (r = 0.953, P < 0.000).
Conclusions: The use of the three instruments tested has no influence on the determination of CCT and on the correction of intraocular pressure. There is a significant correlation between each instrument in measuring CCT.
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P050 BIOMETRIC AND CORNEAL TOPOGRAPHIC CHARACTERISTICS IN PATIENTS WITH WEILL-MARCHESANI SYNDROME

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Purpose: Weill-Marschesani syndrome (WMS) is a genetically determined rare systemic connective tissue disorder. The patients present with short stature, brachycephaly, short and stubby hands and feet, and may have stiff joints, especially in the hands, and characteristic eye abnormalities including shallow orbits, microspherophakia, ectopia lentis, high myopia, and chronic angle-closure glaucoma due to papillary block. This study was conducted to determine the biometric findings of ocular structures and corneal topographic characteristics in patients with Weill-Marchesani syndrome (WMS).
Design: Case-control study.
Participants and controls: A total of seven female patients with WMS and twenty female age-matched normal subjects as control subjects.
Methods: All underwent a complete ocular examination including refraction and analysis using Fourier transformation, slit-lamp biomicroscopy, pachymetry, keratometry, and ocular biometry.
Main outcome measures: The following A-scan parameters including anterior chamber depth (ACD), lens thickness (LT), axial length (AL), lens/axial length factor (LAF), and relative lens position (RLP) were measured. Corneal topography and Orbscan II were performed only in the patients.
Results: As compared to normal subjects, the patients with WMS were more myopic (Spherical Equivalent: -12.07 ± 5.52; -0.52 ± 0.56; $p < 0.0001$), and had more total astigmatism (-2.43 ± 1.09; -0.27 ± 0.37, $p < 0.0001$) and corneal astigmatism (-2.53 ± 1.20; -0.47 ± 0.47, $p < 0.0001$). Oblique astigmatism was commonly found in the WMS individuals, showing a strong right-left specificity (right eyes' axes in the 135°-meridian, left eyes' axes in the 45°-meridian). The patients presented a shorter AL (21.4 ± 1.31; 23.3 ± 0.47, $p < 0.0001$), a shallower ACD (2.7 ± 0.40; 3.5 ± 0.32, $p < 0.0001$), a thicker lens (4.8 ± 0.45; 3.8 ± 0.24, $p < 0.0001$), a more calculated lens power (24.5 ± 4.12; 20.7 ± 0.99, $p < 0.0001$), a more LAF (2.2 ± 0.26; 1.6 ± 0.01, $p < 0.0001$), but the same RLP (2.4 ± 0.02; 2.3 ± 0.01, $p = 0.32$). A thicker cornea (622.07 ± 26.13; 549.47 ± 25.78, $p < 0.0001$) and higher keratometry values (46.50 ± 2.58; 43.7 ± 71.22, $p < 0.0001$) were found in the WMS group compared to the control.
Conclusions: Steeper and thicker cornea with a strong right-left specificity of corneal astigmatism, a thick lens, less axial length and anterior chamber depth are characteristic ocular findings in patients with WMS. The corneal characteristics of these patients should be taken into account while measuring the intraocular pressure in patients with this syndrome.
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P051 CORNEAL THICKNESS AND ENDOTHELIAL CELL DENSITY IN ASYMMETRICAL GLAUCOMA

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Purpose: Sustained increase in intraocular pressure (IOP) will result in loss of corneal endothelial cells, resulting in increase of corneal thickness. This study was designed to determine whether in asymmetrical primary open-angle glaucoma (POAG) the worse eye demonstrates a thicker cornea and lower endothelial cell density than the better eye.
Design: Cross-sectional study.
Participants: Patient logs were used to identify subjects with asymmetrical POAG, defined as those with asymmetric glaucomatous visual field loss (mean deviation (MD) > -2 dB, cup-to-disc ratio (CDR) of 0.2, and IOP > 5 mmHg difference between the two eyes. Exclusion criteria included history of corneal disease, ocular inflammation, trauma, surgery or laser treatment. Severity of glaucoma was determined by the mean deviation (MD) value of Humphrey visual field test. Glaucomatous damage was graded as Mild (MD < -6 dB), Moderate (MD <-12 dB), Severe (MD > -12dB).
Methods: The following data were extracted from the patient's records: duration of glaucoma, risk factors, number of medication, visual field MD value and documented IOP. Specular microscopies were performed on central corneas, endothelial images were analyzed, and CCT and ECD were calculated.
Main outcome measure: An independent t test was used to analyze the mean CCT and ECD in the worse and better eye in the asymmetrical glaucoma subjects.
Results: Sixty-eight patients who met all the criteria were included in this study. Mean CCT in the worse eye and better eye in the glaucoma group was 0.504 ± 0.364 µm and 0.509 ± 0.343 µm respectively. There was no significant difference of mean CCT between worse and better eye; t test, $P = 0.426$. Mean ECD in the worse eye was 2767.66 ± 292.51 cells/mm^2 and in the better eye 2817.85 ± 248.33 cells/mm^2. There was no significant difference of mean ECD between worse and better eye; t test, $P= 0.283$. CCT in mild, moderate and severe glaucomatous damage was 0.516 ± 0.409 µm, 0.514 ± 0.289 µm and 0.497 ± 0.367 µm respectively. This difference were not significant, one-way ANOVA, $P = 0.175$. ECD in mild, moderate and severe glaucomatous damage were 2934.00 ± 268.87 cells/mm^2, 2797.04 ± 261.88 cells/mm^2, 2715.53 ± 296.19 cells/mm^2 respectively. This differences were not significant, one-way ANOVA, $P = 0.078$. Patients receiving four glaucoma medications had lower cell counts than those receiving three or less.
Conclusions: This study may suggest that in asymmetrical

POAG, the worse eye may have lower endothelial cell density than the better eye. There was no significant difference in the CCT between the worse and better eye.

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P052 THE RELATIONSHIP BETWEEN CENTRAL CORNEAL THICKNESS, GENDER, IOP AND CORNEAL CURVATURE

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Purpose: To investigate the relationship between central corneal thickness, gender, intraocular pressure and corneal curvature.

Design: A prospective cross-sectional study

Methods: Volunteer participants were selected. Two hundred-two eyes of 101 persons (84 females, 17 males) were analyzed. The mean age was 22 years, range: 18-26 years. Central corneal thickness was measured by ultrasonic pachymeter (Quantel medical B VI, France), intraocular pressure by applanation tonometry (Tono-Pen) and the corneal curvature by autorefractometer (Topcon KR 800).

Results: The mean (± SD) central corneal thickness of right eyes was 548,23 ± 34,81 μm, of left eyes 548,65 ± 35,71 μm, this is a statistically significant difference. Intraocular pressure of the right eye was 15,18 ± 2,94 mmHg and of the left- 15,36 ± 2,78 mmHg ($p < 0,001$). Corneal curvature: right was 7,808 ± 0,253 mm (43,26 ± 1,39 D) and left was 7,800 ± 0,250 mm (43,47 ± 2,01 D) ($p < 0,001$). Correlation coefficient in comparison central corneal thickness with: 1) gender was $r = 0,211$ ($p < 0,05$); 2) intraocular pressure in right eye was $r = 0,119$ ($p = 0,235$), in left eye – $r = 0,167$ ($p = 0,095$); 3) corneal curvature in right eye was $r = 0,171$ ($p = 0,088$), in left eye – $r = 0,114$ ($p = 0.257$). Correlation coefficient in comparison intraocular pressure with corneal curvature in right eye was $r = 0,177$ ($p = 0,076$), in left eye – $r = 0,061$ ($p = 0,546$).

Conclusions: There was statistically significant difference between analyzed variables (central corneal thickness, intraocular pressure, corneal curvature) in both eyes. Correlation between central corneal thickness and gender ($p < 0,05$) and weak correlation between intraocular pressure and corneal curvature were estabilished.

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P053 MEASURING CENTRAL CORNEAL THICKNESS ACHIEVES A BETTER MACULA IN HYPOTONY MACULOPATHY AFTER TRABECULECTOMY

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Purpose/Objective: To study the relationship of central corneal thickness (CCT) and optical coherence tomogram(OCT) of the macula in hypotony maculopathy (HM) after trabeculectomy.

Design: Prospective case-control study.

Participants: Seventeen patients with HM and 32 controls with persistent hypotony (defined as intraocular pressure (IOP) of 7 mmHg or less) without signs of maculopathy after trabeculectomy alone or combined phacotrabeculectomy.

Methods: Proper information from consecutive patients and controls was collected in a prospective manner. Significant contributing factors associated with HM were studied by comparing the findings in two groups in univariate and multivariate analysis.

Main outcome measures: The factors investigated were: demographic pattern (age and gender), existing refractive errors, presenting IOP, nature and extent of choroidal effusion,and OCT of macular retina (pre- and post-operative), among others.

Results: A significant and appreciable difference between the two groups was observed in terms of the patient's presenting age (patients with HM being significantly younger; 48 ± 17 years *vs* 69 ± 11 years; $p = 0.014$), CCT (corneas of HM patients being significantly thicker; 561 ± 49 μm *vs* 502 ± 37 μm; $p = 0.005$) and macular mean follow-up OCT (thicker corneas of HM patients having significantly thicker macula; 170 ± 19 μm *vs* 163 ± 17 μm; $p = 0.013$). All the predictive factors (young patient with thicker cornea and thicker macula) strongly persisted significantly in a multivariate logistic regression analysis. The measured IOP (mean office-visit post-operative IOP) during post-operative hypotony was

similar in eyes with hypotony alone and HM (5.1 ± 2.3 mmHg *vs* 4.9 ± 1.7 mmHg; p = 0.543). No differences in gender, other demographic pattern, presence/degree of myopia or hypermetropia, degree of lens opacity, presence of choroidal effusion were observed between the two groups.

Conclusions: This study shows that younger patients with thicker corneas have a greater risk of developing HM. Also the macular thickness pattern positively correlates with thicker corneas of HM. This study suggests that consideration of pre-operative CCT values in a proper way may retard the HM state in trabeculectomized eyes particularly when setting a low target pressure. This study emphasizes that a better looking macula with little fluid can be obtained in HM, if pre-operative CCT is properly considered.

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P054 THE IMPACT OF THE GLAUCOMA MEDICATION ON THE BIOMECHANICAL PROPERTIES OF THE CORNEA

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Purpose: The aim of this study was to evaluate the biomechanical properties of the cornea in primary open-angle glaucoma (POAG) eyes measured by the Ocular Response Analyzer (ORA) before and after use of the antihypertensive drugs. The healthy individuals were studied as a control group.

Methods: This prospective, comparative clinical trial included 246 eyes, normal (n = 80) and POAG (n = 166). POAG eyes were divided into four groups depending on the type of medication which had been used prostaglandine analogues (PGA), betablockers (BB), inhibitor carboanhydrase (ICA) and combined therapy.

Main outcome measures: Intraocular pressure (IOP), hysteresis (CH), corneal resistance factor (CRF) and central corneal thickness (CCT). The mean follow-up time was 24 months.

Results: The hysteresis (CH) in the primary open-angle glaucoma group did not change significantly, the mean change in CH was 2,2 mmHg, 1,9 mmHg, 1,8 mmHg and 2,3 mmHg in the PGA, BE, ICA, and combined-therapy groups. The mean CCT was lower in the POAG than in the control group. The other outcome measures were not statistically significant.

Conclusion: The biomechanical measures of the cornea in POAG are not significantly influenced by the long-term use of antihypertensive therapy.

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P055 GLAUCOMA RISK FACTORS IN DSEK PATIENTS

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Purpose: To analyze preoperative risk factors for development of post operative secondary glaucoma.

Design: Retrospective study.

Material and method: We analyzed 165 cases of Descemet stripping endothelial keratoplasty (DSEK) to find out major risk factors, which are responsible for glaucoma in postoperative period. We analysed data from 71 men and 90 women in mean age 66,5 ± 11,1 years. In 4 patients DSEK was performed in both eyes. In 98 eyes DSEK was performed in pseudophakic patients, in 48 eyes DSEK was combined with cataract surgery, 10 patients had secondary IOL implantation, 9 patients remained aphakic. We analysed the anterior chamber depth, iridocorneal angle, and total eyeglobe lenth.

Results: Nineteen eyes had previous glaucoma history. Twenty-four patients developed glaucoma after surgery. In this group the anterior chamber depth was 1,98 ± 0,12 µm vs 2,54 ± 0,31 µm in nonglaucoma patients. The angle was 21,3 ± 4,1 degrees vs 29,4 ± 6,2 degrees in nonglaucoma patients. Preoperative anterior synechiae were present in 12 eyes with postop glaucoma vs 11 in nonglaucoma patients. Postopeartive synechiae occurred in 9 patients (6 in the glaucoma group). Lens status as well as total eyeglobe length did not correlate with presence of glaucoma.

Conclusions: Anterior chamber depth is a very important risk factor for development of glaucoma in DSEK patients.

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donor adherence. J Cataract Refract Surg 2006; 32: 411-418.

P056 RACIAL DIFFERENCES IN CENTRAL CORNEAL THICKNESS IN NARROW-ANGLE GLAUCOMA PATIENTS AND CORRELATION WITH THE SEVERITY OF GLAUCOMA FROM A COMMUNITY GLAUCOMA PRACTICE

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Purpose: To check the differences among central thickness and glaucoma severity in narrow-angle glaucoma patients by racial origins.
Design: Narrow-angle glaucoma patients by gonioscopy and S/P Laser PIs were selected from the glaucoma practice of SS and severity of glaucoma and central corneal thickness were compared.
Participants: Narrow-angle glaucoma patients by gonioscopy and/or S/P Laser PIs. The patients were identified by their racial origins and compared.
Methods: Forty-two patients with narrow angles and/or glaucoma (27 White and 15 Black patients) were identified. Slit-lamp biomicroscopy, indirect gonioscopy with Goldmann 2 mirror lens, and dilated fundus exam were performed. Central corneal thickness (CCT) was measured by ultrasound pachymetry. The severity of glaucoma was stratified by the cup-to-disc (CD) Ratios, Scanning Laser Polarimetry by GDX Access Nerve Fiber Analyzer and NFI were used to stratify severity. Perimetry by Humphrey Visual Fields 24-2 (Standard) program were analysed and stratified. The patients' CCTs, CD ratios, GDX Scores and HVF MDs were compared.
Main Outcome Measure: CCT.
Results: Forty-two patients (27 Whites and 15 Blacks). Female to male ratio: 31:11. Ages were 41-60: 13; 61-80: 22; and 81-100: 7. CCTs in Whites were 576 ± 69 um OD (505-661) and 583 ± 99 um OS (507-705). Among Blacks CCTs were 530 ± 62 um OD (443-554) and 535 ± 66 um OS (444-555). Mean C/D ratios were 0.5 OD and 0.5 OS (Whites) and 0.64 OD & 0.70 OS (Blacks). Mean GDX Numbers were 31 OD and 26 OS for Whites and 41 OD and 42 OS among Blacks. HVF Mean MDs were -5.17 OD and -4.16 OS (Whites) and -9.50 OD and -9.9 OS (Blacks) showing thinner corneas, more advanced CD ratios, worse HVF MD Scores and GDX numbers among Blacks compared to Whites.
Conclusions: Among narrow-angle glaucoma patients, Blacks tend to show thinner corneas, more advanced CD ratios, GDX numbers and HVF MD scores, indicating worse glaucoma among Blacks in this narrow-angle glaucoma population.
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P057 INFLUENCE OF CENTRAL CORNEAL THICKNESS AND ENDOTHELIAL CELL DENSITY IN ASYMMETRICAL PRIMARY OPEN ANGLE GLAUCOMA

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Objective: To determine differences in central corneal thickness (CCT) and endothelial cell density (ECD) between eyes within the same patient with asymmetrical primary open angle glaucoma (POAG). Differences in CCT and ECD among eyes with different levels of glaucomatous damage was also investigated.
Design: Cross-sectional study.
Participants and control: Subjects were POAG patients attending our glaucoma clinic with either one of these differences between both eyes: cup-to-disc ratio (CDR) of 0.2 difference or more, untreated intraocular pressure (IOP) of more than 5 mmHg difference at diagnosis, repeatable asymmetric glaucomatous visual field loss on Humphrey visual perimetry with mean deviation values > 2 SD. Exclusion criteria included history of corneal disease, ocular inflammation, trauma, surgery or laser treatment. Glaucomatous damage was graded according to the level of mean deviation values on Humphrey visual perimeter (HVP): Mild (MD < -6 db), Moderate (MD < -12 db), Severe (MD > -12).
Intervention or method of testing: Specular microscopy was performed and CCT and ECD were calculated.
Main outcome measure: Mean CCT and ECD in the worse and better eye in asymmetrical glaucoma subjects and in controls.
Results: Sixty eight patients with asymmetrical POAG were included. Mean CCT in the worse eye and better eye in glaucoma group was 0.504 ± 0.364 mm and 0.509 ± 0.343 mm respectively. There was no significant difference (p = 0.426) of mean CCT between the worse and better eye. Mean ECD in the worse eye was slightly lower than the better eye; 2767.66 ± 292.51 and 2817.85 ± 248.33 respectively, but this difference was not significant (p = 0.283). There was a pattern of decreasing CCT in eyes with mild, moderate and severe glaucomatous damage (0.516 ± 0.409, 0.514 ± 0.289 and 0.497 ± 0.367 respectively), but this difference was not significant (p = 0.175). There was also no difference in ECD in eyes with mild, moderate and severe glaucomatous damage, 2934.00 ± 268.87, 2797.04 ± 261.88, 2715.53 ± 296.19 respectively, p = 0.078.
Conclusion: There is no influence of the CCT and ECD between eyes within the same patient with asymmetrical POAG. There CCT and ECD is also not influenced by glaucoma severity.
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loss within the same patient. Optom Vis Sci 2006; 83: 516-519.

P058 EVALUATION OF CENTRAL CORNEAL THICKNESS (CCT) IN PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA (POAG) USING VISANTE AS-OCT AND ULTRASOUND PACHYMETRY

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Purpose: To evaluate CCT in patients with POAG using Visante AS-OCT and ultrasound pachymetry (Tomey SP-100).
Material and method: Observational prospective study. CCT in 30 patients with PAOG and in 30 healthy volunteers (control group) was measured with Visante AS-OCT and ultrasound pachymetry. Two measurements were obtained from each participant the same day and the mean values were evaluated.
Results: The mean age of POAG patients was 65 (50-80) and in the control group 58 (30-70). The CCT in the control group was 532 ± 36 measured with Visante and 542 ± 37.5 with ultrasound pachymerty. In the POAG group was 524 ± 38.1 and 533 ± 42 respectively. The mean values of measurements with both machines were compared with paired t-test, $t(25) = -6.87$, $p < 0.001$ in POAG group and $t(25) = -6.84$, $p < 0.001$) in the control group. The independent t-test did not reveal serious differences neither with Visante in both groups, $t(50) = 0.79$, $p = 0.43$, nor with pachymetry, $t(50) = 0.79$, $p = 0.43$. The Bland Altman analysis showed a percentage of disagreement 24.37% between both machines. We also evaluated max and min values in each case.
Conclusions: The CCT in POAG patients was smaller measured with both machines. The values measured with Visante AS-OCT were also smaller compared with those obtained with the ultrasound pachymetry.
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2.2. Anatomical structures in glaucoma: Cornea

see P120, P129, P153, P275, P310, P347

2.3. Anatomical structures in glaucoma: Sclera

P059 IMBALANCE OF SERUM TH1/TH2 CYTOKINES IS ASSOCIATED WITH OPTIC NEUROPATHY IN PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: The aim of this study is to compare serum levels of Th1 and Th2 cytokines between patients with open-angle glaucoma and normal subjects with no glaucomatous eye disease at distinct stages of glaucomatous neuropathy.
Design: Retrospective case-control study.
Participants: Thirty-two patients with primary open-angle glaucoma (POAG) served as the glaucoma group and 26 normal individuals served as the control group.
Methods: Enzyme-linked immunosorbent assay (ELISA) was used to assay for cytokines sIL-2R, IL-2, IL-4, IL-6, IL-12p40, IL-12p70, IL-23, TNF-alpha, and IFN-gamma and mean concentrations of these cytokines were compared between groups.
Main outcome measures: The visual fields of all 32 patients in the glaucoma group were examined and divided into 2 groups according to their mean defect (MD) levels with MD < 12dB or MD ≥ 12dB, with the latter defined as severe glaucomatous optic neuropathy. Statistical study comparing mean cytokine levels for each group was performed.
Results: Patients with POAG exhibited a significant elevation of IL-4 ($p = 0.031$) and a significant reduction of IL-6 ($p = 0.024$) compared to the control group, while no significant differences in IL-4 and IL-6 levels was observed between the MD ≥ 12dB and MD < 12dB groups. The level of IL-12p40 was significantly increased ($p = 0.006$) in patients with POAG compared to controls, while there was no difference of IL-12p70 between the two groups. The average levels of IL-23 were significantly reduced in the POAG patients ($P = 0.024$) in both MD ≥ 12dB and MD < 12dB groups compared with controls. A significant decrease in TNF-alpha levels was found in the POAG group compared with the control group ($p = 0.024$), while IFN-gamma levels were consistent between the two populations. The levels of both IFN-gamma ($p = 0.017$) and TNF-alpha ($p < 0.001$) are significantly reduced in the MD < 12dB POAG group compared with MD≥ 12dB in the POAG group.
Conclusions: Elevation of Th2 predominant cytokines and reduction of Th1 cytokines is associated with mild glaucomatous neuropathy, suggesting the possibility that abnormal immune environments contribute to the glaucomatous neuropathy of POAG.
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P060 CORNEAL HYSTERESIS AND BIOCHEMICAL PARAMETERS OF SCLERAL TISSUE AT DIFFERENT STAGES OF PRIMARY OPEN ANGLE GLAUCOMA (POAG)

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Purpose: To study corneal hysteresis, cross-linking level and amino acid composition of the sclera of patients with various stages of POAG.
Methods: Corneal hysteresis (CH) was measured in 238 patients (311 eyes) aged 40-84 (median age 67.4 yrs) at various stages of compensated primary open-angle glaucoma (POAG) using Reichert Ocular Response Analyzer (ORA). Besides, scleral samples obtained during sinus trabeculectomy combined with sclera trephination in the inferio-exterior quadrant of 28 patients (28 eyes) with various stages of POAG were studied using differential scanning calorimetry (Mettler TA 4000 with DSC20 cell) and amino acid analyzer (Hitachi-835, Japan).
Results: CH (mmHg) gradually decreased from 10.1 in the initial glaucoma stage (I) to 9.1 in the developed (II) and 8.6 in the advanced (III) glaucoma stage. The decrease of this clinical parameter is caused by structural and biochemical damage of the corneoscleral coat. In stage I, endothermic scleral collagen transition occurred at the median thermal peak Tm = 60.3°C, while in stages II and III the median peaks of scleral collagen melting emerge at higher temperatures: Tm = 62.0°C and Tm = 64.5°C, respectively ($p < 0,05$). This testifies to a significant increase of scleral cross-linking during glaucoma development, which means that biomechanical properties of the sclera shift towards the decrease of elasticity and increase of stiffness. In stage I, the level of scleral collagen was 45.9% of dry tissue weight, whereas in stage II it was 50.8% and in III, 53.7%. These levels are significantly higher than the norm, which was determined at 39% by F. Keeley et al. In all scleral samples the GLY/ALA ratio was 2.74, while HYP/HYL ratio in stage I was lower than in stage III (16,5 *vs* 20.7) due to low hydroxylysine content. This implies that glaucomatous sclera contains collagen type I and has practically no collagen types II and III (the same as in healthy eyes).
Conclusions: Structural and biochemical disorders of glaucomatous sclera (increased collagen content and cross-linking) may cause clinical changes of biomechanical parameters of corneoscleral shell of eyes with POAG. This may be an important link of POAG pathogenesis requiring special therapy.
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2.4. Anatomical structures in glaucoma: Anterior chamber angle

see also P077, P232 and P277

P061 CHANGES OF THE ANTERIOR CHAMBER ANGLE AFTER LASER PERIPHERAL IRIDOTOMY ASSESSED BY ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY

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Purpose: To evaluate change of the anterior chamber angle (ACA) after laser peripheral iridotomy (LPI) using anterior segment optical coherence tomography (AS-OCT).
Design: Cross-sectional study.
Participants: Forty-six eyes with primary angle closure (PAC) without peripheral anterior synechiae or primary angle closure suspect (PACS) diagnosed by gonioscopy.
Methods: Participants underwent LPI. AS-OCT imaging was performed before and after LPI under standardized lighting condition.
Main outcome measure: The presence of angle closure defined as the contact between peripheral iris and angle wall anterior to scleral spur was confirmed by AS-OCT imaging before and after LPI. The increment of ACA parameters (AOD500, ARA500, TISA500) defined as exceeding the measurement variability was also reported before and after LPI. Angles in nasal and temporal quadrants were incorporated for analysis.
Results: Overall, all three parameters, AOD500, ARA500, TISA500 in nasal quadrant significantly changed before (0.169 ± 0.104 mm, 0.092 ± 0.051 mm^2, 0.068 ± 0.037 mm^2) and after LPI (0.296 ± 0.138 mm, 0.148 ± 0.075 mm^2, 0.119 ± 0.062 mm^2, all $p < 0.001$). All three parameters also revealed significant increment in temporal angle (all $p < 0.001$). However, in 22 eyes (47.8%), ACA of nasal quadrant remained closed, while 16 eyes (34.8%) remained closed in temporal quadrant after LPI. AOD500, ARA500 and TISA500 did not significantly change in 11 (24%), 12 (26%) and 9 eyes (20%) of nasal angles, 7 (15%), 13 (28%) and 4 eyes (8.7%) of temporal angles.
Conclusions: Overall, ACA parameters changed significantly after LPI determined by AS-OCT. However, ACA remained closed in some PAC or PACS eyes despite LPI and this result was also confirmed by quantitative analysis of ACA parameters. Our findings suggest multiple causes other than pupillay block may contribute to angle closure in PAC and PACS eyes.
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P062 LENS EXTRACTION AS A SECOND-LINE TREATMENT FOR PRIMARY ANGLE CLOSURE; A PILOT STUDY

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Purpose: The aim of this study is to determine the effectiveness of lens extraction in the management of primary angle closure (PAC) as a second line treatment following laser peripheral iridotomy (LPI).
Methods: In this retrospective study, we examined case notes of 8 patients who underwent lens extraction to control intraocular pressure (IOP) (or alleviate symptoms due to residual appositional angle closure) following a patent LPI. Demographic data, visual acuity (VA), IOP at presentation and at final visit, treatment, biometric measurements, and complications are reported.
Results: Ten eyes of 8 patients had lens extraction following PAC. There were 4 (50%) men, 4 (50%) women, mean age was 66.6 years range (57-78). Presenting VA was ≥ 6/9 in 8 (80%) eyes, and ≥ 6/12 in 2 (20%). Surgery was performed for 1 (10%) who had visual symptoms, 9 (90%) had uncontrolled IOP with residual PAC. Biometric measurements showed mean axial length of 20.90 mm, mean lens thickness 5.13 mm, and mean anterior chamber depth 2.08. Preoperatively mean IOP was 19.8 mmHg range (10-53), with mean number of medications of 2.8 ± SD 1.5. 2 (20%) eyes had IOP > 21 mmHg pre operatively on treatment. Postoperatively mean IOP was 15.5 mmHg range (10-17), 10 (100%) eyes had < 21mmHg with or without treatment. There was a significant reduction of mean number of medications to 0.9 ± SD 0.8 ($P < 0.005$). Four (40%) eyes did not need any medications postoperatively. Final VA at 12 months follow-up was = 6/9 in 10 (100%) eyes. There was no significant complication reported in this study.
Conclusion: Lens extraction is a safe modality of treatment for patients with PAC, when IOP is not well controlled post LPI. In our pilot study all patients with relatively shorter axial lengths maintained excellent central vision, and had no complications.
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P063 UNILATERAL ANGLE-CLOSURE GLAUCOMA INDUCED BY PLATEAU IRIS AND ADIE'S TONIC PUPIL – AN ANTERIOR SEGMENT (AS-OCT) ANALYSIS

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Purpose: Adie's pupil is characterized by a dilated pupil from post-ganglionic fiber sphincter damage. With plateau iris, a tonic pupil can induce angle closure with intraocular pressure (IOP) elevation by potentially blocking the trabecular meshwork. Utilizing the AS-OCT, we describe a rare unilateral presentation of blurred vision, dilated pupil, IOP 37 and total cup in an eye with Adie's tonic pupil. We propose a mechanism for the unilateral angle closure.
Design: Pharmacologic constriction with 0.125% pilocarpine OU to assess pupil and angle changes OU. Control: Contralateral eye with normal pupil.
Methods: AS-OCT angle was assessed pre- and 30 minutes post administration of topical 0.125% pilocarpine OU as follows: 1) Four single plane images displaying angle structures 180 degrees apart (0/180, 45/225, 90/270, 135/315) measuring central anterior chamber depth, pupil size, and lens vaulting; 2) Eight high resolution images for each angle noted, including angle opening distance (AOD) at 500 and 750 microns from scleral spur (SS) and SS angle.
Main outcome measure: AS-OCT demonstration of angle opening in Adie's pupil with constriction.
Results: Pre-drop AS-OCT imaging in Adie's pupil eye: flat iris plane, peripheral iris roll, anteriorly positioned ciliary processes. Peripheral iris was apposed at level of Schwalbe's line (SL). Most noticeable changes occurred in pupil size (pre-drop range: 4.29-5.08 mm vs post-drop range: 3.40-3.93 mm) with 18.1%, 17.6%, 25.4% and 25.4% constriction for each of four single planes noted above respectively. Minimal slit like SS angle opening accompanied pupil constriction. In control eye, uninvolved pupil did not respond to dilute pilocarpine.
Conclusion: With plateau iris, the extent of anterior iris displacement into the anterior chamber determines the level at which angle structures become occluded with pupillary dilation and IOP rise. Complete occlusion at SL accounts for IOP elevation. Non-uniform pupil constriction after pilocarpine reflects asymmetric sphincter denervation in Adie's tonic

pupil. SS Angle opening with pupil constriction < 4 mm suggests that the large tonic pupil primarily precipitated angle closure in an otherwise narrow but open angle. With unilateral mydriasis, AS-OCT imaging allows quantification of Adie's tonic pupil pre and post-pilocarpine administration demonstrating extent of angle closure and defining a mechanism of IOP elevation in vivo, appositional closure. Anatomic assessment using a non-invasive technique such as the AS-OCT can help clinicians identify patients at high risk' for IOP elevation with tonic dilated pupils and anatomically narrow angles, enabling prompt intervention to prevent onset and/or progression of glaucoma.

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P064 USE OF RETCAM GONIOGRAPHY IN DETECTION OF OCCLUDABLE IRIDOCORNEAL ANGLES

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Purpose: This study compares the RetCam Shuttle with the current gold standard of clinical gonioscopy for the detection of occludable iridocorneal angles. The objective of this study is to determine the sensitivity and specificity of RetCam goniography in detecting occludable angles.

Design: Institutional Review Board approval was obtained for this study. Subjects accepting to participate underwent clinical gonioscopic evaluation using the Shaffer grading system. Occludable angles were taken as any angle graded from 0-2. All clinical gonioscopic examinations were performed by the principal investigator. RetCam angle goniography was performed subsequently. All measurements were performed independently in a masked fashion. RetCam images were taken in a dimly lit room with the patient in a semi-recumbent position. Nasal and temporal quadrants of each participating eye were included in the study. RetCam goniography images were graded in a masked fashion by the principal investigator using the same parameters used for clinical gonioscopy.

Participants: All participants were recruited from the private practice of the principal investigator, Participants were invited to the study at the time of their visit with principal investigator.

Results: One hundred nineteen eyes of 59 patients were enrolled in this study. Mean age of the participants was 62.0 years. RetCam goniography was found to have a sensitivity of 93.9% and a specificity of 92.5% for detecting narrow angles at risk of occlusion. The area under receiver operating characteristics for detection was 0.928.

Conclusion: The RetCam is able to provide color photo documentation of the angle, which, when compared to the gold standard of clinical gonioscopy, appears to have very good sensitivity and specificity with respect to identifying angles at risk for occlusion. We report the use of RetCam photogoniography as a potentially useful tool in detecting occludable angles.

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P065 INFLUENCE OF OCULAR BIOMETRIC PARAMETERS ON MEAN ANGLE WIDTH IN A POPULATION-BASED STUDY

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Purpose: To study the influence of axial length, anterior chamber depth and lens thickness on gonioscopically determined mean angle width in a population based study.

Design: Population-based cross-sectional study.

Participants: One thousand eight hundred and forty four of 7774 subjects from the Chennai Glaucoma Study were included

Methods: All subjects had undergone a comprehensive eye examination that included grading of angle width using the modified Shaffer grading system. They also went ultrasound A Scan measurements of axial length, anterior chamber depth and lens thickness. Mean angle width for each eye was derived from gonioscopic grades recorded . Only the right eye was used for analysis.

Main outcome measure: Co-efficient of determination for tested variables.

Results: Axial length ($r = 0359$, $p < 0.0001$),anterior chamber depth ($r = 0.612$, $p < 0.0001$), lens position ($r= 0.526$, $p < 0.0001$) and relative lens position ($r = 0.397$, $p < 0.0001$) were significantly correlated with mean angle grade. On linear regression the best model consisted of axial length and anterior chamber depth provided ($r^2 = 0.385$, $p < 0.0001$). Addition of lens thickness, lens position or relative lens position only marginally improved predictive ability ($r^2 = 0.386$).

Conclusion: Central anterior chamber depth was the strongest predictor of mean gonioscopic angle width.

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P066 A LONGITUDINAL STUDY OF ANTERIOR CHAMBER DEPTH AND ANGLE OPENING IN GLAUCOMA PATIENTS USING SCANNING PERIPHERAL ANTERIOR CHAMBER DEPTH ANALYZER

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Purpose: The aims of this study are to investigate the longitudinal change of the anterior chamber configuration and the associated factors of patient with primary open angle glaucoma (POAG) and normal tension glaucoma (NTG) using scanning peripheral anterior chamber depth analyzer (SPAC).
Design: Observational cohort study.
Participants: Participants of this study were patients with POAG or NTG who periodically examined their anterior chamber configuration using SPAC from March 2003 until June 2008 at University of Yamanashi Hospital. Patients were excluded from this study in the following cases: history of laser or incisional surgery, difficulty to evaluate their anterior chamber configuration, other ocular diseases that may affect visual field or visual acuity, receiving pilocarpine eyedrops. One hundred and fifty-seven eyes of 157 patients (66 males and 91 females) were included in this study.
Methods: Ophthalmologic examinations were periodically performed, including intraocular pressure (IOP) measurement, gonioscopy, automated static perimetry, refractive error test, and visual acuity measurement in addition to SPAC measurement. SPAC evaluated anterior chamber depth (ACD) by numeric grades from grade1 to grade 12, and anterior chamber angle (ACA) using most peripheral three or four ACD values (ACAα3 and ACAα4). Change in ACD and ACA, and their associated factors were investigated. The relation between anterior chamber configuration and treatment condition of glaucoma were also analyzed.
Main outcome measures: The ACD grade was significantly decreased from 7.2 ± 2.3 to 6.5 ± 2.1 ($p < 0.001$). The ACAα3 and ACAα4 were also significantly decreased from 34.2 ± 12.6 degree to 28.1 ± 10.3 degree ($p < 0.0001$) and 29.3 ± 10.5 degree to 27.6 ± 8.8 degree ($p < 0.05$), respectively. The change in the anterior chamber configuration was more emphasized at the peripheral region than the central region. Shallowness of ACD was significantly correlated positively to the female sex, greater ACD at the baseline, and tended to associate with age. Narrowness of ACA was significantly correlated to refractive error, greater ACA at the baseline, decrease in corrected visual acuity. Patient having shallower ACD showed much more rapid deterioration of their visual fields defect and greater increase in number of anti-glaucoma eyedrops compared with those with deeper ACD. There were no significant differences between POAG and NTG.
Conclusions: This study clarified time-dependent change in the anterior chamber configuration and some associated factors in patients with POAG and NTG. The anterior chamber configuration may influent glaucoma progression even in eyes with open angle.
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2.5.1. Anatomical structures in glaucoma: Meshwork: Trabecular meshwork

P067 TRABECULAR PART OF UVEOSCLERAL OUTFLOW

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Purpose: To specify the anterior chamber source of uveoscleral outflow pathway.
Methods: We performed perfusion of human cadaver eyes with India ink suspension through clear corneal tunnel. Lamellar scleral dissection revealed the ciliary muscle surface. We observed the character and volume of suprachoroidal fluid in different pressure conditions. After formaldehyde fixation we performed further dissection of trabecular meshwork and ciliary muscle with subsequent preparation of flat specimens of different layers of trabecular meshwork. Histological sections were prepared for light microscopy.
Results: Unexpectedly voluminous flow of India inc-stained fluid was observed after the ciliary muscle exposure. No unintended damage of the anterior chamber structures or choroid (the possible cause of the outflow observed) was found. Histological research revealed numerous ink particles in the trabecular meshwork and between the ciliary muscle bundles. The ink particles go from the anterior chamber to the Schlemm's canal and particularly retain at the scleral spur. The main stream goes along the trabecular beams, bypass the scleral spur and flows into the ciliary muscle. Most of the trabecular shapes appears to continue directly into the ciliary muscle bundles. No inc particles were found in other structures of anterior chamber.
Conclusion: Aqueous drainage from the anterior chamber appears to be entirely trabecular with two components: transtrabecular (usually considered as the conventional or trabecular outflow) and para-trabecular ('uveoscleral' outflow). Sufficient pathway for uveoscleral outflow may be represented by inter-trabecular slits continued directly into the spaces between the ciliary muscle bundles. The other structures of the anterior segment of the eye appear to play no substantial role in the aqueous outflow.

P068 THE MORPHOLOGY AND TOPOGRAPHY OF TRABECULAR MESHWORK LAYERS

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Purpose: To specify the multilayer structure of trabecular meshwork and to reveal topographical relationship of different trabecular layers with surrounding structures.
Methods: We performed dissection of trabecular meshwork and ciliary muscle with subsequent preparation of flat specimens of different layers of trabecular meshwork as well as histological sections for light microscopy.
Results: Human trabecular meshwork was found consisting of 4 definite layers. These layers differ from each other both in structure and connections. Only the 1st (external) layer can be considered as corneoscleral. The 2nd layer contains the scleral spur and merges with the meridional part of ciliary muscle. The 3rd layer extends into the radial portion of the ciliary muscle. The 4th layer extends from Schwalbe`s ring to iris root. The slits between trabecular shits within the 3rd layer continue into the spaces between the ciliary muscle bundles of radial portion.
Conclusion: Most of the trabeculae appears to continue directly into the ciliary muscle bundles, and therefore, should be considered as the uveal ones. As the uveal trabeculae continue directly into the clilary muscle bundles, the intertrabecular slits naturally continue directly into the spaces between the bundles of ciliary muscle. These slits may represent sufficient pathway for uveoscleral outflow.

2.6. Anatomical structures in glaucoma: Aqueous humor dynamics, production, composition.

see P370

2.6.2.2. Anatomical structures in glaucoma: Aqueous humor dynamics, production, composition: Outflow: Uveoscleral

P069 AQUEOUS HUMOR DYNAMICS AT ONE VERSUS SIX WEEKS OF TREATMENT WITH TIMOLOL OR LATANOPROST IN PATIENTS WITH OCULAR HYPERTENSION

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Objectives: This study examines differences in aqueous humor dynamics between one week and six weeks of treatment with latanoprost and timolol.
Design: Prospective, double-masked, crossover, interventional, six-visit study.
Participants: Thirty participants with a diagnosis of bilateral ocular hypertension. Intervention or methods or testing: Measurements were made of IOP by pneumatonometry, aqueous flow and outflow facility by fluorophotometry, episcleral venous pressure by venomanometry and uveoscleral outflow by mathematical calculation. Measurements were collected at baseline and at 1 and 6 weeks of treatment with timolol 0.5% twice daily or latanoprost 0.005% once daily in the evening.
Main outcome measure: One and 6 weeks of treatment were compared with the appropriate baseline and the two drugs were compared at each respective visit
Results: Both drugs significantly ($p < 0.001$) reduced IOP at 1 and 6 weeks of treatment. Timolol reduced aqueous flow by 27% at week 1 ($p < 0.001$) and 16% at week 6 ($p < 0.007$). Latanoprost increased uveoscleral outflow at each visit ($p < 0.05$). Neither drug had consistent effects on outflow facility compared to baseline, nor showed a change in aqueous humor dynamics at week 6 compared to week 1. Timolol showed no change in IOP efficacy over time but latanoprost showed a 1 mmHg increase in IOP ($p = 0.04$) at week 6 compared to week 1.
Conclusions: Timolol and latanoprost reduce IOP by different mechanisms. Timolol reduces aqueous flow whereas latanoprost increases uveoscleral outflow. Significant differences in mechanisms at 1 versus 6 weeks of treatment were not demonstrated. Consistent outflow facility effects were not detected.
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2.7. Anatomical structures in glaucoma: Episcleral veins and venous pressure

P070 RETINAL GANGLION CELL APOPTOSIS INDUCED BY ENDOPLASMIC RETICULUM STRESS IN CHRONIC GLAUCOMA MODEL

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Purpose: To investigate the correlation and associated pathways of apoptosis by ER stress in chronic ocular hyperten-

sive state, one of retinal ganglion cell death mechanisms using experimental glaucoma rat model.
Methods: Glaucoma was induced in adult male Sprague-Dawley rats by cauterizing three episcleral veins. Quantification of retinal ganglion cells and TUNEL-stained cells were observed microscopically. IOP and protein expression of Bip, phosphorylated form of PKR (p-PERK), eukaryotic initiation factor 2 (eIFα2), phosphorylated eukaryotic initiation factor 2 (P-eIFα2), C/EBP-homologous protein (CHOP) were evaluated at 1, 2, 4, and 8 weeks after injury. Retinal expression of p-PERK and CHOP were assessed using immunohistochemistry.
Results: IOP was chronically elevated in cauterized eyes for the 8 week experimental period, however, it was not elevated in contralateral control eyes. Average number of RGCs was significantly decreased and TUNEL positive cells were detected at the ganglion cell layer. In western blotting, Bip, p-PERK, and CHOP were significantly expressed at 1 week or 2 weeks and persisted throughout the 8 weeks observation period. p-eIF2α began to increased at 1 week, sustained throughout the 4 weeks, and mildly decreased at 8 weeks. In cauterized eyes, p-PERK and CHOP immunoreactivity were strongly observed in ganglion cells in immunohistochemistry at 8 weeks after IOP elevation.
Conclusions: In experimental chronic glaucoma model, ER stress is involved in retinal ganglion cell death and PERK-p-eIF2α-CHOP pathway play a role in RGC apoptosis associated with ER stress. These might be a good therapeutic target to protect the RGC from ER stress injury in glaucoma.
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2.8. Anatomical structures in glaucoma: Iris

P071 IRIS COLOR AND CENTRAL CORNEAL THICKNESS ASSOCIATION IN GLAUCOMA. DOES BLUE IRIS PORTEND THICK CORNEA ?

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Purpose: To evaluate the association of iris color to the central corneal thickness (CCT) and compare patients' blue and brown irides to corneal thicknesses among green, hazel, light & medium brown iris patients.
Design: CCTs by ultrasound pachymetry among 239 glaucoma patients and analyzed by iris color and compared participants: 239 glaucoma patients.
Methods: CCTs were measured by ultrasound pachymetyry among 239 glaucoma patients. The patients were classified by the color of the iris: blue (B), green (G), hazel (H), light (L), medium (M) and dark brown (D) categories. The comparisons of CCTs were made between blue & dark brown, light brown and hazel, BGH and LMD iris patients. CCTS > 600 um were identified among all groups (BGD LMD) Comparisons were made between blue and dark brown, BGH vs LMD irides, H vs L irides and > 600 um frequency compared among blue vs dark brown and BGH vs LMD groups.
Main outcome measure: CCT vs iris color.
Results: The blue, greenand hazel irides patients as a group CCTs were 570 ± 41um OD & 572 ± 41 um OS & LMD brown irides 545 ± 38 um OD and 547 ± 39 um OS ($P < 0.01$). Blue irides 582 ± 42 um OD & 589 ± 43 um OS dark brown irides group 532 ± 32 um OD & 539 ± 33 um OS ($P < 0.01$) hazel irides 570 ± 38 um OD & 565 ± 37 um OS vs light brown 558 ± 37 um OD & 560 ± 41 um OS ($P > 0.5$) . CCTs > 600 um were blue 39% vs dark brown 2.9%
($P < 0.01$) showing extreme high frequency among blue irides patients. Between BGH vs LMD irides CCTs > 600 um were 23% OD & 19% OS vs 0.7% OD & 0.8% OS showing higher frequency among BGH group ($P < 0.01$) Among the BGH groups blue vs green/hazel irides 582 ± 42 OD & 589 ± 43 um OS vs 559 ± 36 um OD & 557 ± 33 um OS ($P = 0.05$ OD & $P < 0.01$ OS) light brown vs medium & dark brown irides Pts 558 ± 37 um OD & 560 ± 41 um OS vs 540 ± 38 um OD and 542 ± 38 um OS ($P < 0.01$ OD & $P < 0.05$ OS) thinner corneas in dark brown patients.
Conclusions: Blue irides patients show thick corneas more frequently and significantly thicker than brown irides patients, while hazel & light brown irides patients were close to very similar CCTs. Among all colors blue, hazel, green, light, medium and dark brown patients thickest average CCTs in blue irides and thinnest among dark brown irides.
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2.9. Anatomical structures in glaucoma: Ciliary body

P072 THE ROLES OF PAROXETINE AND CORTICOSTERONE ON ADULT MAMMALIAN RETINAL CILIARY BODY CELL PROLIFERATION

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Objective: The neurogenesis in retina of adult mammals is generally abolished, and this renders the retina lack of regenerative capacity. Despite this, there is a small population of nestin-positive cells in the ciliary epithelium which retains neurogenic potential. The present study aims at investigating the effect of two drugs, corticosterone and paroxetine (a selective serotonin reuptake inhibitor used as antidepressant) on the cell proliferation of the ciliary body.
Methods: Adult Sprague-Dawley rats were given vehicle,

corticosterone, paroxetine, or both corticosterone and paroxetine treatment for 14 days. Cell proliferation in the ciliary body was quantified using BrdU immunohistochemistry. Colabelling of BrdU and stem cell marker was used to phenotype the BrdU immunoreactive cells.
Results: Corticosterone treatment suppressed while paroxetine treatment increased the cell proliferation of the ciliary body. Co-labelling with cell markers revealed that the BrdU positive cells also showed nestin expression but not GFAP.
Conclusion: The results illustrates that proliferation of retinal progenitor cells situated in ciliary body are subjected to regulation by SSRI and corticosteroid, which is similar to our previous findings in neurogenic regions in CNS. Paroxetine treatment could reverse the suppressive effect of corticosterone on ciliary body cell proliferation. This provides information for future investigation of retinal stem cell biology and potential treatment of glaucoma and other retinal degenerative diseases.
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P073 THE TREATMENT OF SECONDARY GLAUCOMA WITH THE USE OF LEKSELL GAMMA KNIFE AND A COMPARISON OF SHORT-TERM AND MID-TERM RESULTS

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Objective: The target of this study was to compare the 2-year results with the 5-year results of patients treated for secondary glaucoma by use of Leksell gamma knife (LGK), using the same parameters. In short-term results a reduction of subjective difficulties of patients suffering this painful and treatment-resistant condition by using mini-invasive stereotactic neurosurgical procedure has been already proved.
Design: We compared a first group of 94 patients (short term observation) with a second group of 58 patients (middle-term observation).
Participants and controls: Patients suffered from a painful advanced stage of secondary glaucoma.
Methods: We used 4 isocenters (8-mm collimators) overlapping the ciliarly body with plugs sparing the lens and cornea. D max 40 Gy, D margin 20 Gy for blind eyes and D max 30Gy and D margin 15Gy on 50% therapeutic isodose for partially preserved vision was applied.
Results: All of the studied parameters showed significant improvement in both groups during the observation period: intraocular pressure (IOP), the level of antiglaucoma therapy, pain perception and preservation of visual acuity. With 5 patients an enucleation was performed because of the intolerable conditions of the eye (pain, malformations, atrophy and cosmetic reasons).
Main outcome: We proved in both groups steady decrease of IOP, improvement in pain perception and reduction of extensive farmacotherapy.
Conclusions: By using stereotactic radiosurgical cyclodestruction with the Leksell gamma knife one can achieve reduction of pain, IOP and excessive pharmacotherapy in secondary painful glaucoma and we proved these results in the mid-term period.
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2.10. Anatomical structures in glaucoma: Lens

P074 RELATIVE POSITION OF ANTERIOR LENS SURFACE AND ITS CONTRIBUTION ON NARROW ANGLE IN ADULT CHINESE EYES

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Purpose: To investigate the relative position of the anterior lens surface (RPALS) with the angle opening distance (AOD) and iris curvature (IC) in adult Chinese.
Design: Population-based study.
Participants: Eight hundred forty adults aged 35 years and over were recruited from a population-based study conducted in urban Chinese.
Methods: ASOCT and custom software was used to quantify the anterior chamber parameters.
Main outcome measures: AOD was measured at the location 500 um anterior to scleral spur; IC was determined by firstly creating a line from the most peripheral to the most central point of the iris and then measured as the maximal distance to the posterior border of the iris on the direction that perpendicular to the line that was drawn initially. The RPALS was estimated as the maximal distance of the anterior lens surface to the line connecting the scleral spurs at both sides on the optic axis, RPALS < 0 suggested that the

lens surface was posterior to scleral spur plane whereas RPALS > 0 suggested anterior to scleral spur plane.
Results: In multiple linear regression model, the lens surface was 11 um more anterior and iris curvature increased 5 um per year of age, both these two measurements were greater (68 um more anterior for lens surface and 20 um increase for IC) in females. AOD decreased with age (6 um/age) and narrower (27 um) in females. Lowess curve suggested that the association of AOD and RPALS was not linear – with a break-point when the lens surface was 500 um anterior to scleral spur plane: AOD decreased 7 um for every 10 um anterior movement of lens surface and 57% of the AOD variance was explained by RPALS changes when RPALS < +500 um, while this association was 1 um for every 10 um and only 5% of the AOD variance was explained by RPALS if RPALS ≧ +500 um. Similarly, the iris curvature increased 4 um for each 10 um anterior movement of the lens and 44% of the iris curvature variance was explained by lens surface when RPALS < +500 um, whereas, there was no association of the iris curvature and lens surface location when RPALS ≧ +500 um.
Conclusions: Pupil block force linearly increases with the anterior movement of the lens but won't further increase when the anterior lens surface is 500 um or more anterior to the scleral spur plane.
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2.12. Anatomical structures in glaucoma: Choroid, peripapillary choroids, peripapillary atrophy

see P199

2.13. Anatomical structures in glaucoma: Retina and retinal nerve fibre layer

see also P191, P210, P11, P252, P253, P256, P314, P324

P075 EXPRESSION OF HEPATOCYTE GROWTH FACTOR AND C-MET IN EXPERIMENTAL GLAUCOMA RAT MODEL

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Objective: Recently, hepatocyte growth factor (HGF) and the receptor c-Met are anticipated to play an important role in normal nervous system development and have a neuroprotective effect in certain pathologic conditions. We are to investigate the expression of HGF and c-Met in rat retina in chronic optic nerve compression models.
Design: We designed two groups by artificial procedure (A group of chronic IOP elevation versus normal eye) and evaluated their data.
Participants and controls: Adult male Sprague-Dawley rat with episcleral vein cauterization procedure (control is each of the other eye).
Methods: After inducing chronic intraocular pressure elevation by electrocauterization of rat episcleral veins, serial quanltification and spatial correlation were performed by means of Western blot and immunohistochemical staining.
Main outcome measure: Immunohistochemical (IHC) staining, Western blot & quantification, retinal tissue ganglion cell densitometry.
Results: After elevating intraocular pressure, HGF and c-Met positive cells were mainly observed in the ganglion cell layer (GCL) and inner nuclear layer (INL) in immunohistochmeical study. Grossly, gradual increase of HGF and c-Met were observed until 2-4 weeks after IOP elevation, and these were decreased 4-6 weeks after ischemic insult.
Conclusions: We supposed that upregulation of HGF and c-Met in rat retina may play a neuroprotective role against chronic optic nerve ischemia.
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P076 ENDOPLASMIC RETICULUM STRESS RESPONSE IN AXOTOMY-INDUCED RETINAL GANGLION CELL DEATH

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Purpose: Endoplasmic reticulum stress relates to various neurodegenerative disorder. This study investigated the involvement of ER stress response in retinal ganglion cell death by using axotomized rat model.
Methods: We made an axotomy rat model by transecting optic nerve from 2 mm posterior to globe of Sprague-Dawley and took the retinal tissue at 1, 3, 5, 7 and 14 days. With western blot and immunohistochemistry, we observed the expression level and the location of phospho-PERK, phospho-eIF2α and CHOP.
Results: Protein level of phospho-PERK and CHOP increased throughout the observation period. Phospho-eIF2α showed decrease at day 1 but increased and reached a peak value at 7th day and then decreased thereafter. In the immunohistochemistry, phospho-PERK was expressed at ganglion cell layer, inner plexiform layer and inner nuclear layer. And

CHOP was expressed mainly at ganglion cell layer. With whole mount rat retina, phospho-PERK and CHOP colocalized with osteopontin labeled ganglion cells.
Conclusions: Increased level of phospho-PERK and CHOP following axotomy suggests that ER stress may play an important role in retinal ganglion cell death in acute injury of optic nerve. Therefore ER stress modulators can be a strong candidate for therapeutic targets in retinal ganglion cell death including glaucoma.
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2.14. Anatomical structures in glaucoma: Optic disc

see also P165, P199, P254

P077 NEW ALGORITHM FOR SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY IMAGING OF OPTIC NERVE HEAD DRUSEN

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Purpose: To demonstrate a new algorithm that can determine the shape, location, and volume of optic nerve head drusen (ONHD) from spectral domain optical coherence tomography (SDOCT) data, which can be displayed in 3-dimensional videos.
Design: Prospective case series.
Participants: One orbital melanoma patient (1 eye) and 4 glaucoma patients (8 eyes) with bilateral ONHD were imaged.
Methods: Patients were recruited from the Massachusetts Eye and Ear Infirmary and from a private practice office. Images were obtained using a prototype SDOCT system developed at the Wellman Center for Photomedicine, Massachusetts General Hospital. Utilizing a commercially available superluminescent diode (SLD) (Superlum, Russia) with a spectral width of 50 nm centered at 840 nm, this SDOCT system can obtain 2-dimensional images with axial resolutions of about 6 microns in 1/29 of a second, compared to commercially available time domain OCT instruments with 10 micron resolution images in 1.28 seconds. After obtaining SDOCT images, a new algorithm allowed for three-dimensional reconstruction of the borders of the optic nerve head drusen (ONHD) using a gradient anisotropic diffusion filter.
Main outcome measures: The shape, location, and volume of the ONHD were determined using this new algorithm, and ONHD volumes were then correlated with visual field mean deviation.
Results: Since one patient required exenteration surgery for orbital malignant melanoma, this patient afforded the opportunity to demonstrate excellent correlation of histology with SDOCT ONHD images obtained with our new algorithm. SDOCT can display two-dimensional images comparable to histology as well as 3-dimensional videos of ONHD. ONHD are signal-poor regions with high-signaled borders. Larger ONHD volumes are directly correlated with larger mean deviation absolute values on Humphrey visual field testing.
Conclusions: This presentation shows the feasibility of a new algorithm that can be used to delineate ONHD in SDOCT images. SDOCT is a potentially useful technique for ONHD imaging and may better evaluate the cause of progressive visual field loss in eyes with both ONHD and glaucoma.
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P078 - withdrawn

P079 DIAGNOSTIC CAPABILITY OF FOURIER-DOMAIN OPTICAL COHERENCE TOMOGRAPHY IN EARLY PRIMARY OPEN-ANGLE GLAUCOMA

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Objective: To evaluate the diagnostic capability of Fourier-Domain optical coherence tomography (FD-OCT) for early primary open-angle glaucoma (POAG) in Chinese patients.
Design: Observational cross-sectional study.
Participants and controls: Two groups of patients, those with and without glaucoma, were included in the study.
Methods: All patients underwent FD-OCT and visual field examination.
Main outcome measure: Sensitivity, specificity, and positive (LR+) and negative (LR-) likelihood ratios were calculated using conventional 2 by 2 tables. The area under the receiver operating characteristic curves (AROC) was calculated to distinguish between normal and early glaucomatous eyes.
Results: Thirty-four eyes (34 patients) with early glaucoma and 42 disease-free eyes (42 normal subjects) were analyzed. Cup/Disc (C/D) vertical ratio had the best sensitivity and positive likelihood ratio for particular specificities (95% and 85%), 79.4% and 88.2%, 33.4 and 7.4, respectively. Among all single parameters, the C/D vertical ratio had the highest AROC, which was 0.930 [95% confidence interval (95%CI), 0.863-0.996; $P < 0.001$]. The AROC of the thickness of superior and inferior GCC were 0.847 and 0.893. The

AROC for combined parameter GCC-total (GCC-Inferior and GCC-Superior) was 0.907. The C/D vertical ratio, RNFL AT on 3.45 mm, and rim area were combined using a logistical diagnostic model, and obtained the largest AROC which was 0.949.

Conclusions: FD-OCT is able to distinguish the differences of optic disc, thickness of RNFL, and thickness of GCC between POAG patients and normal patients. A better diagnostic strategy for FD-OCT might be to combine the parameters of C/D vertical ratio, RNFL AT on 3.45 mm, and rim area.

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P080 - withdrawn

P081 RETINAL NERVE FIBER LAYER (RNFL) ANALYSIS USING GDXVCC AND CIRRUS HD-OCT AND PATIENT PROFILE IN CASES WITH BARING OF CIRCUM-LINEAR VESSELS (CLV) OF OPTIC DISC

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Objective: To study the profile and RNFL thickness in cases with baring of CLV using GDx VCC and Cirrus HD-OCT.
Design: Observational case series.
Participants: Forty (22 OD and 18 OS) eyes, of 31 (26 males and 5 females) consecutive patients.
Materials and methods: All patients with baring of CLV with age =18 years, with best corrected visual acuity of 20/20 underwent detailed ophthalmological evaluation including RNFL analysis on GDxVCC and Cirrus HD-OCT.
Main outcome measures: RNFL abnormality detected by GDx VCC and/or CirrusTM HD-OCT and increased risk factors for development of glaucoma in cases with baring of CLV.
Results: The mean age was 38.3 ± 15.9 years (range 18 to 73). Of 40 eyes, baring was superior in 33 eyes, inferior in 10 eyes and both superior and inferior in 3 eyes. Of 31 cases, 4 had open-angle glaucoma (6 eyes), one had pseudophakic glaucoma (1 eye), one was ocular hypertensive (2 eyes) and of 25 normal patients 4 had a history of glaucoma in either parent (4 eyes). On GDx VCC, TSINT RNFL thickness was defective in 12 eyes ($p < 5\%$ - 9, $p < 0.5\%$ - 3). Superior RNFL average was defective in 14 eyes ($p < 5\%$ -12, $p < 0.5\%$ - 2), inferior RNFL average was defective in 10 eyes ($p < 5\%$ - 4, $p < 1\%$ - 1, $p < 0.5\%$ - 5), nerve fiber indicator defect was seen in 8 eyes (30-50-6, > 51-2). Any form of defect was seen in 18 of 40 eyes. On cirrus HD-OCT, superior RNFL average was defective in 8 eyes ($p < 5\%$ - 4, $p < 1\%$ - 4), inferior RNFL defect was seen in 7 eyes ($p < 5\%$ - 3, $p < 1\%$ - 4), overall RNFL thickness was defective in 7 cases ($p < 5\%$ - 4, $p < 1\%$ - 3). Any form of defect was seen in 13 of 40 eyes.
Conclusion: Baring of circumlinear vessels may be an early sign of glaucoma and is associated with increased chances of picking up RNFL defects with GDx VCC and/or Cirrus HD-OCT.

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P082 DO OPTIC DISCS GET 'THINNER' OR 'NARROWER'?

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Purpose: To determine if the terms 'thinning' and 'narrowing' are used interchangeably to describe the phenomenon in which the optic disc cup becomes larger and the rim smaller and to propose standardization of the description of progressive changes of the neuroretinal rim in glaucoma.
Design: Literature review.
Methods: Literature review looking for frequency of descriptors such as narrowing, widening, width, thinning, thickening

and thickness for describing the characteristics or change in the character of the optic nerve head.
Main outcome measures: Neuroretinal rim descriptors 'thinning' and 'narrowing' in glaucoma patients.
Results: Of the 275 articles, 80 described the neuroretinal rim clinically. Forty one articles used 'thinning' to describe progressive loss of rim tissue in a radial axis, and 13 articles used 'narrowing'.
Conclusions: 'Narrowing' and 'thinning' are not synonymous. Narrowing of the neuroretinal rim describes an increase in the cup disc ratio or a decrease in rim/disc ratio. Thinning of the neuroretinal rim refers to a decrease in the thickness of the optic nerve head, that is, the distance between the anterior surface of the optic nerve head and the lamina. 'Thinning' is used more commonly in the literature in place of narrowing. Both phenomenon, however, occur and unless the words are properly used it is not clear which character is being described. We recommend that the change in width of the neuroretinal rim be described as 'narrowing' or 'widening' and the change in the thickness of the optic disc be called 'thinning' or 'thickening'.
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2.15. Anatomical structures in glaucoma: Optic nerve

P083 RETINOTOPY IN THE OPTIC NERVE USING CFP-EXPRESSING TRANSGENIC MOUSE

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Purpose: To investigate topographic localization of the axons in the mouse optic nerve corresponding to each retinal quadrant.
Methods: B6.Cg-TgN(Thy1-CFP)23Jrs/J mice, in which the Thy1 promoter linked to CFP reporter, were obtained from the breeding colony of The Jackson Laboratory. One or three areas of retinal quadrants (superior, inferior, temporal, nasal) of right eyes were destroyed by laser photocoagulation in the mice. After a survival period over 2 weeks, the mice were deeply anesthetized with a xylazine/ketamin mixture and transcardially perfused with 4% paraformaldehyde. The eyes with optic nerve and the brains were then enucleated. Frozen cross-sections of optic nerve with 10 μm thickness were excised, and stained with GFAP and DAPI. Fluorescent images of CFP (axon), GFAP (astrocyte), and DAPI (nucleus) were obtained using a fluorescence microscope with appropriate filters. The location of retinal photocoagulation site was expressed by the lack of axon (CFP) in optic nerve. We could recognize the retinal location in optic nerve by comparing GFAP-stained area which showed astrocyte covering optic nerve.
Results: The degeneration patterns of the axons were easily identified by the expression of CFP indicating retinotopy in the optic nerve. The axons of each retinal quadrant were clustered and orderly changed their position through the optic disc and the anterior portion (0-1000 μm) of the optic nerve. At 1000 μm, 4 clusters of axons in each retinal quadrant queued up in order of inferior, temporal, superior, nasal and inferior quadrant clusters from the lateral side of the optic nerve. Interestingly, the inferior quadrant axons located at the ventral side at the optic nerve head were divided into two clusters and occupied the lateral and medial sides of the optic nerve at posterior optic nerve. Then, the axons of every retinal quadrant were diffusely distributed at 3000 μm from the optic disc and remained ubiquitously dispersed through the optic chiasm and into the optic tract.
Conclusions: We could easily identify topographic localization of the axons corresponding areas of the retinal quadrants in optic pathway using transgenic mice which express CFP in RGCs. Retinal axons were located regularly within 1000 μm from optic disc, but lost their retinotopic order at the posterior in optic nerve. This study will be useful for investigating retinotopy or optic nerve degeneration in mouse ocular models.
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P084 CLINICAL VISUAL FIELD DEFECTS CORRELATE WITH NUMERICAL PREDICTIONS OF BIOMECHANICAL STRAIN IN THE OPTIC NERVE HEAD ESPECIALLY IN VASOSPASTIC PATIENTS

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Purpose: Ocular hypoperfusion and IOP-induced mechanical strains likely play a synergistic role in glaucomatous axonal damage. Our objective was to determine if there is a relationship between strains predicted using finite element (FE) models and visual field mean defect (MD), in vasospastic and non-vasospastic patients.
Design: Cross-sectional study.

Participants: Normal (n = 53), ocular hypertensives (n = 51), glaucoma suspects (n = 51) and advanced open-angle glaucoma (n = 106) patients were recruited (total n = 261).
Methods: IOP, axial length, central corneal thickness (CCT), corneal hysteresis (CH) and optic nerve head surface morphology (using an HRT) were measured. Also recorded were maximum historic IOP, H24-2 MD and vasospasticity (according to a history of cold hands). The measurements were then transformed into the input factors of the FE model of Sigal et al. to obtain predictions of strains for each eye. When an FE-model input factor was not directly available from the measurements it was either left at the default level (*e.g.*, lamina cribrosa thickness), or estimated from the measurements (e.g. scleral thickness and stiffness estimated from CCT and CH respectively).
Main outcome measure: Correlation analysis was carried out between the FE-predicted strains and MD for the patient population as a whole, and divided into vasospastic (n = 51) and non-vasospastic (n = 171; 39 unassigned).
Results: MD correlated significantly with all modes of strain (tensile and compressive in the LC and in the pre-laminar neural tissue): R = -0.34 to -0.44 ($p < 0.001$). When eye-specific surrogate scleral stiffness estimates were replaced by a default value the correlations were weaker but were still significant (R = -0.19 to -0.31, $p < 0.001$). When the cohort was divided into vasospastic and non-vasospastic groups the correlations were stronger in the vasospastic group: R = -0.61 to -0.70 ($p < 0.001$) vs R = -0.19 to -0.36 ($p < 0.016$).
Conclusions: IOP-induced strains within the ONH predicted by the FE model correlated significantly with visual field defects. In all correlations higher strains were associated with increased visual field defect. The correlations were stronger in vasospastic patients and when scleral stiffness estimates were included. Greater estimated scleral stiffness was associated with smaller visual field defects. Although the results are encouraging, the assumptions implicit in the FE models and the transformations of clinical measurements into input factors are substantial and should be studied further.
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2.16. Anatomical structures in glaucoma: Chiasma and retrochiasmal central nervous system

P085 EARLY GLIAL RESPONSES IN THE VISUAL PATHWAY IN A RAT MODEL OF ACUTE INTRAOCULAR HYPERTENSION

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Purpose: To study the responses of glial cells in the retina and brain to a transient elevation in intraocular pressure (IOP) in rats.
Participants and controls: Thirty-six adult eight weeks old female Wistar rats were used in this study, which involved 30 rats in the surgery group and six as control.
Methods: Acute elevated intraocular pressure (IOP) was induced in the right eye of the rats by anterior chamber perfusion. To evaluate neuronal loss, cell counts in retina ganglion cell layer, lateral geniculate nuclear (LGN) and superior colliculus (SC) were performed at 1, 3, 7, 14 and 28 days after surgery. Immunoreactivity changes of glial fibrillary acidic protein (GFAP), a specific marker of reactive astrocytes and early sign of neural injury, were investigated at the same time points.
Main outcome measure: Neuronal loss and glial responses.
Results: Gradual and time-dependent loss of RGCs in right eye was noted at 3 days onward after surgery. Transsynaptic degeneration posterior to optic nerve head occurred at the same time course to the retina (began at 3rd day and persisted for up to 1 month). Atrophies of optic tract, LGN and SC were observed on the contralateral side. Neuronal cell size in the contralateral dLGN and SC was decreased. GFAP immunoreactivity displayed remarkable increase in retina and contralateral LGN and SC at 1st and 3rd day, respectively.
Conclusions: There is a widespread change in visual pathway in response to acute elevation of IOP. Brain changes may occur at early stage after ocular injury. Reactive astrocytes may serve as a early sensitive marker of brain injury and may be involved in the pathological changes in LGN and SC, but whether it play a protective or destructive role is still under investigated.
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3.1. Laboratory methods: Microscopy

P086 SURVEY OF CONFLICT OF INTEREST DISCLOSURE POLICIES OF OPHTHALMOLOGY JOURNALS

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Purpose: To survey the disclosure policy for authors, peer reviewers and editors of English language ophthalmology journals.
Design: Cross-sectional survey.
Participants: English-language ophthalmology journals.
Methods: All indexed English-language ophthalmology journals were identified. The journals' web pages were reviewed for published conflict of interest disclosure policies for authors, peer reviewers and editors. In cases where no policy was found, the journals' editor was contacted directly to confirm if a policy existed.
Main outcome measure: The existence of conflict of interest policy for authors, peer reviewers and editors.
Results: Forty-two English-language ophthalmology journals were identified. Web-based published conflict-of-interest policies were found for authors in 33 (79%), peer reviewers in 3 (7%) and editors in 2 (5%) of the 42 journals. After contacting those journals with no published policies, these numbers increased to 37/37 (100%) for authors, 18/30 (60%) for peer reviewers and 10/30 (33%) for editors. Seven journals with published disclosure policies for authors, but not for peer reviewers or editors, did not respond to the survey, and a further 5 journals without any published disclosure policy did not respond to the survey. Journals with a higher impact factor were more likely to have a web-based published disclosure policy for peer reviewers and a disclosure policy for editors.
Conclusions: Our study of 42 English-language peer-reviewed ophthalmology journals in 2008 found that 79% had publicly available conflict of interest policies for authors, which is an improvement from 16% in 1997 and 33% in 2004 for scientific journals. The results, however, for ophthalmology journals' peer reviewers and editors were less impressive at 7% and 5%, respectively. Declaration of conflict of interest for peer reviewers and editors is critical, since these individuals have a great deal of control over the content and ultimate publication of manuscripts including influence on commentaries and editorials. In particular, commercial bias due to their own conflicts of interest could affect the content of their journals. Following our survey questionnaire to journals without a web-based public policy statement we were able to confirm the existence of conflict of interest policies in 60% for peer reviewers and 33% for editors. Two studies have previously reported that journals with a higher impact factor were more likely to have a disclosure policy. We were able to find a similar association between the existence of a published conflict of interest policy for editors and higher journal impact factor. We recommend all journals have a publicly available policy which includes all individuals involved in the publication process.
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3.4. Laboratory methods: Molecular genetics

P087 TRANSMISSION DISEQUILIBRIUM AND HAPLOTYPE ANALYSES IN THE GLC3C LOCUS: SUGGESTIVE LINKAGE TO PRIMARY CONGENITAL GLAUCOMA IN CHINESE HAN

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Purpose: To further investigate the association between primary congenital glaucoma and the candidate disease locus glaucoma 3, congenital, C (GLC3C) on chromosome 14 in the Han Chinese population.
Design: The marker D14S279 of chromosome 14q24.3 showed significant association with primary congenital glaucoma in a Chinese Han sample. We used single nucleotide polymorphism (SNP) fine mapping to search for the vulnerability genes of primary congenital glaucoma.
Participants and controls: One hundred twenty-six trios (126 sick children and 252 normal parents as controls) were recruited in our study.
Methods: We selected 28 SNPs covering 40 Kb around D14S279 from the Hapmap PhaseI database of Chine-Han-Beijing. The cutoff criteria: HW p-Value less than 0.001, genotype call rate less than 75%, minimum minor allele frequency less than 0.001. Define haplotype block using Gabriel's method (confidence intervals). A graphic presentation of block pattern was completed with the use of Haploview software. Ten haplotype-tagged single nucleotide polymorphisms (htSNPs) were selected. Transmission disequilibrium test (TDT) was adopted in small nuclear families. This family-based association was performed using an FBAT program.
Main outcome measure: We calculated p value and Z statistic both in single-locus and haplotype-based association analysis. The significance value of markers transmitted to case probands were verified through 104 test permutations to guard against spurious associations.
Results: All the p values of each SNP in single-locus TDT were larger than 0.05. While in haplotype-based association analysis, block2 (five-SNP) showed significant association with primary congenital glaucoma, located between ADCK1 (aarF domain containing kinase 1) and NRXN3 (neurexin 3) genes. The block was composed with rs2111701, rs4020123,

rs4903696, rs11159318 and rs177216. The haplotype TAACG was a risk haplotype to disease (Z = -3.255, negative Z statistic, p = 0.001). After 104 test permutations, p value was still less than 0.05 (p = 0.0305).
Conclusions: These findings confirmed that GLC3C was a potential disease locus associated with primary congenital glaucoma in the Han Chinese population. Chromosome 14q24.3 harbors ADCK1 and NRXN3 or more genes as candidate genes for primary congenital glaucoma.
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P088 MODIFIER GENES FOR SEVERITY OF GLAUCOMA

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Purpose: Open-angle glaucoma (OAG) is a complex disease. We studied two huge autosomal dominant French-Canadian glaucoma pedigrees in which the deleterious genes were associated with wide variabilities of the disorder. In the CA family, OAG was caused by the K423E myocilin (MYOC) mutation. In the BV kindred, glaucoma was associated with a FOXC1 duplication at 6p25. The goal of this study was to assess if a second gene, known as a modifier gene, accounted for variability of age-at-onset (AAO) when glaucoma was caused by a primary disease mutation.
Design: Using the CA and BV pedigrees, we searched for clusters of heterozygotes carrying the primary disease mutation who showed extreme ages at onset. Age-at-onset was defined as age at which ocular hypertension (OHT) or OAG was first detected. For each heterozygote, we calculated the median for age-at-onset of his/her neighborhood. The neighborhood of a carrier was defined as members of the family harboring a mutation who were closer than, or equal to, his/her first degree cousins.
Participants: In the CA family, out of 152 heterozygotes, 104 were OAG or suspects with OHT and treatment, while 11 were untreated suspects. In the BV family, out of the 41 FOXC1 duplication carriers, 30 were OAG or suspects with treatment, 2 untreated suspects while 2 had Axenfeld-Rieger anomaly. Other carriers were asymptomatics.
Results: Phenotypes ranged from OHT, juvenile open-angle glaucoma, primary open-angle glaucoma, to asymptomatic subjects. Ages at onset ranged from 7 to 63 years old in the CA family and, from 5 to 75 years old in the BV kindred. In the CA family, we detected 7 distinct clusters relative to extreme age-at-onset. Three of these clusters encompassed branches of the pedigree in which the median for age-at-onset calculated for the neighborhood of each one of the heterozygotes was younger than 26 years old (NM: neighborhood's AAO median). These three clusters contained 35 MYOC mutant heterozygotes. In the other 4 clusters (56 heterozygotes), at least half of the heterozygotes showed a median for age-at-onset (NM) = 34 years of age. In the BV pedigree, five distinct clusters for AAO were detected. Three clusters (18 FOXC1 duplication carriers) had NM = 39 years whereas the other 2 clusters (17 carriers) demonstrated a NM = 25 years. Within the BV family, ages at onset displayed a tendency to decrease in younger generations.
Conclusions: Our clustering approach strongly suggests that variability of age at onset in the CA pedigree was caused by a genetic modifier. In the BV kindred, although we can not exclude some form of anticipation, the wide variation of ages at onset may be also accounted for by a modifier gene. These observations strongly support the notion that modifier genes alter the severity of glaucoma when the disorder is caused by a primary disease-gene.
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3.4.1. Laboratory methods: Molecular genetics: Linkage studies

P089 GENETIC ANALYSIS OF MYOC, COCH AND CYP1B1 GENES IN A CHINESE FAMILY WITH DEVELOPMENTAL GLAUCOMA

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Purpose: To analyze three candidate genes, myocilin (MYOC), cochlin (COCH) and cytochrome P450 1B1 (CYP1B1), in a Chinese pedigree of developmental glaucoma.
Design: A genetic approach to study developmental glaucoma.
Participants: A three-generation developmental glaucoma family, included 13 members, six of whom were patients with glaucoma and the rest were asymptomatic.
Methods: Complete ophthalmologic examinations were performed on all memebers of the family. All coding exons 1-3 and flanking introns of MYOC gene, exons 8-12 and flanking introns of COCH gene, and exons 2-3 and flanking introns of CYP1B1 gene were amplified by polymerase chain reaction and sequenced by direct cycle sequencing for mutations or variations. Nucleotide changes were detected by chromatogram and pairwise BLAST analysis of the sequence output data against the normal copy of cDNAs of these genes.

Main outcome measure: Mutations in MYOC, COCH, and CYP1B1 genes were analyzed in glaucoma patients and asymptomatic members of the family to determine whether possible association exists between genetic mutations and developmental glaucoma.
Results: Elevated intraocular pressure (IOP) was found in all patients and trabeculodisgenesis was detected in three of them with relatively transparent cornea. One MYOC heterozygous mutation, C > T (P370L), in exon 3 was identified in all six patients afflicted with glaucoma but not in asymptomatic family members. The P370L MYOC mutation cosegregated with the disorder within the family. Two CYP1B1 mutations, C > G (R48G) in exon 2 and C > T in intron 1, were identified in all six patients afflicted with glaucoma and but not in asymptomatic family members except the proband's grandmother. Five single nucleotide polymorphisms (SNPs) were identified to be in linkage disequilibrium: G > A in intron 2 of MYOC, C > G (S352T) in exon 11 of COCH, C > A in intron 11 of COCH, G > C (V432L) in exon 3 of CYP1B1, T > C (D449D) in exon 3 of CYP1B1.
Conclusions: The presence of P370L mutation of MYOC, likely in combination with mutations of CYP1B1, in all six glaucoma patients but not their healthy family members suggests a casual association between these mutations and developmental glaucoma.
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P090 THE PRIMARY OPEN-ANGLE GLAUCOMA DISEASE-CAUSATIVE GENE FOR PEDIGREE LI IN CHONG QING WAS RELATED TO GLC1H

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Purpose: To screen the candidate genes and loci of POAG that affected a large pedigree Li in Zhongxian, Chongqing.
Methods: We utilized the strategy of 'candidate loci cloning' and linkage analysis by means of short tandem repeat (STR).
Results: 1. Pedigree Li had significantly Mendelian feature of autosomal dominant inheritance. There were 34 members of 4 generations in actual existence and 11 patients with POAG (8 males and 3 females). The age-of-onset less than 40 years old (the male's average: 26.5; the female's average: 32.7), severly damaged optic nerve and serious loss of visual function. 2. The 34 gDNAs, corresponding to the 34 individuals of Pedigree Li, had good property to meet the standard of genotyping, Eight STR markers representing MYOC, OPTN, WDR36 and CYP1B1 were made to run the first screening experiment under the strategy of candidate loci cloning. The results of two-point linkage analysis showed that D2S367 and D2S2259 had significant LOD score (LODs), especially D2S2259, whose LODs (2.135) and Θ (0.06) came up to the standard (LOD=2.1, $\Theta < 0.10$). 3, Increased the density of STR markers near D2S2259 and verified 4 fine-mapping STR markers (D2S2369: LODs = 4.584, Θ = 0.00; D2S2352: LODs = 2.992, Θ = 0.00; D2S378: LODs = 6.238, Θ = 0.00;D2S337: LODs = 4.892, Θ = 0.00) to be the significantly linked with Pedigree Li and narrowed the linked region down to 2p15~2p16.3. This region was about 7cM or 7.5Mb and there were at least 12 genes expressing in the eye within it.
Conclusion: The disease-causative gene of POAG at Pedigree Li in Chongqing has be mapped in 2p15~2p16.3. The discovery is consistent with the study by Suriyapperuma SP, (GLC1H), but the patient's is younger and more serious than theirs.
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P091 STUDY ON THE GENE MUTATION OF MYOC AND OPTN IN A PAIR OF TWINS WITH PRIMARY OPEN-ANGLE GLAUCOMA IN CHINA

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Objective: To study myocilin gene(MYOC) and optineurin gene (OPTN) mutation in a pair of twins with primary open-angle glaucoma (POAG) in China.
Methods: The twins and 22 relatives were examined by ophthalmologists. The twins were identified by extracting DNA. All coding sequences of the MYOC and OPTN gene plus the flanking sites were amplified by polymerase chain reaction (PCR) using genomic DNA from the twins followed by sequencing of the PCR products.
Results: The direct sequencing results of the twins are: no double-no abnormal changes. We found that the MYOC gene and OPTN gene mutations are not related to the monozygotic twins.

Conclusion: Genetic factors may be not play an important role in primary open-angle glaucoma, nongenetic factors must also be included such as environment.

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P091.1 A FUNCTIONAL SNP IN THE CYP1B1 PROMOTER REGION IS STRONGLY ASSOCIATED WITH PRIMARY CONGENITAL GLAUCOMA

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Purpose: Primary congenital glaucoma (PCG), an autosomal recessive disorder of the eye is largely implicated to mutations in the human cytochrome P450 gene (CYP1B1) in varying frequencies with a high degree of allelic heterogeneity. The involvement of the CYP1B1 promoter has been unexplored in understanding the functions of this gene. Hence, the present study explored the role of CYP1B1 promoter in PCG.

Design: Case-control study.

Participants and/or controls: A large extended cohort of clinically well characterized PCG cases (n = 300) and ethnically matched normal controls (n = 200) were studied.

Methods: The CYP1B1 promoter was screened by resequencing a 486 bp upstream region containing the basal promoter with a TATA-like Box and an initiator motif and two SP1 binding sites. Promoter assay was carried out using Dual Luciferase Assay System in TM3 cell line derived from the trabecular meshwork and luciferase activity was measured using a luminometer. Possible transcription factor binding sites for the promoter variant was done using the MatInspector software. Haplotype analysis was done with the Haploview software.

Main outcome measure: Association of variants in the CYP1B1 promoter affecting gene function.

Results: Three PCG-associated variants were observed in the promoter, of which, an SNP(T > C) within the DNA response element (DRE) and SP1 binding site was significantly associated with PCG cases harboring CYP1B1 mutations ($p = 5.01 \times 10\text{-}4$). The presence of the risk allele (C) in the haplotype (C-C-G) was associated with significant risk amongst cases harboring a homozygous mutation in the CYP1B1 coding region ($p = 1.06 \times 10\text{-}7$), while the T-C-G haplotype was protective. There was no association of the promoter variant with cases that did not exhibit any CYP1B1 mutation. Haplotype analysis indicated similar results across cases with and without CYP1B1 mutation in different geographical regions. Luciferase assay revealed a significant reduction in the promoter activity in individuals with the homozygous risk genotype suggesting that this variant could regulate CYP1B1 levels in vivo. Further bioinformatic analysis suggested two transcription factors (Nuclear Factor Y and Pbx-1) that could be possibly binding to this variant.

Conclusions: The reduction of promoter activity due to the promoter variant demonstrates for the first time, a loss of function in a large cohort of PCG cases harboring CYP1B1 mutations. The overall reduction of enzyme activity due to the promoter and coding region mutations along with the riskhaplotype underscore their potential role as biomarkers in PCG pathogenesis.

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3.4.2. Laboratory methods: Molecular genetics: Gene studies

P092 TP53 GENE CODON 72 POLYMORPHISM IN BRAZILIAN PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: Based on the assumption that gene TP53 may play an important role in the apoptosis that occurs in glaucomatous optic neuropathy, gene TP53 codon 72 polymorphism has been studied in different populations, with conflicting results. Since polymorphism has not been studied in the Brazilian population, the objectives of the present study were: to determine the distribution of the Pro-Pro, Arg-Arg and Pro-Arg genotypes of gene TP53 codon 72 in a sample of this population; and to verify the association of these genotypes with POAG.

Design: Case-control study.
Participants: The study was conducted on 51 patients with POAG and 72 normal individuals (control group).
Methods: POAG diagnosis was based in gonioscopy, tonometry, ophtalmoscopy and Goldmann perimetry. DNA was amplified by polimerase chain reaction. The exon 4 region of gene TP53 was amplified and digested with the restriction enzyme BseDI (restriction fragment lenght polymorphism).
Main outcome measure: Determination of gene TP53 codon 72 Pro-Pro, Arg-Arg or Pro-Arg genotype.
Results: The Pro/Arg genotype is the most frequent in Brazilian patients with POAG, but its frequency did not differ significantly from that observed in the controls.
Conclusions: The results indicate lack of association of any genotype of TP53 codon 72 polymorphism in Brazilian patients with POAG.
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P093 MYOCILIN MT.1 GENE PROMOTER SINGLE NUCLEOTIDE POLYMORPHISM UNRELATED TO THE RISK AND SEVERITY OF PRIMARY OPEN-ANGLE GLAUCOMA IN BRAZILIAN PATIENTS

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Purpose: The myocilin (MYOC) gene promoter polymorphism -1000C > G (MYOC mt.1) is found to be associated with faster progression of primary open-angle glaucoma (POAG). Others have failed to corroborate those results. The purpose of the study was to investigate the polymorphism MYOC mt.1 in Brazilian patients with POAG and to evaluate its possible role on the phenotype and the severity of the disease.
Design: Cross-sectional study.
Participants and controls: One hundred thirty-seven patients with POAG and 130 normal controls were enrolled in the study.
Methods: DNA samples were prepared and the MYOC mt.1 polymorphism in the promoter region was screened by RT - PCR in a SNP assay. Frequencies of the MYOC mt.1 promoter polymorphism were determined for both groups and compared by Fisher's exact test and Chi-square test with Yate's correction. Phenotype variables IOP, cup-to-disk ratio (C/D), number of glaucoma medications and number of surgical procedures for IOP control were compared between carriers (either CG or GG) and non-carriers (CC) using Student's t test and Mann-Whitney U test.
Main outcome measures: Frequencies of MYOC mt.1, odds ratio and relative risk, phenotype-genotype correlation.
Results: MYOC mt.1 genotype frequencies did not differ in POAG and healthy subjects (P = 0.631); 16.4% of control subjects and 14.6% of POAG patients were MYOC mt.1 carriers. The frequency of G allele was similar between glaucoma and controls (9.3% and 7.3%, respectively; P = 0.477). The odds ratio for mt.1 + was 0.815 (95% CI: 0.414 - 1.597, P = 0.636). Among POAG patients there was no difference, according to the genotype, in C/D, number of glaucoma medications and number of surgical procedures for IOP control. IOP levels, however, were higher in non-carriers (P = 0.013).
Conclusion: The G allele of the MYOC mt.1 promoter polymorphism was equally distributed in POAG patients and healthy subjects suggesting that it is unrelated to the risk and severity of disease in the Brazilian population.
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P094 EVALUATION OF POLYMORPHISMS OF TEN GENES IN CHINESE PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: Primary open-angle glaucoma (POAG) is a major form of glaucoma. Genetics has been indicated to have an

important role in its development. Although at least 20 genetic loci have been reported, only three causative genes (MYOC, OPTN and WDR36) are identified from these loci. Mutations in these genes account for less than 10% of patients with POAG. Several other genes are associated with POAG, but reports on these associations are inconsistent. It is important to further evaluate these genes using larger samples and in a different population. In the present study, we investigated ten genes for association with POAG in a large Chinese case-control sample.

Methods: Four hundred five unrelated patients with POAG (255 high-tension glaucoma [HTG], 100 normal tension glaucoma [NTG], and 50 juvenile-onset open angle glaucoma [JOAG]) and 360 unrelated control subjects were recruited. Fifteen SNPs in 10 genes (CDH1, CDKN1A, CYP1B1, GSTM1, GSTT1, MTHFR, NOS3, OPA1, TNF and TP53) that were reported to be significantly associated with POAG were genotyped using ABI TaqMan assays or direct sequencing. Single-SNP association was analyzed using the chi-squared test. Haplotype analysis was performed using PLINK. Multiple comparisons were corrected by the Bonferroni method.

Results: One SNP (rs1800629) in TNF and one SNP (rs1042522) in TP53 showed nominally significant association with POAG ($p = 0.021$ and 0.025 respectively). However, these two SNPs and the other thirteen SNPs tested were no longer significantly associated with POAG after correcting for multiple comparisons (Bonferroni corrected $p > 0.32$). Haplotype analysis did not find significant association of individual genes with POAG ($p > 0.09$).

Conclusions: Our findings suggest that these polymorphisms in the studied genes that were previously associated with POAG are not significant risk factors for the development of this complex disorder, at least in the Chinese population. Further studies are needed to search for major genetic factors that contribute to this important blinding disease.

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P095 ASSOCIATION OF THE LOXL1 GENE POLYMORPHISM WITH EXFOLIATION SYNDROME AFTER INTRAOCULAR SURGERY

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Purpose: n 2007, Thorleifsson et al. demonstrated that lysyl oxidase-like 1 (LOXL1) gene polymorphisms confer risk to exfoliation syndrome (XFS) in patients from Iceland and Sweden. Then, it was also reported that the LOXL1 gene polymorphisms were associated with XFS in the Japanese population. Clinically, it is experienced that the XFS sometimes occurs after intraocular surgery. To investigate the influence of intraocular surgery on XFS, we assessed the association between the LOXL1 gene polymorphisms and XFS after intraocular surgery.

Design: ase-control study.

Participants and controls: leven consecutive Japanese patients who had XFS after intraocular surgery (XFS-A), and 89 patients who had XFS without intraocular surgery (XFS-W). The mean ages at the time of blood sampling were 73.7 ± 9.2 and 76.5 ± 6.6 years (SD) in patients with XFS-A and XFS-W respectively.

Methods: Two non-synonymous SNPs, rs1048661 (758G/T, Arg141Leu) and rs3825942 (794G/A, Gly153Asp), both located in the first exon of LOXL1 gene, were genotyped using restriction fragment length polymorphism analysis.

Main outcome measures: The compound genotype frequencies of these SNPs were compared between the patients with XFS-A and XFS-W.

Results: There was a significant difference ($P < 0.0001$, Chi-square test) in the compound genotype frequencies between the patients with XFS-A and XFS-W (XFS-A: TT/GG 8, TG/AG 1, GG/GG 2 *vs* XFS-W: TT/GG 88, TG/AG 1). Two XFS-A patients with GG/GG compound genotype were observed, although there were no XFS-W patients with GG/GG compound genotype.

Conclusions: Intraocular surgery may induce XFS in patients with GG/GG compound genotype of the LOXL1 gene.

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P096 ASSOCIATION OF LOXL1 GENE POLYMORPHISMS WITH PSEUDOEXFOLIATION IN THE CHINESE

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Purpose: Single nucleotide polymorphisms (SNPs) rs1048661 and rs3825942 within the Lysyl Oxidase Like-1 (LOXL1) gene was found to confer risk to pseudoexfoliation glaucoma (XFG) through pseudoexfoliation syndrome (XFS) in Nordic, Caucasian and in two Asiatic populations (Indian and Japanese). The incidence (0.2-0.7%) of XFS in the Chinese is considerably lower compared to Nordic populations. The aim of this study was to determine the LOXL1 association in Chinese subjects with XFS/XFG.
Design: Genetic association case-control study.
Participants: Chinese subjects with clinically diagnosed XFS/XFG and normal controls were recruited.
Methods: Genomic DNA was extracted and the two SNPs (rs1048661 and rs3825942) of LOXL1 gene were genotyped by bi-directional sequencing.
Main outcome measure: Allele and genotype frequencies were compared between cases and unrelated controls using PLINK. Linkage disequilibrium (LD) calculations and haplotype association analysis were done using the Haploview package and WHAP package respectively.
Results: 62 Chinese patients (17 XFG and 45 XFS) and 171 Chinese controls were studied. The G allele of SNP rs3825942 of LOXL1 was moderately associated (OR = 10.97, P = 0.0018) with pseudoexfoliation in the Chinese. The frequency of the G allele of rs1048661 was not significantly different in cases compared to controls (P = 0.142) in the allelic association test. However, the genotype test showed marginal association for rs rs1048661 (P = 0.030). Only three haplotypes were observed (T-G, G-G and G-A), with G-G as a risk haplotype (P = 0.0034) and G-A as a protective haplotype (P=0.00039). T-G, which was a risk haplotype in the Japanese was not associated with XFG in the Chinese (P = 0.124).
Conclusions: Polymorphisms in the LOXL1 gene confer risk to XFS/XFG in the Chinese. The lower incidence of XFS suggests additional genetic or environmental factors to have a major influence on the phenotypic expression of XFS in the Chinese. The G allele of rs3825942 has been shown to be associated with XFS/XFG in all populations studied to date.
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P097 INVESTIGATION OF CYP1B1 MUTATIONS IN CHINESE PATIENTS WITH PRIMARY CONGENITAL GLAUCOMA

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Purpose: This study was conducted to investigate the mutation spectrum of the CYP1B1 gene in Chinese patients with primary congenital glaucoma (PCG).
Design: Observational case study and gene mutation screening.
Participants and controls: Forty-one Chinese PCG patients and 80 normal Chinese controls.
Methods: Phenotype description, and mutation detection in the CYP1B1gene.
Main outcome measure: The coding regions of the CYP1B1 gene from 41 Chinese PCG patients were analyzed using polymerase chain reaction (PCR) and heteroduplex analysis-single strand conformation polymorphism (HA-SSCP) followed by subsequent cloning and bidirectional sequencing. New variants were confirmed by restriction fragment length polymorphism (RFLP) analysis in 80 normal Chinese controls.
Results: Six distinct mutations, 4 of which are novel, were identified in 14.6% (6/41) of all patients. The CYP1B1 mutations in two patients were homozygous, and the other 4 patients were compound heterozygous. Beyond the four novel mutations (g.4531_4552del22bp, g.4633delC, p. S336Y, p.I471S), two reported missense mutations (R469W, R390H) were also identified. The missense mutation R390H was involved in 9.8% (4/41) of patients in our study. None of the novel mutations was observed in any of the 80 controls.
Conclusion: Our results support the premise that the CYP1B1 gene is a major gene for primary congenital glaucoma, appearing to be responsible for the disease in roughly one in six Chinese PCG patients. The R390H mutation was identified as a predominant CYP1B1 allele among the Chinese PCG patients in our study. This observation emphasizes the importance of mutational screening of the CYP1B1 gene, especially for the R390H mutation in Chinese patients.
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3.5. Laboratory methods: Molecular biology incl. SiRNA

P098 MATRIX METALLOPROTEINASES AND THEIR INHIBITORS IN AQUEOUS HUMOUR OF PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA AND PRIMARY ANGLE-CLOSURE GLAUCOMA

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Purpose: To determine the presence, activity and the quantitative differences of matrix metalloproteinases (MMPs) and their inhibitors, the tissue inhibitors of metalloproteinases (TIMPs) in the aqueous humour of patients with primary open-angle (POAG) and primary angle-closure glaucoma (PACG).
Participants and controls: Seventy-one patients, of whom 28 with POAG, and 16 PACG patients with 27 who had cataract serving as the control group were recruited.
Method: A prospective, single centre study was carried out. Aqueous humour was collected from 71 patients undergoing intraocular surgery.
Main outcome measure: Substrate zymography was performed to determine the presence of gelatinolytic or caseinolytic activities. Total protein levels were measured with a commercially-available kit. ELISA kits were used to quantitate the levels of MMP-2, -3, TIMP-1 and -2.
Result: We found the presence of gelatinolytic activity from the zymography of all the three groups especially the POAG group which may represent the presence of MMP-2 and MMP-9. There was no detectable caseinolytic activity which suggests low levels of stromelysins. The protein levels were significantly higher in POAG eyes compared to control ($p = 0.003$) but not between the PACG and control ($p = 0.190$). However, the levels of MMP-2, -3, TIMP-1 and -2 were higher in both the POAG and PACG compared to control. Nevertheless, the difference was only significant in the levels of MMP-2, TIMP-1 and -2 between the POAG and control eyes. Meanwhile, PACG eyes have significantly higher MMP-2 and TIMP-1 levels than the control eyes. The ratio of MMP-2/TIMP-2 and MMP-2 + 3/TIMP-1 + 2 were decreased in POAG and PACG compared to control.
Conclusion: The presence of gelatinolytic activity in the aqueous humour was consistent with previous studies done by Ando et al., Maatta et al. and Schlötzer-Schrehardt et al. The caseinolytic activity however, was undetectable as shown by Schlötzer-Schrehardt et al., but detectable after prolonged incubation by Ando et al. suggesting low activity level. The imbalance of MMP/TIMP may contribute to the pathogenesis of not only the POAG, but also the PACG eyes. The reduced MMP activity in both these glaucomatous groups supports the hypothesis that accumulation of extracellular matrix may be the causative factor in the pathogenesis of both the POAG and PACG eyes. To our knowledge, this is the first study done on the activity and levels of MMPs and TIMPs in PACG eyes and in Asia. This is important as Asians will represent 47% of those with glaucoma and 87% of those with ACG worldwide by the year 2010.
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3.6. Laboratory methods: Cellular biology

P099 THE ROLE OF MITOCHONDRIAL INHIBITORS ON GLUTAMATE INDUCED EXCITOTOXICITY IN RGC5 CELLS

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Purpose: Mitochondrial DNA mutations have been proposed to increase retinal ganglion cells vulnerability to cell death in glaucoma. The purpose of the study was to investigate whether inhibitors of mitochondrial complex I (rotenone) and complex III (antimycin) increased excitotoxic cell death and if agents that enhance mitochondrial function (resveratrol) prevent glutamate-induced excitotoxic injury in a retinal ganglion cell *in vitro* (RGC5).
Design: Dose response curves were first established to determine the response of RGC-5 cells to increasing concentrations of glutamate, rotenone, antimycin A and resveratrol. Monolayers were then co-treated with glutamate and rotenone, antimycin A or resveratrol at a range of concentrations.
Testing: The MTT colorimetric assay was used to quantify RGC-5 live cell number. Mitotracker probes were used to look at changes in mitochondrial distribution. Changes in HO-1 expression indicative of oxidative stress were determined by Western blotting.
Results: RGC5 cells showed reduced cell numbers in the presence of high concentrations of glutamate, with a significant reduction in cell number observed above 25 μM ($p < 0.01$). Glutamate excitotoxicity was significantly reduced by resveratrol above 25 μM, with resveratrol treated cells show-

ing an increase in cell survival by more than 50%. Surprisingly, inhibitors of complex I also reduced glutamate excitotoxicity determined by cell number and HO-1 expression.
Conclusion: Agents that modify mitochondrial activity reduce glutamate-induced excitotoxicity in cultured retinal ganglion cells. Further studies are now required to investigate the mechanisms that mediate protection.
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P100 COMPARISON OF EFFECTS ON THE ISOLATED RETINAL GANGLION CELL BETWEEN MÜLLER CELL AND OPTIC NERVE ASTROCYTE USING RAT CO-CULTURE SYSTEM

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Purpose: To investigate the effects of Müller cell and optic nerve astrocyte on the survival and neurite outgrowth of isolated retinal ganglion cell (RGC) from postnatal rats.
Design: Experimental study.
Methods: RGC, Müller cell, and astrocyte were isolated from three-day-old Sprague-Dawley rats, and were cultured, as reported previously. Primary culture of RGC and fifth to seventh passage of Müller cell and astrocyte were used for the experiments. As previous report, RGC were co-cultured in serum-free medium containing 0, 5, 10, or 50 μM of S-nitroso-N-acetyl-l,l-penicillamine (SNAP) with either confluent Müller cells or confluent astrocytes that were seeded onto a semipermeable membrane for 48 hours. Then, survival rate of RGC was evaluated by flow cytometry, and the number of RGCs having neurite outgrowth and length of neurite outgrowth were evaluated by an examiner with a masked fashion about the experimental conditions.
Main outcome measure: Survival and nuerite outgrowth of RGC.
Results: The survival rate of RGC was decreased by SNAP loading with a dose-dependent manner. Co-cultured both glial cells improved the survival rate, but there was no significant difference in neuroprotective effects between Müller cell and astrocyte. In contrast, astrocyte significantly increased the number of RGC having neurite by 1.5, 1.5, and 1.7 times than Müller cell at doses of 0,5 μM, and 10 μM of SNAP, respectively. Astrocyte also increased the length of nuerite outgrowth of RGC by 2.4, 2.9, and 1.4 times than Müller cell at doses of 0,5 μM, 10 μM of SNAP, respectively. These differences between Müller cell and astrocyte were statistically significant.
Conclusion: Both glial cells similarly protect RGCs against NO loading, but astrocyte may be more beneficial to neurite outgrowth of RGC than Müller cell.
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P101 CHEMICAL CHAPERONES TO CORRECT CELLULAR LESIONS

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Purpose: To investigate the pharmacological effect of chemical chaperones on misfolded myocilin mutants, which caused primary open-angle glaucoma.
Methods: Human trabecular meshwork cells were transfected to express FLAG/myc-tagged wildtype or glaucoma-causing mutant myocilin created by site-directed mutagenesis. The cells were treated or not with chemical chaperones, namely 4-phenylbutyric acid (4-PBA, 1 μM), trimethylamine N-oxide (TMAO, 100 μM) or in deuterium oxide (D2O)-based medium.
Main outcome measures: Extracellular myocilin was analyzed by immunoprecipitation-western blotting. Intracellular proteins were separated into Triton X-100-soluble and insoluble fractions, which were analyzed by Western blotting. Apoptosis was quantified as percentages of cells with fragmented nuclei. The effect on ER stress and subcellular myocilin distribution was examined.
Results: Aggressive myocilin mutants causing high intraocular pressure juvenile-onset primary open-angle glaucoma were Tx-insoluble, aggregation prone and non-secreted, whereas mild variants were less severe. Treatment with 4-PBA, TMAO or D2O reduced insoluble myocilin mutants and restored its secretion in a mutation-dependent manner. Optimal correction was found for TMAO, which shortened the ER retention and corrected mutant myocilin non-secretion dose-dependently. It alleviated the ER stress and rescued cells from apoptosis.
Conclusions: We demonstrated that small molecule chemical chaperones, in particular natural osmolyte TMAO, allevi-

ated mutant phenotypes of myocilin. Since they are cell permeable, this warrants a test of topical administration for treating myocilin-caused primary open-angle glaucoma.

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3.7. Laboratory methods: Biochemistry

P102 A STUDY OF AQUEOUS HUMOR PROTEINS IN CASES OF PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: To investigate changes in the protein composition of aqueous humor in primary open-angle glaucoma (POAG).
Design: Case control study comparing the protein profile of aqueous humor obtained from human eyes with and without POAG.
Participants and controls: Participants were established cases of POAG, > 50yrs old, uncontrolled on medical treatment, undergoing trabeculectomy. Controls were age matched patients of senile cataract, without any evidence of glaucoma, undergoing cataract surgery. Patients with history of ocular surgery within 6 months, evidence of intraocular inflammation, complicated cataract, history of uveitis, history of ocular trauma were excluded from both groups. Fifty-two eyes of 48 patients: 26 eyes of 22 patients in the POAG group and 26 eyes of 26 patients in control group, were ultimately selected for the study.
Methods: At the beginning of the surgery 0.1 ml of aqueous humor was collected, before entering the anterior chamber of all the eyes. The aqueous humor was stored in microtubes at -20° C until analysis.
Total protein was estimated in all the aqueous humor samples by the Bradford method. Sodium dodecylsulfate polyacrylamide gel electrophoresis (SDS-PAGE) of the aqueous humor samples was also performed to compare the electrophoretic patterns of the two groups.
Main outcome measure: Total aqueous humor protein concentration was found to be increased in the POAG group. Three protein bands were detected only in the POAG group, two of which had molecular weights similar to heat shock proteins.
Results: The geometric mean of total protein concentration of the aqueous humor samples was 55.73 mg/dl (range: 31-72) in the POAG group and 46.46 mg/dl (range: 27-65) in the control group. The difference between the two groups was statistically significant, with p = 0.001. Well-defined protein bands of 10kDa, 20kDa, 30kDa, 50kDa, 60kDa, 70kDa, 90kDa were detected in the POAG group. The control group exhibited fewer well defined bands, their molecular weights being 6kDa, 10kDa, 30kDa, 70kDa, 90kDa.
Conclusions: The total concentration of proteins in aqueous humor of patients with POAG on medical treatment is higher than in controls. The 20kDa, 50kDa and 60kDa proteins are present only in the aqueous humor of POAG patients. The 10kDa, 30kDa,70kDa and 90kDa proteins are present in aqueous humor of both POAG and control group.

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P103 ROLE OF MATRIX METALLOPROTEINASE-2 AND ITS INHIBITOR AND ERYTHROPOIETIN IN THE PATOGENESIS OF PSEUDOEXFOLIATIVE GLAUCOMA

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Purpose: To determine the level of MMP2 and its endogenous inhibitor, tissue inhibitor metalloproteinase-2 (TIMP2) and erythropoietin (EPO) in the aqueous humor and serum of patients with pseudoexfoliative glaucoma (PEXG) in relation to samples derived from cataract control patients.
Design: Aqueous humor and serum samples were collected from patients with PEXG and cataract (25 glaucoma samples and 15 cataract samples).
Participants: Glaucoma and cataract subjects underwent routine trabeculectomy and cataract extraction surgeries respectively.
Main outcome measure: The levels of MMP-2 ,TIMP2 and EPO were determined by ELISA.
Results: Whereas serum samples showed no significant differences, MMP2 was detected in significantly higher concentration in aqueous samples from PEXG patients compared to cataract patients. The ratio of MMP2 to its principle inhibitorTIMP2 was balanced in cataract patients but increased in samples from PEXG patients resulting in excess of MMP2 over TIMP2. The mean aqueous humor EPO concentration in eyes with PEXG was significantly higher than that in eyes with cataract. Also, there was significant increase in the serum EPO concentrations of PEXG patients when compared to the control group. There was no correlation between the EPO aqueous humor concentration and the EPO serum con-

centration in both PEXG and catract patients. Also a positive correlation was detected between total MMP2 and EPO in aqueous of PEXG patients.
Conclusion: These findings suggest that complex changes in the loca MMP-TIMP balance in aqueous humor may promote the abnormal natrix accumulation characteristic of PEX syndrome and may be involved in the pathogenesis of PEXG. Also, our results indicate that EPO may play a role in the opathogenesis of PEXG.
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P104 PROTECTION EFFECTS OF DEXTRAN 70 ON DAMAGE INDUCED BY BENZALKONIUM CHLORIDE IN HUMAN CONJUNCTIVAL EPITHELIAL CELLS
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Purpose: To investigate the protection effects of dextran 70 on damage in human conjunctival epithelial cells induced by benzalkonium chloride (BAC) which is a kind of major preservative in anti-glaucoma eye drops.
Design: Cell culture in vitro.
Methods: Cultured human conjunctival epithelial cells were exposed to medium solutions containing 0.0005% BAC, dextran 70 in 0.0005% BAC at 0.01%, 0.05%, 0.1%, 0.2% concentrations and culture solutions for control respectively for a period of 15 min. Cells were harvested 48 and 72 hours after treatment. The proliferation inhibition rate of conjunctival epithelial cells was measured by MTT assay. The relative expression of the MUC1 was determined by conventional reverse transcription-polymerase chain reaction (RT-PCR) at mRNA level. Monoclonal antibody for MUC1 was used in western blot analysis to detect MUC1 at protein level.
Results: Cells exposed to 0.05%, 0.1%, 0.2% dextran 70 in 0.0005% BAC did not decrease the expression of MUC1 neither at gene level 48 hours and protein level 72 hours after treatment. Cells treated with 0.0005% BAC and 0.01% dextran 70 in 0.0005% BAC decreased the expression of MUC1 at both mRNA level and protein level.
Conclusions: These results suggest that decreased expression of MUC1 induced by 0.0005% BAC can be prevented by 0.05%, 0.1%, 0.2% dextran 70. Dextran 70 can regulate the expression of MUC1.
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3.8. Laboratory methods: Pharmacology

P105 - withdrawn

3.10. Laboratory methods: Immunobiology

P106 - withdrawn

P107 CX3CL-1/FRACTALKINE EXPRESSION IN THE TRABECULAR MESHWORK
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Purpose: To investigate whether CX3CL-1 and its receptor CX3CR-1 could contribute to inflammation in the trabecular meshwork.
Methods: Cultured glaucomatous human trabecular cells (HTM3) were assessed for CX3CL-1/CX3CR-1 expression by immunochemistry and flow cytometry after exposure to TNF-alpha or Benzalkonium chloride (BAC). In-vivo trabecular expression of CX3CL-1 was assessed by immunohistochemistry in a glaucomatous model of rats and/or after instillation of BAC.
Results: HTM3 cells constitutivelly expressed CX3CL-1/CX3CR-1. Exposure to TNF-alpha or BAC enhanced CX3CL-1 expression. CX3CL-1 was detected in rat trabecular meshwork and ciliary body. Its expression was detailed in rat normal eyes, glaucomatous eyes and after BAC exposure.
Conclusion: Inflammatory mediator- and toxic-induced modulations of CX3CL-1 expression in the trabecular meshwork suggests that CX3CL-1/CX3CR-1 interaction could play a role in the glaucomatous eye, especially when exposed to preservative like BAC.

3.13.1.2. Laboratory methods: In-vivo imaging: Laser Scanning: Confocal Scanning Laser Polarimetry

P108 POLARIMETRIC ANALYSIS OF THE PERIPAPILLARY REGION IN GLAUCOMA PATIENTS

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Purpose: To explore the peripapillary region in glaucoma patients by means of a novel method of polarimetric analysis, evaluating its utility in improving visualization and detecting changes.
Design: Cross-sectional study.
Participants: Seventy one eyes with open-angle glaucoma or suspects of glaucoma were selected to be tested from the glaucoma outpatient practice at the School Hospital from the Ribeiro Preto Medical School, Sao Paulo University.
Methods: We acquired polarimetric image data using a commercially available scanning laser polarimeter. Using near-infrared illumination at each of 20 input polarizations, a series of image pairs was digitized. Using raw data from the instrument, new images were computed based on their polarization content. For classification of peripapillary changes we used color photos acquired by a digital retinograph. Regions of hyperpigmentation and atrophy with respective controls were quantified in the computed polarimetry images.
Main outcome measure: Measurements on versus off hyperpigmentation and atrophy were used to calculate contrast in each image type.
Results: The differences in grayscale between hyperpigmentation or atrophy and respective controls were statisticaly significant ($P < 0.0001$) for all the computed images. Statistical analysis showed significant correlation ($P < 0.0001$) between the grade of hyperpigmentation and the computed images, but only for depolarized and ratio depolarized images. For atrophy, there was moderate correlation between the grade and the depolarized images ($P < 0.0001$). Contrast on the confocal Images was not statistically significant either for hyperpigmentation or atrophy.
Conclusions: Polarimetry analysis is capable of increasing contrast and improving visualization of peripapillary changes.
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3.13.2. Laboratory methods: In-vivo imaging: Optical Coherence Tomography

P109 GOLD NANORODS AS POTENTIAL CONTRAST AGENTS FOR OCULAR OPTICAL COHERENCE TOMOGRAPHY

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Purpose: To engineer backscattering gold nanorods (NRs) suitable for enhancing contrast of spectral domain optical coherence tomography (SD-OCT) images in order to investigate their use as in-vivo contrast agents.
Design: Cross-sectional.
Participants: Animal model using C57Bl/6 mice.
Methods: Gold NRs with an aspect ratio of ~4.5 were grown using a seed-mediated surfactant-directed synthesis. This aspect ratio was chosen such that the gold NRs exhibited a maximum surface plasmon resonant response at the wavelengths used by SD-OCT (center wavelength = 870 nm, bandwidth = 200 nm). NRs were coated with 1% polyacrylic acid to minimize aggregation of the particles, and then resuspended in ultrapure water. NR solutions were imaged using SD-OCT (Bioptigen, Research Triangle Park, NC) and compared to control solutions of ultrapure water. An intravitreal injection of the NR solution was then administered to healthy adult male C57Bl/6 mice. Raster SD-OCT images of the retina were acquired before and after injection using the same scanning protocol. Animals were then sacrificed and eyes were processed for transmission electron microscopy (TEM) imaging.
Main outcome measures: Backscattered SD-OCT intensity levels and TEM findings.
Results: Gold nanorods with a longitudinal resonance point at 840 nm and transverse resonance point at 520 nm were successfully grown and their rodlike shape was confirmed by TEM. SD-OCT imaging showed localized areas of increased intensity in the NR solutions but not in the control solution. We also saw local increases in backscattered intensity in the eye after intravitreal injection when imaging with SD-OCT. We confirmed the presence of the NRs in the eye using TEM imaging.
Conclusions: We were able to observe a change in reflectivity in the mouse eye after an intravitreous injection of NRs using SD-OCT imaging. Gold NRs may therefore be a tool for selective enhancement of tissue in OCT imaging.
References:

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P110 STUDY OF VARIOUS ANGLE PARAMETERS AS MEASURED ON ANTERIOR SEGMENT OCT (VISANTE) IN CASES OF OPEN ANGLE AND ANGLE CLOSURE

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Objective: To compare angle parameters in cases with open angle and angle closure on Visante.
Design: Comparative case series.
Participants: Thirty eyes of 15 patients with open angles and primary angle closure.
Materials and methods: All patients underwent detailed ophthalmological evaluation including anterior segment OCT and gonioscopy. Patients with open angels on gonioscopy with or without ocular hypertension or open-angle glaucoma were included in the open-angle group; patients with occludable or closed angles with primary angle closure or primary angle-closure glaucoma were included in the angle closure group. Enhanced anterior segment single images were used to determine angle-opening distance (AOD) at 500 µm and 750 µm, trabecular-iris space area (TISA) at 500 µm and 750 µm from scleral spur and Scleral spur angle at 180°, 0°, 270° and 90° using custom software.
Main outcome measures: Quantification of difference in angle parameters.
Results: The mean age in the open-angle group was 43.27 ± 10.57 (range 22-64), and in the angle-closure group was 50.9 ± 8.32 (range 39-68). Each group had 8 males and 7 females. All parameters in the angle-closure group were less than corresponding parameter in the open-angle group. Iridocorneal angle measurements were least in the 90 and maximum at 0 in both groups. Results are shown in a table.
Conclusion: Anterior segment OCT (Visante) is a non-contact method to reliably distinguish between closed from open angles.
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3.13.2.2. Laboratory methods: In-vivo imaging: Optical Coherence Tomography: Posterior Segment

P111 OPTIC NERVE DISC MEASUREMENTS AND RNFL THICKNESS ANALYSIS WITH FOURIER DOMAIN OCT COMPARED TO TIME DOMAIN OCT

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Purpose: To compare optic nerve disc measurements and RNFL thickness obtained from two optical coherence tomography systems.
Design: Prospective, observational study.
Participants: Seventy eyes of 35 healthy volunteers were recruited for the study.
Methods: Examination repeated three times under the same photopic condition during one visit with TD OCT and FD OCT.
Main outcome measure: Optic nerve disc area, cup area, cup to disc area ratio, mean RNFL thickness in four quadrants. Bland-Altman plots were used to evaluate agreement between systems.
Results: Mean optic nerve disc area was 2.58 mm^2 (±0.36 mm^2) by TD OCT and 2.32 mm^2 (±0.34 mm^2) by FDOCT. Mean cup area and cup-to-disc area ratio were respectively, as follows: 0.51 mm^2 (±0.31 mm^2), 0,42 mm^2 (±0.36 mm^2); 0.198 (± 0.08), 0.191 (± 0.07). Mean optic nerve and cup area was respectively 0.26 mm^2 (±1.96 SD; ± 0.42 mm^2); 0.1 mm^2 (±1.96 SD; ± 0.32 mm^2) larger for TD OCT system, while there was no significant difference in cup-to-disc ratio for both systems. The mean nasal and temporal RNFL thickness was significantly greater for the FD OCT compared with the TD OCT. The mean difference was 22.1 µm (±1.96 SD; ± 32.7 µm) for nasal quadrant and 8.8 µm (±1.96 SD; ± 22.7 µm) for temporal quadrant. There was no significant difference in the mean inferior and superior RNFL thickness.
Conclusions: Although two systems may not be used interchangeably for RNFL thickness analysis, they show good agreement for cup to disc area ratio assessment.
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3.20. Laboratory methods: Other

P112 COMPARATIVE FLOW STUDY OF 3 DIFFERENT MODELS OF A STAINLESS STEEL MINIATURE GLAUCOMA IMPLANT

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Purpose: To determine flow characteristics of 3 models of a stainless steel miniature glaucoma implant at different levels of pressure under *in vitro* conditions.
Design: Controlled laboratory investigation.
Methods: Three different models of a glaucoma mini drainage device (P-50, R-50 and P-200) were tested at 5 different levels of pressure (5, 10, 15, 20, 25 mmHg). Four measurements per sample over a 15 minutes period were taken. The experimental set-up was based on a gravity driven flow test where the device was subjected to a constant gravitational force of fluid. The apparatus consisted of a water column that was occluded with Parafilm 'M', a water reservoir, and a scale. The device was implanted into the Parafilm 'M' under a microscope. The drainage was collected in a beaker which was continuously weighed with a precision scale. Flow (Q) was calculated as grams of balanced salt solution (BSS) per minute at each pressure level and then converted to ml/min. Resistance (R) was calculated using the variables pressure (P) and flow (Q). All tests were done with balanced salt solution at room temperature.
Main outcome measure: Flow rate.
Results: Q for the P-50 model was 0.09 ± 0.004 ml/min (mean ± SD) at 5 mmHg, 0.18 ± 0.01 at 10 mmHg, 0.27 ± 0.006 at 15 mmHg, 0.32 ± 0.03 at 20 mmHg, and 0.41 ± 0.02 at 25 mmHg. For the R-50 model Q was 0.11 ± 0.02 at 5 mmHg, 0.22 ± 0.03 at 10 mmHg, 0.33 ± 0.05 at 15 mmHg, 0.42 ± 0.06 at 20 mmHg, and 0.51 ± 0.08 ml/min at 25 mmHg. For the P-200 model Q was 0.66 ± 0.02 at 5 mmHg, 1.18 ± 0.02 at 10 mmHg, 1.57 ± 0.02 at 15 mmHg, 1.92 ± 0.02 at 20 mmHg, and 2.24 ± 0.02 ml/min at 25 mmHg. Resistance to flow over all pressure levels was 56.45 ± 2.87 mmHg/ml/min (mean ± SD) for the P-50, 46.70 ± 8,24 for the R-50 and 9.40 ± 0.20 for the P-200 model. A comparison of the flow rates among the 3 models showed statistically significant differences between the P-50 and P-200 and the R-50 and P-200 model at all pressure levels ($p < 0.01$; paired t-test). Similarly the calculated resistance values demonstrated a statistically significant difference ($p < 0.02$) between the P-50 and P-200 and between the R-50 and P-200. No statistically significant differences in flow rates or resistance could be detected between the R-50 and P-50 model.
Conclusions: The currently available models of a stainless steel miniature glaucoma implant vary in their flow characteristics, as predicted by the differences in their internal lumen diameters. The P-200 model shows a statistically significant higher flow rate compared to both the P-50 and R-50 model. The P-50 and R-50 model show statistically similar flow rates.
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P113 IMPLANTABLE DEVICE FOR CONTINUOUS MONITORING OF INTRAOCULAR PRESSURE

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Purpose: To develop a non-contact device for continuous monitoring of intraocular pressure. The system is based on the intraocular implantation of an extremely small, entirely passive transducer.
Methods: The transducer is a flexible structure that changes volume in response to changes in intraocular pressure. The transducer is an integrated module that consists of a parallel plate capacitor and a discrete inductor connected in series to form an L-C circuit. As the pressure surrounding the capacitor changes, the separation of the capacitor plates is varied and the resonant frequency of the L-C circuit changes. Non-contact pressure readings are made by measuring the resonant frequency of the coil using radio frequency (RF) energy from an external probe (grid-dip meter). The current system was designed with a target accuracy of 2 mmHg over a pressure range of 0-60 mmHg.
Results: A 3-mm diameter prototype device was fabricated using silicon micro machining techniques. The capacitance change of the sensor was 7pF between 0 and 40 mmHg. The natural frequency varied from 37 MHz at 0 mmHg to 33 MHz at 40 mmHg. The IOP was measured by determining the resonant frequency of the sensor and was accurate to 2 mmHg. These frequency changes of the L-C circuit formed by the sensor yielded sufficient sensitivity to measure small changes in the pressure.
Conclusion: We have demonstrated that a 3 mm in diameter continuous IOP sensor can be designed and fabricated by using silicon micro machining techniques that is accurate to 2 mmHg, to aid in the diagnosis and treatment of glaucoma.
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P114 IMPORTANCE OF CIRCULATING PLATELET AGGREGATES AND HAEMODYNAMIC CHANGES IN OPHTALMIC ARTERY AND PROGRESSION OF VISUAL FIELD LOSS AT PSEUDOEXFOLIATION GLAUCOMA

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Objectives: The aim of the work is to examine a role of circulating platelet aggregates (CPA) at pseudoexfoliation glaucoma, haemodynamic changes in ophtalmic artery by CDI searching for VF progresion.
Design: The examination included 80 patients, where 40 of them suffered from POAG as a control group, and 40 from PXG as a experimental group.
Subjects: The examination included in POAG group were 11 men (25%) and 29 (75%). In PXG group were 24 (60%) men and 16 (40%) women ($p \leqq 0.001$).
Methods: All the examinees underwent basic ophtalmological control. VF examination was done at 6-months intervals. CPA values (proportion) were tested by the method according to Wu and Hoak and ultrasonic measurement of blood perfusion in ophthalmic artery CDI.
Main outcome measure: Increased resistivity index as found in ophtalmic artery (RI AOF) in PXG groups in comparision with POAG group, where the values found were lower ($p = 0.029$).
Results: Analyzing obtained values of circulating platelet aggregates (CPA) between the groups (POAG and PXG) we got statistically significantly bigger CPA vaules in POAG group than in PXG group for 1.4 times ($p \leqq 0.001$).
We have also performed the analysis of ultrasonically (CDI) examinated parameters, velocities ans resistivities of left and right side in ophthalmic artery and internal carotid artery, at both PXG and POAG glaucoma groups.
Increased resistivity index as found in ophtalmic artery (RI AOF) in PXG groups in comparision with POAG group, where the values found were lower ($p = 0.029$). Statistically significant were found bigger ultrasonic resistivity index values in internal carotid artery (RI ACI) ($p = 0.031$) and pulsatility index in internal carotid artery (PI ACI) ($p = 0.013$) in PXG group than in POAG group. There is a 90% probability of the difference between PXG and POAG groups regarding perfusion velocity in diastola in ophtalmic artery (VD AOF) ($p = 0.106$), namely in the sense of bigger values in POAG group in comparision with PXG group.
Conclusion: Decreased CPA values found resulted in hypercoagubility of blood in PEX group. Also at PEX glaucoma were found incerased perfusion resistivity indexes in ophtalmic artery and internal carotid artery which most probably finally resulted with ischemia and hypoxia, thus helping progression of visual field.
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5.1. Experimental glaucoma; animal models: Rodent

see also P075

P115 DETERMINATION OF CONVENTIONAL PROTEIN KINASE C ISOFORMS INVOLVED IN HIGH INTRAOCULAR PRESSURE-INDUCED RETINAL ISCHEMIC PRECONDITIONING OF RATS

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Objective: Conventional protein kinase C (cPKC) plays an important role in the development of retinal ischemic preconditioning (IPC). The present study was undertaken to investigate whether cPKC activity following the induction of retinal IPC is mediated through specific isoforms.
Design: High intraocular pressure (IOP) was used to induce retinal IPC.
Subjects: Pathogen-free, adult male Wistar rats.
Methods: Immunofluorescence staining with cPKC-specific antibodies, and Western blot analyses of cPKC isoforms.
Main outcome measures: Establish the membrane translocation and protein expression of cPKC in retina at various intervals after the IPC stimulus.
Results: cPKCgamma membrane translocation was increased significantly early after inducing IOP (20 min-1 h), whereas the protein expression levels of cPKCalpha and gamma were elevated much later (12-168 h). The increased protein expression of cPKCalpha at 72 h and cPKCgamma? at 24 h after IPC were confirmed by immunofluorescence staining. In addition, cPKCgamma? co-localized with retinal ganglion cell (RGC)-specific marker, neurofilament.
Conclusions: The results indicate that cPKCalpha and gamma differentially control the cellular signaling of high IOP-induced retinal IPC.
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P116 THE EFFECT OF ACUTE ELEVATED HYDROSTATIC PRESSURE ON THE RAT EX-VIVO EYECUP PREPARATION

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Objective: To investigate the retinal impairment induced by elevated hydrostatic pressure using isolated eyecups prepared from rats. Involvement of glutamate excitotoxicity is also examined.
Design: Laboratory investigation.
Materials: Isolated eyecups prepared from 30 (± 2)-day-old Spraque-Dawley rats.
Methods: SD rats were anesthetized with diethyl ether and decapitated. After removal of the anterior segment and vitreous, the eyecup was placed at the bottom of 1.2 m height glass cylinder filled with artificial cerebrospinal fluid (aCSF) at 30° for 24 h. Hydrostatic pressure was calculated as 74 mmHg at the bottom of the column. The aCSF contained (in mM): 124 NaCl, 5 KCl, 2 MgSO4, 2 CaCl2, 1.25 MgH2PO4, 22 NaHCO3, 10 glucose, bubbled with 95%O2-5% CO2. Glutamate (1 mM) was administered in some experiments. Upon completion of an experiment, eyecups were sliced into two or three equal segments, and fixed in a solution containing 2.5% glutaraldehyde overnight at 4°C. After postfixation with 1% osmium tetroxide for 60 min, specimens were dehydrated in an alcohol series, embedded in Epon, and cut into 1-µm-thick sections. For immunocytochemistry, the specimens were fixed with 4% paraformaldehyde in 0.1 M phosphate buffer for 1 hour. They were then embedded in OCT compound, and frozen with liquid nitrogen. Cryosections were incubated with anti-human glial fibrillary acidic protein (GFAP) antibody. FITC-conjugated goat anti-rabbit IgG antibody was applied to the frozen section as a second antibody. Binding sites of IgGs were detected by confocal laser scanning microscopy.
Main outcome measure: Histological and immucocytochemical analyses.
Results: 1. Elevated hydrostatic pressure led to axonal swelling of the retinal ganglion cells. In accordance with the previous in vivo experiment, there was marked accumulation of smooth-surfaced vesicles in the swollen axon. An increase in RNFL thickness was statistically significant compared with controls. 2. Administration of 1 mM glutamate caused Müller cell swelling in eyecups not exposed to elevated pressure. Müller cell swelling was considered as an accumulation of glutamate. 3. Under the elevated hydrostatic pressure with aCSF containing 1 mM glutamate, the retinas exhibited excitotoxic neuronal degeneration. Glutamate-mediated Müller cell swelling was prevented in this experimental condition. 4. Müller cells reacted to the insult of elevated hydrostatic pressure by expressing GFAP, which was considered as a pathological marker for the cell stress.
Conclusions: Based on the present findings, it is considered that presumable obstruction of axonal transport led to axonal swelling and disruption of the glial glutamate uptake resulted in exitotoxicity are the fundamental mechanism of pathogenesis in the present glaucoma model.
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P117 STEM CELLS AND GLAUCOMA: PRELIMINARY RESULTS

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Objective: In the last years some authors explored the possible role of stem cells in the therapy of glaucoma. In our experience, bone marrow-derived mesenchimal autologue stem cells (that considering literature don't seem to have teratogenous effects) used with intravitreal or via pars plana injection, can repair the loss of ganglionar retinal cells (for glaucomatous optic neuropathy) or, genetically modified, can modulate the function of ciliary bodies or can generate growth factors for neuroprotection (CNTF, GDNF,PEDF). Immunohistochemical studies have shown that ocular hypertension induces modifications into trabecular tissue, particularly a reduction of trabecular cells. In this preliminary study we propose to evaluate if it is possible to repopulate trabecular meshwork cells in glaucomatous patients inoculating bone marrow-derived mesenchimal stem cells in the anterior chamber of the eye.
Design: Ocular hypertension is induced in rats. Bone marrow-derived mesenchimal stem cells are implanted in the anterior chamber of one of the eyes. The untreated is used as a control. The animals are sacrificed at different time points and the eyes are subjected to histological and immunohistochemical examination.
Participants and controls: We induced ocular hypertension and implanted mesenchimal stem cells in the right eye of 12 adult rats (left eye as control).
Methods: Ocular hypertension was periodically induced in rats by means of a needle-cannula with manometer in the anterior chamber of the eye. The animals (three for each of the first two time points, 5 at day 30) were sacrificed at 1,7 and 30 days from the implant, and the eyes were subjected to hystological and immunohystochemical examination.
Main outcome measure and Results: At day one from the implant in all cases stem cells were present in the trabecular tissue. None of the cells showed signs of differentiation. At day 12 stem cells were present in two rats, absent in one. In one of the two positive cases the cells were differentiated, in the other one were not differentiated.
At day 30 in four rats cells were present and in one rat were not present. In 3 of the 4 rats cells were differentiated. We lost one rat during the study.
Conclusions: Preliminary results suggest that stem cells can replace trabecular tissue cells damaged by glaucoma.
We will extend the study to a larger number of experimental animals, analyzing the effect upon IOP. We will test injection

of stem cells both in anterior and in vitreal chamber (to suggest a complete treatment of glaucoma).

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5.3. Experimental glaucoma; animal models: Other

P118 A MODEL TO MEASURE TISSUE HYDRAULIC PERMEABILITY IN RABBIT CAPSULES POST GLAUCOMA SURGERY

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Objective: It has been well established that the hallmark of failure of any glaucoma filtration surgery is postoperative conjunctival scarring. Mechanical forces have been shown to have a significant influence on fibroblast-mediated wound healing activity and wound remodelling. These factors may be particularly important following glaucoma surgery where ocular fluid (aqueous humour) perfuses the wound site. As yet, no animal model of glaucoma surgery described enables fluid flow and pressure through the subconjunctival tissues to be regulated and measured consistently and reliably. We aimed to establish a model to measure tissue hydraulic permeability in rabbit capsules post experimental glaucoma filtration surgery to evaluate the influence of biomechanics on the wound healing response following glaucoma surgery.
Design and Participants: This was a study of 8 New Zealand White rabbits undergoing modified filtering surgery in their left eyes and their right eyes were used as controls.
Intervention: Each rabbit had a single-plate paediatric Molteno implant placed in the superotemporal quadrant of their left eyes. The rabbits were allocated to one of 2 groups. The first group would have measurements done at 1 week after surgery (n = 4) and the second would have measurements at 4 weeks (n = 4). The drainage tube within the anterior chamber was cannulated ostium in-situ with a needle attached to a pressure transducer and fluid column at 15 mmHg and the drop in the fluid column was measured every minute for 5 minutes. For the control group, the anterior chamber of the unoperated fellow eyes was cannulated and similar measurements were performed on the same day as that of the other eye.
Main outcome measure: The drop in height of the fluid column was a reflection of the tissue hydraulic permeability of the rabbit capsule of the operated eyes and a reflection of the outflow in the control eyes.
Results: At 1 week after surgery, the drop in the height of the fluid column was (mean ± SD) 1.46 (0.74 mm/min/mmHg, whereas at 4 weeks, it was 0.10 (0.07 mm/min/mmHg (p = 0.03, Pair-t test). The control eyes had a mean drop in the height of the fluid column at 1.41 ± 0.17 mm/min/mmHg.
Conclusion: Tissue hydraulic permeability in rabbit capsules post glaucoma filtration surgery can be quantified reliably and consistently with this model. A 4-week post-surgery capsule in the rabbit has reduced tissue permeability as compared to that at 1 week post-surgery.

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P119 ANTISCARRING EFFECT OF COMBINED BEVACIZUMAB WITH 5-FLUOROURACIL ON BLEB SURVIVAL FOLLOWING EXPERIMENTAL GLAUCOMA FILTRATION SURGERY

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Purpose: The management of post-operative scarring after trabeculectomy remains clinically challenging. Current treatment of failing blebs is with subconjunctival 5-Fluorouracil (5FU) injections. Bleb vascularity is one of the clinical predictors of poor bleb function. 4 TGF beta stimulates VEGF production in human conjunctival fibroblasts. We postulate that VEGF is actively involved in the post-op scarring response and bleb failure. The aim of the study was to determine the effect of Bevacizumab combined with 5FU on bleb survival following trabeculectomy in the rabbit and compare its effect with Bevacizumab only, 5FU only and placebo.
Design and participants: This was an observer-masked study of twenty-six New Zealand White rabbits undergoing modified filtering surgery.
Methods: The animals were allocated to one of four treatment groups i.e. placebo (phosphate buffered saline, PBS) control (n = 7), 5 fluorouracil (5FU) (n = 4), bevacizumab (n = 8) or bevacizumab + 5FU (n = 7). Subconjunctival injections of the agent(s) were administered immediately after surgery and then weekly for 28 days.
Main outcome measure: The primary outcomes were bleb survival, bleb vascularity and expression of fibrotic markers. The clinical parameters were graded by two masked observers. The animals were sacrificed and the eyes histologically analysed for signs of scarring, collagen I and fibronectin expression at the bleb site were quantified by RT-PCR.

Results: At day 28, At day 28, all 7 of the blebs (n = 7, 100%) in the bevacizumab/5FU treated group remained functioning compared to 3 out of 8 (37.5%) blebs with bevacizumab treatment alone, 1 out of 4 in the 5FU (25%) group and 0 in the placebo group. Near normal conjunctival vascularity was observed in bevacizumab/5FU-treated eyes, compared to bevacizumab and placebo-treated eyes, where there was an increase in vascularity noted on days 21 and 28. Bevacizumab/5FU-treated blebs had significantly less expression of collagen I and fibronectin ($p < 0.05$).
Conclusion: Combined Bevacizumab with 5FU may provide a more effective antiscarring alternative than 5FU alone in the treatment of post-trabeculectomy bleb failure.
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6.1. Clinical examination methods: Intraocular pressure measurement; factors affecting IOP

see also P047, P275, P310, P347, P353, P361

P120 CORNEAL THICKNESS MEASUREMENTS IN NORMAL-TENSION GLAUCOMA WORKUPS: IS IT WORTH THE EFFORT?

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Purpose: To correlate central corneal thickness and intraocular pressure with disease severity in normal-tension glaucoma patients.
Design: We conducted a retrospective review of all patients diagnosed with normal-tension glaucoma (NTG) in our institution between 2002-2006. NTG was diagnosed according to the glaucomatous visual fields loss, glaucomatous optic disc cupping and an intraocular pressure (IOP) < 22 mmHg on diurnal curve measurements. Mean central corneal thickness (CCT) and IOP values before and after treatment were also evaluated. Patients were divided into three groups according to advanced glaucoma intervention score (mild, moderate and severe visual field defects).
Main outcome measures: IOP (before and after treatment) CCT.
Results: A total of 33 females and 35 males with bilateral NTG were enrolled. The mean follow up was 4.6 years. CCT was inversely correlated with glaucoma severity. CCT was normal in both eyes in mild disease, thin in the right eye and normal in the left eye in moderate disease, and low in both eyes in severe disease. Initial bilateral mean maximal IOP was similar at all disease stages and became lower following treatment in parallel to disease severity: 13.44, 12.22, 11.63 mmHg in the right eye and 13.29, 12.60 and 12.32 mmHg in the left eye, respectively. There was no statistical difference in disease severity between the right and left eyes.
Conclusions: CCT correlated with disease severity: the more advanced the disease, the thinner the cornea. Initial maximal IOP did not predict disease severity, but it was lower in the more severe cases following treatment, possibly representing a more aggressive treatment protocol.
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P121 INTRAOCULAR PRESSURE VARIATIONS BEFORE AND AFTER VISUAL FIELD TEST

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Objective: To evaluate the influence of visual field (VF) examinations on the intraocular pressure (IOP).
Design: Prospective, case-control study
Participants and/or controls: Thirty patients with primary open-angle glaucoma (POAG), in 30 patients with normal-tension glaucoma (NTG) and in 30 healthy subjects.
Methods: Intraocular pressure was measured in 30 patients (60 eyes) with primary open-angle glaucoma (POAG), in 30 patients (60 eyes) with normal-tension glaucoma (NTG) and in 30 healthy subjects (60 eyes) before and immediately after VF examination (Humphrey 640 Field Analyzer, central 24-2 SITA standard program). All patients had stable IOP and were treated for glaucoma.
Main outcome measure: IOP.
Results: The mean IOP was 14.9 ± 2.8 mmHg and 15.1 ± 2.9 mmHg in normal subjects, 14.2 ± 3.3 mmHg and 14.1 ± 3.1 mmHg in NTG, and 17.3 ± 3.8 mmHg and 17.5 ± 3.9

mmHg in POAG before and after the VF test. The mean differences in IOP were less than 2 mmHg before and after the VF examination, and there were no statistically significant differences in each group.
Conclusion: The VF techniques with relative short examination time (it takes 7 minutes to test VF with central 24-2 SITA standard program per eye) do not seem to significantly influence IOP.
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P122 CALIBRATION OF MODERN TONOMETERS
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Objective and purpose: Only precise calibration of modern tonometers guarantees reliability of measurement assessed for clinical diagnosis or follow-up of the glaucomas. The correctness for the measurement of intraocular pressure, the fundamental measurement parameter in ophthalmology, leads to right estimation and correct assessment of the health state of human eye. The measurement accuracy connected with the knowledge of measurement uncertainty of a tonometer characterise the measurement quality of modern tonometers.
Design: The calibration of human eye tonometers is in the most cases performed by clinical comparison measurements with a reference tonometer. The purpose of this comparison is the exact determination between the measured values of a reference tonometer and the tonometer (called test tonometer) to be calibrated. Before carrying out the clinical comparison measurements the reference tonometer has to be calibrated by means of special test apparatuses. The international standard of tonometers ISO 8612 is the current basis to control the calibration of modern tonometers. This standard applies two different methods for data analysis between measurement results of reference and test tonometer, the differences method and the total method of least squares.
Method: The clinical calibration state of tonometers is transferred to tonometers of the same design by means of test apparatuses. These test apparatuses own a feedback to physical unities, for instance the mass, the length, the force, the pressure. By applying these test apparatuses the clinical calibration state of a test tonometer is conserved.
Main outcome measure: A new procedure is introduced and performed for the description of the mathematical dependence between the measurements events of reference and test tonometer. The application of the new method is presented, elucidated, and assessed.
Results: The newly performed method has the advantages of both mathematical procedures of the international standard ISO 8612 with a better representation of measurements results by applying of one proceeding. The new method is applicable to calibrate modern tonometers of completely different design, *e.g.*, non-contact tonometers, rebound tonometers, impedance tonometers, contur tonometers, and so on.
Conclusion: The correct calibration by clinical comparison measurements of is the fundamental basis for the measurement quality and measurement stability of modern tonometers. The correct measurement of intraocular pressure on human eye guarantees to apply right medical treatment methods in diagnostics and therapy.
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P123 METABOLIC SYNDROME AS A RISK FACTOR FOR HIGH OCULAR TENSION
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Purpose: The metabolic syndrome is a collection of risk factors that increase a person's chance of developing heart disease, stroke, and diabetes. The mean IOP value is reported to increase linearly according to the number of risk factors for metabolic syndrome. The aim of present study is to examine the relationship between high ocular tension and the metabolic syndrome.
Design: Cross-sectional study.
Participants: This study involved 10182 apparently healthy Japanese, 18 to 79 years of age, with a mean IOP of 14.6 ± 3.0 mmHg in a medical health checkup program at Murakami Memorial Hospital. The participants who reported previous ophthalmic anti-glaucoma therapy or operation, or usage of steroid drugs were excluded. Moreover, participants who reported the use of any drugs which could influence the metabolic syndrome were also excluded.
Methods: Intraocular pressure (IOP) was examined by non-contact tonometer (TOPCON CT-90A, TOPCON Corp., Tokyo, Japan) between 9 and 10-o'clock AM. We averaged three successive IOP measurements per eye and adopt the values of right-eye IOP. Optic disc was evaluated by fundus photography (TOPCON TRC-NW200, TOPCON Corp., Tokyo, Japan) with no mydriasis. High ocular tension was defined as IOP more than 21 mmHg without optic disc abnormalities or history of receiving any anti-glaucoma therapy.

Modified criteria of the National Cholesterol Education Program Adult Treatment Panel III were used to characterize the metabolic syndrome. We undertook blood and urine examinations with MODULAR ANALYTICS (Hitachi High-Technologies Corp., Ltd., Tokyo, Japan). Air temperature was assessed from the Gifu Meteorological Observatory, Gifu, Japan.
Main outcome measure: The prevalence of high ocular tension, the rate of subjects with high ocular tension in each group divided by the number of metabolic syndrome components and the adjusted odds ratio of the metabolic syndrome for high ocular tension.
Results: The prevalence of high ocular tension was higher in the male and female subjects with the metabolic syndrome than in those without (P < 0.01, both). There was a linear relationship between the rate of high ocular tension and the number of components of metabolic syndrome, both in males and females. To analyze by logistic regression, the metabolic syndrome was positively, and maximum temperature was negatively correlated with high ocular tension in males (adjusted odds ratio: 2.92 [95% CI, 1.79 to 4.78] and 0.95 [95% CI, 0.91-0.98], respectively) and in females (adjusted odds ratio: 9.94 [95% CI, 3.17 to 31.16] and 0.92 [95% CI, 0.86-1], respectively).
Conclusions: The metabolic syndrome is associated with high ocular tension. When evaluating IOP, the metabolic syndrome is one of the important factors. To better glaucoma treatment, the patients with the metabolic syndrome should be provided guidance in improving their metabolic syndrome.
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P124 COMPARISON OF IOP MEASUREMENTS IN POST-LASIK EYES USING GOLDMANN APPLANATION TONOMETER AND OCULAR RESPONSE ANALYZER IN INDIAN SUB-POPULATION
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Purpose: To determine the efficacy of ORA in measurement of Intra Ocular Pressure(IOP) following LASIK.
Design: Cross-sectional, observational, non-interventional study.
Participant and/or controls: Patients who underwent LASIK at Narayana Nethralaya, Bangalore, India.
Methods: IOP measurement using GAT and ORA.
Main outcome measure: IOP was measured one month following LASIK (-1.25D to -17D) using GAT and ORA which yielded corneal compensated IOP (IOPcc), Goldmann correlated IOP (IOPg), corneal Hysteresis (CH) and corneal resistance factor(CRF). Central corneal thickness (CCT) was measured pre-operatively and one month post LASIK.
Results: Fifty-one eyes of 26 patients (7 male, 19 female) were studied. Mean age 28.23 ± 6.67 years. Mean GAT 13 ± 3.02 mmHg, mean IOPcc was 15.227 ± 2.39 mmHg, mean CH 8.016 ± 1.32 mmHg, CRF 7.25 ± 1.41 mmHg. Statistical significance was noted between GAT, IOPcc and IOPg (p < 0.0005, t test). GAT showed a moderate correlation with IOPcc and IOPg (r = 0.514, r = 0.665 respectively). IOPcc had a negative correlation with CH (r = -0.465) as compared to GAT (r = 0.123).The difference between IOPcc and GAT and IOPg and GAT were analysed using multiple regression analysis and found to be statistically significant with respect to age, CRF and CH (Std error = 0.011, 0.058, 0.000 and 0.011, 0.006, 0.027 respectively).GAT was found to have a weak correlation with CCT (r = 0.264) while IOPcc did not have a correlation (r = 0000).
Conclusions: In post-LASIK eyes with low CH values GAT underestimated the true IOP. IOPcc was least influenced by central corneal thickness as compared to IOP measured using GAT.ORA is a valuable tool in measurement of IOP in post LASIK eyes.
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P125 COMPARISON OF INTRAOCULAR PRESSURE, MEASURED WITH THE PASCAL DYNAMIC CONTOUR TONOMETRY, GOLDMANN APPLANATION TONOMETRY AND MAKLAKOV TONOMETRY
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Purpose: To compare the intraocular pressure (IOP), measured with the Pascal dynamic contour tonometry (DCT), Goldmann applanation tonomety (GAT) and Maklakov applanation tonometry.
Design: Prospective comparative study.
Participants: The IOP of 40 patients (76 eyes) with primary open-angle glaucoma (POAG) at an average age of 58.8 ± 16.5 years was measured.
Methods: Central corneal thickness (CCT) was measured with the ultrasound pachymeter. All other routine diagnostic methods used in the opthalmolgy practice were made: biomicroscopy, ophthalmoscopy, gonioscopy, computer perimetry.
Main outcome measure: The mean CCT was 542.68 ± 40.5 µm. The mean IOP with Pascal DCT was 19.47 ± 4.14 mmHg.

The mean IOP with GAT was 19.64 ± 5.29 mmHg and with Maklakov - 20.57 ± 4.38 mmHg.
Results: In the result of the research made similar results were obtained of the IOP value, measured by the three methods and conformable with the CCT factor to the Goldmann's tonometry.
Conclusion: A significant difference was not found between the IOP records, according to the Pascal's, Goldmann's and Maklakov's tonometers.
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P126 INTRAOCULAR PRESSURE MEASUREMENTS VALUES IN PATIENTS WHO HAVE HAD VARIOUS LAMELLAR KERATOPLASTIES
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Purpose: To effect of corneal thickness in patients who have had Descemet's stripping endothelial keratoplasty (DSEK) or deep anterior lamellar keratoplasty (DALK) on intraocular pressure (IOP) measurements investigated using two different techniques.
Design: Prospective cross-sectional study.
Participants and controls: Participants were divided into three groups. Group 1: Twenty patients who have had uneventful DSEK; Group 2: Twenty-one patients who had have uneventful DALK, at least 12 months prior to testing; Group 3: Control group of 30 healthy patients.
Methods: Intraocular pressure was determined by Goldmann applanation tonometry (GAT) and iCARE (IC) rebound tonometer. Central corneal thickness, endothelial disc (ED) and graft site (GS) were determined by anterior segment OCT (Visante OCT).
Main outcome measure: Mean GAT and IC IOP levels were calculated for the three groups: DSEK, DALK and control. The agreement between results from IC and the GAT were assessed using the Bland-Altman method. The deviation of IC readings from GAT values, corrected for CCT, ED and GS were calculated and correlated to CCT using a linear regression model.
Results: In DSEK group mean CCT was 697.51 ± 54 microm, in DALK 470. 6 ± 39 microm and in control 550.9 ± 29 microm. The mean IOP ± standard deviation (SD) in group 1: 12.8 ± 3.8 mmHg; in group 2: 16.5 ± 11.1 mmHg and in group 3: 16.7 ± 4.2 mmHg for IC. GAT measurements: 2.8 ± 4.05 mmHg in group 1; 15.7 ± 2.4 mmHg in group 2; and 13.2 ± 2.6 mmHg in control. IC IOP measurements were significant higher than GAT ($P < .005$) in all groups. The difference between IOP and CCT, ED and GS readings were not statistically significant ($P = .53$). The correlations between IOP and corneal thickness were not significant in these cohorts ($P > .09$). The agreement between results from IC and the GAT was assessed.
Conclusions: Intraocular pressure measured by IC was consistently higher when compared with GAT, and this difference was greatest with thicker CCT. Falsely elevated IOP in GAT was not demonstrated after DSEK as well as falsely underrated IOP in DALK. There is agreement between results from IC and the GAT.
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6.1.1. Clinical examination methods: Intraocular pressure measurement; factors affecting IOP: Devices, techniques

see also P155

P127 CORRELATION OF OCULAR PULSE AMPLITUDE AS MEASURED BY GOLDMANN APPLANATION TONOMETRY WITH THAT MEASURED BY DYNAMIC CONTOUR TONOMETRY
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Introduction: Various landmark studies have pointed out that patients with lower intraocular pressures (IOP) could have progressive visual field loss while patients with higher IOP s could have no visual field loss. Ocular pulse amplitude (OPA) is becoming an emerging parameter for predicting such visual field loss in glaucoma .A decrease in OPA of patients suffering from normal tension glaucoma (NTG) has been noted.Increased OPA appears to protect ocular hypertensive patients from visual field loss. OPA is measured quite accurately in the present day, but the Dynamic contour tonometer (DCT) involves an initial and recurrent expenditure. Goldmann applanation tonometry (GAT) has been used to correlate intraocular pressures, but has not yet been tried in assessing OPA, though it gives an oscillatory reading which may be used to record OPA.
Aim: To correlate OPA measured by GAT with that measured by DCT.
Methods: In a prospective study done on 100 eyes of healthy

patients (without glaucoma or any other ocular or systemic disease) between the ages of 25 to 45 years, OPA was measured using DCT (called DOPA) and Estimated OPA was measured by GAT (called GOPA) and the values were compared by various statistical methods. The sample size was calculated by the Chebychev's inequality method as the distribution of the values is still unknown. The formula used was $N = \sigma/\alpha k2$, where k = difference between sample mean and population mean and s is population standard deviation.Since the study was done at 1% significance and K as well as population standard deviation was considered as one, the sample size was determined to be 100. In GAT, when the hemi circles start oscillating the pressure at which they just touch each other from outside in and the pressure at which they meet from inside out are noted and the difference between the two was called GOPA. The GAT reading was taken first in every eye to avoid bias.DCT recorded OPA electronically.

Results: A good correlation between OPA measured by DCT and GAT was found as seen in all the statistical tables.The Bland Altman plot also showed agreement of measurements by the two instruments. OPA was found to reduce with age.

Conclusion: OPA may be measured accurately by the existing GATs in our clinical practices and may not need expensive DCTs. This could give important information regarding the possibility of a patient developing a field defect and thus prevent under treatment as well as over treatment even at centres where expensive DCTs may not be available.

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P128 HOW BREATH HOLDING CHANGES THE PASCAL DYNAMIC CONTOUR TONOMETER MEASUREMENTS IN HEALTHY, YOUNG, MALE SUBJECTS

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Purpose: To detect the effect of breath holding on short term variations of intraocular pressure (IOP) and ocular pulse amplitude (OPA) values in healthy, young, male subjects.

Methods: IOP and OPA values were measured before and during breath holding by Pascal dynamic contour tonometer (PDCT) in 105 eyes of 55 healthy, male subjects.

Results: Mean ± SD IOP before breath holding in the eyes of subjects was 17.11 ± 12.83 mmHg and during the breath holding was 19.88 ± 84.04 mmHg. The increase in IOP during the breath holding was found statistically significant ($p < 0.01$). Mean ± SD OPA value before breath holding in the eyes of subjects was 3.49 ± 1.38 and during the breath holding was 3.52 ± 1.38 mmHg. The difference was found statistically insignificant ($p = 0.933$)

Conclusions: In this study cohort , the OPA remains stable during breath holding and was not correlated with IOP change meanwhile. Our findings suggest that short duration breath holding in healthy, young, males do not affect ocular hemodynamics.It was concluded that the absence of any effect could be due to successful ocular blood flow autoregulation in young, healthy, male subjects.

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P129 EFFECT OF CENTRAL CORNEAL THICKNESS ON TONOMETRY AS MEASURED BY DYNAMIC CONTOUR TONOMETRY AND GOLDMANN TONOMETRY IN PRIMARY CONGENITAL GLAUCOMA

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Purpose: To analyze the agreement, and the influence of central corneal thickness (CCT) on intraocular pressure (IOP) measurements obtained with dynamic contour tonometry (DCT) and Goldmann applanation tonometry (GAT) in primary congenital glaucoma (PCG) patients.

Methods: Eighteen (31 eyes) PCG patients (25.7 ± 7.2 years old) were examined. PCG was defined by history of elevated IOP, enlarged corneal diameter (buphthalmos), Haab's striae and abnormal findings at gonioscopy. GAT (Haag Streit R900, Switzerland), DCT (SMT Swiss Micro Technology, Switzerland), and CCT (Sonomed Micropach 200P+, USA) measurements were obtained, in this order, by three examiners (one examiner per instrument). The mean of 5 CCT measurements was used for analysis. DCT measurements were accepted only when quality scores indicated good quality (1 or 2). Linear regression analysis was performed to test the correlation between CCT, DCT and GAT measurements. Bland Altmann analysis was performd to evaluate the agreement between DCT and GAT measurements.

Results: Mean CCT was 534 ± 72.3 µm (range: 430 to 610). Mean IOP measurements were 15.1 ± 4.2 mmHg (range: 7 to 34) for DCT and 14.5 ± 5.6 mmHg (range: 5,5 to 22,7) for GAT ($P = 0.514$, paired t test). Spearman correlation tests showed IOP measured by GAT and DCT to have poor cor-

relation with CCT (r = 0.006, P = 0.38 and r = 0.035, P = 0.82, respectively). IOP measurements by GAT displayed a strong correlation with those obtained with DCT (r = 0.462, P = 0.0089). Bland-Altmann analysis revealed poor agreement between DCT and GAT readings, with 95% confidence intervals of ± 5.31 mmHg.
Conclusions: Although GAT and DCT measurements did not differ significantly in these PCG patients, there was a poor agreement between the measurements obtained with each instrument. Neither DCT nor GAT was influenced by CCT in this series of PCG patients.

P130 24-H IOP MEASUREMENTS USING iCARE TONOMETER

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Purposes: To evaluate the reliability and precision of intraocular pressure measurements over 24 hours using the iCARE tonometer.
Design: Clinical, prospective, monocentric, non-randomised, unmasked study.
Participants: Eighteen patients investigated or treated for glaucoma.
Methods: The intraocular pressure (IOP) was initially measured using a Goldmann applanation tonometer (GAT) and patients were then given an iCARE tonometer for regular measurements over 24 hours. Measurements were conducted between February and November 2008.
Main outcome measure: IOP, best corrected visual acuity (BCVA), number of medication.
Results: Data were obtained for 18 patients, 12 women and 6 men. The mean follow-up was 4.1 ± 3.1 months, and the mean age at the time of measurement was 59.3 ± 11.3 years. The mean GAT IOP was 14.9 ± 2.8 mmHg for the right eye, and 14.1 ± 2.8 mmHg for the left eye. The mean number of iCARE IOP measurements was 13.6 ± 6.4 and included measurements performed at regular basis throughout a 24h period (00:00; 04:00; 08:00; 12:00; 16:00; 20:00; 24:00). The mean iCARE IOP was 13.9 ± 2.3 mmHg and 13.3 ± 2.3 mmHg for the right and left eye, respectively. The difference between GAT and iCARE tonometry over 24h was not significant (p = 0.77). The best corrected visual acuity was 0.8 ± 0.4 for the right eye, and 0.9 ± 0.2 for the left eye, and the mean number of medication was 1.7 ± 1.5.
Conclusions: IOP measurements over 24h using the new iCARE tonometer is an easy and convenient technique to obtain valuable data of the IOP profile for patients at risk of uncontrolled glaucoma during a day and night period. The patients founded the use of this device simple and practicable. Comparison with the gold standard applanation tonometry technique showed no statistical differences in the IOP measurements.
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P131 COMPARISON OF GOLDMANN APPLANATION TONOMETRY WITH DYNAMIC CONTOUR TONOMETRY IN EYES WITH INTRAOCULAR PRESSURE GREATER THAN 30 MMHG

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Purpose: To compare the intraocular pressure (IOP) measurements obtained using the dynamic contour tonometer (DCT) with the Goldmann applanation tonometry (GAT) in eyes with IOP greater than 30 mmHg measured by GAT.
Design: A prospective clinical study.
Participants: Twenty-four eyes (24 patients) whose IOP was greater than 30 mmHg as measured by GAT at the initial examination.
Methods: IOP was measured by GAT and DCT. Central corneal thickness was measured using a specular microscope. The order of measurements was GAT-IOP, DCT-IOP, and then CCT. When the IOP was reduced to 21 mmHg or less measured by GAT after medical therapy had been given, IOP and CCT measurements were taken in the same sequence. Statistical analysis of the data included Wilcoxon signed rank test, Spearmann correlation coefficient and Bland-Altman analysis.
Main outcome measures: GAT-IOP, DCT-IOP and CCT.
Results: At the initial examination, the mean DCT-IOP of the hypertensive eyes was significantly lower than their mean GAT-IOP (29.6 ± 7.0 mmHg *vs* 38.7 ± 9.6 mmHg, p < 0.001). After the IOP-lowering medical therapy had been instituted, the mean DCT-IOP was significantly higher than the mean GAT-IOP (17.9 ± 3.2 mmHg *vs* 15.5 ± 2.7 mmHg, p < 0.001). The mean CCT showed no significant difference after the IOP-lowering therapy (539.4 ± 28.2 µm *vs* 544.5 ± 47.2 µm, p = 0.597).
Conclusion: IOP readings taken by DCT seem to be lower than those by GAT in eyes with severe ocular hypertension exceeding 30 mmHg of GAT-IOP.
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P133 THE POSSIBILITY OF USING THE ICARE TONOMETER FOR SELF-EXAMINATION OF INTRAOCULAR PRESSURE

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Purpose: The ICare® (ICare Finland Oy, Helsinki, Finland) is a rebound tonometer which has a solenoid mechanism that launches a magnetized probe and detects its motion parameters during impact on the cornea. This tonometer is light and compact, and can measure intraocular pressure (IOP) without topical anesthesia. Therefore, the characteristics of this tonometer may prove to be ideal for the self-examination of IOP. In this study we evaluated the usefulness of the ICare® tonometer for the self-examination of IOP.
Design: Evaluation of a new self-examination method for measuring IOP.
Participants: Enrolled in this study were 104 eyes of 52 healthy right-handed volunteers. Volunteers who regularly used soft contact lenses were instructed to remove the lenses for at least 24 hours prior to participation in the study.
Methods: IOP was measured using the ICare® tonometer by an ophthalmologist and by the participants themselves, consecutively. In order to accurately attach the ICare® probe against the center of the cornea during self-measurement, an eyeglass frame was used. A colored board with a 7-mm diameter hole in its center was affixed to the eyeglass frame in place of the usual clear lens. The participants were then instructed to wear the frame, to insert the ICare® probe into the hole, and to self-measure IOP of both eyes with their most convenient method.
Main outcome measure: The accuracy of the self-measurements by the participants was categorized into four subgroups based upon whether the position of probe-tip was in alignment with the center of the cornea. The correlation between the IOP readings obtained by the ophthalmologist and those obtained by the participants during self-examination was evaluated using the Pearson correlation coefficients and regression analysis.
Results: We excluded the data of 23 eyes in which the ICare® probe failed to touch the cornea due to the unsuitable distance or malposition of the probe. In the remaining 81 eyes, there was a correlation between the IOP readings obtained by the ophthalmologist and those obtained by the participants during self-examination ($r = 0.525$). The correlation was stronger when the position between the probe and cornea was in better alignment. In 34 eyes, the probe touched the corneal center exactly, and the readings were strongly correlated ($r = 0.907$). In those 34 eyes, we also compared IOP readings between the right eyes and left eyes, and found that right eyes were in stronger correlation, partly because the direction of the probe might be slightly tilted, due to the cross action of the dominant right arm.
Conclusions: Using our new self-examination method, the ICare® tonometer produced highly reliability IOP readings. This tonometer has the possibility of being used as a home tonometer and will be available clinically for the detection of diurnal changes in IOP.
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P134 COMPARATIVE STUDY OF REBOUND TONOMETER AND GOLDMANN APPALANATION TONOMETER IN POAG PATIENTS AND ITS CORRELATION WITH CENTRAL CORNEAL THICKNESS

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Objective or purpose: To compare IOP measurements by rebound tonometer (RBT) and Goldmann applanation tonometer (GAT) and to find out the effect of central corneal thickness (CCT) values on IOP measurements in both of these methods in POAG patients.
Design: Prospective case-controlled study.
Participants and/or controls: Fifty six eyes of 28 primary open-angle glaucoma patients were being tested.
Exclusion criteria: Patients with secondary glaucomas, previous ocular surgery, any anterior or posterior segment pathology other than glaucoma likely to affect VF, narrow angles.
Intervention or methods or testing: Age, sex, IOP was measured with rebound tonometer and Goldmann tonometer, CCT measurement was done, Slit lamp examination, gonioscopy, HFA and OCT were done to confirm diagnosis of glaucoma.
Main outcome measure: IOP by RBT and GAT and CCT were the main outcomes. The mean IOP measurement by the RBT was compared with the measurement by the GAT, by Student's t-test. The effect of CCT on measured IOP was explored by linear regression analysis.
Results: The mean patient age was 58 years (ranged: 45-80 years). There were 60% men and 40% women in the study group. The mean IOP readings were 24.60 ± 3.20 mmHg using the RBT, and 25.06 ± 3.2 mmHg using the GAT. The difference was not statistically significant (mean difference .46). In more than 85% of cases the IOP readings differed by < 2.2 mmHg between the RBT and GAT. The IOP measurements with the two methods were correlated with CCT. On comparing, correlations of CCT to RBT and GAT didn't show statistically significant effect difference between the two.
Conclusions: The RBT values are found to be slightly higher than the IOP values with the GAT. Nevertheless, the RBT readings appeared to be similarly affected by the various thicknesses of different corneas as compared to those obtained with GAT. Further, RBT is proved to be a safe and well tolerated contact procedure. This is of special value in screening settings, in people who have difficulties in positioning their head on the slit lamp (children, wheelchair, obese), and in cases where eye drops have to be avoided. Rebound tonometry is an easy-to-use, fast and reliable method for IOP measurement. It does not require topical anaesthesia as well

as fluorescein. No patient has complained about even mild pain or discomfort with rebound tonometer in our study.

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P135 COMPARISONS OF INTRAOCULAR PRESSURE MEASUREMENTS: GOLDMANN APPLANATION TONOMETRY, NONCONTACT TONOMETRY, TONO-PEN TONOMETRY AND DYNAMIC CONTOUR TONOMETRY

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Purpose: To compare intraocular pressure (IOP) readings between Tono-Pen tonometry and GAT, between noncontact tonometry (NCT) and GAT, and between dynamic contour tonometry (DCT) and Goldmann applanation tonometry (GAT). The correlation between IOP reading and possible confounder was identified.

Design: Observational cross-sectional study.

Participants: Sixty-two healthy subjects.

Methods: All IOP and ocular pulse amplitude (OPA) measurements were taken by a single ophthalmologist; mean keratometric power (MK), central corneal thickness (CCT) and lens thickness (LT) were measured by a single experienced technician.

Main outcome measure: K, CCT, LT and OPA

Results: Stepwise multiple regression analysis indicated that GAT ($p = 0.017$) and DCT ($p = 0.002$) readings correlated positively with MK; GAT, NCT and Tono-Pen readings correlated positively with CCT ($p < 0.05$); NCT ($p = 0.035$) and DCT ($p = 0.016$) readings correlated negatively with LT; GAT ($p = 0.006$) and Tono-Pen ($p = 0.009$) readings correlated positively with OPA.

Conclusions: The K, CCT, LT and OPA are confounders in tonometry readings.

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P136 CAN I-CARE TONOMETER REPLACE THE GOLD STANDARD?

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Objective: To compare Rebound I-care tonometer with Goldman Applanation tonometer (GAT) in terms of correlation and agreement between two methods. And also to evaluate the influence of pachymetry (CCT) on IOP measurements by each instrument.

Design: Prospective non randomized observational case series.

Participants: Two hundred and three eyes of 102 patients (more than 16 yrs of age) attending general ophthalmology clinic at a tertiary eye care centre in Nov.-Dec 2008. Eyes with IOP < 10 mmHg and > 23 mmHg were excluded and 192 eyes were analyzed. Tests: A single observer using GAT and I-care tonometer measured intraocular pressure, and the pachymetry. Bland Altman analysis was then done to compare the two tonometers. Correlation coefficient was calculated for the two tonometers. The correlation of I-care and GAT readings to CCT was also studied by linear regression model.

Outcome measures: Correlation co-efficient (r) of Pearson correlation between two methods, Bias and limits of agreement between two methods (Bland & Altman), co-efficient of linear regression (r^2) model for association with CCT.

Results: Pearson correlation between two methods showed an $r = 0.78$ (95% confidence interval of 0.71-0.83; p- value < 0.0001). The Bland Altman analysis showed a bias of -0.21 with 95% confidence interval of -0.60 to 0.17 (p-value 0.2783), 95% limits of agreement were ranging from -5.51 to 5.08 mmHg. The association between CCT and IOP measurements with I-care ($r^2 = 0.14$) and GAT ($r^2 = 0.05$) were clinically insignificant.

Conclusion: The correlation between I-care tonometer with Goldman Applanation tonometer is good, but the limits of agreement are wide. Hence it is evident that I-care tonometer can not replace the Gold standard that is the Goldman Applanation tonometer.

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P137 CAN OCULAR RESPONSE ANALYZER (ORA) REPLACE GOLDMAN APPLANATION TONOMETER (GAT) FOR IOP MEASUREMENT IN NORMAL AND UVEITIC GLAUCOMA PATIENTS?

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Objective: To determine agreement between Goldmann Applanation Tonometer (GAT) and Ocular Response Analyzer (ORA) in normal and uveitic glaucoma eyes, and to see the influence of central corneal thickness on the IOP measurements
Design: Prospective non-randomized observational case series.
Participants: One hundred and five eyes of 58 patients were examined at a tertiary eye care centre from January 2008 to April 2008.
Tests: All patients underwent ORA (IOPcc and IOPg), GAT and then pachymetry (CCT) in that sequence. Bland and Altman analysis was done to compare ORA (IOPcc, IOPg) and GAT values. Linear regression model was used to observe the influence of CCT.
Outcome measures: Correlation co-efficient (r) of Pearson correlation between two methods, bias and limits of agreement between two methods (Bland & Altman), Co-efficient of linear regression (r^2) model for association with CCT.
Results: Of 105 eyes 48 eyes were normal and 58 eyes were of uveitic glaucoma. Pearson correlation between GAT and IOPcc showed r = 0.89 (95%CI of 0.84-0.92) and IOPg showed r = 0.91 (95%CI of 0.87-0.94). However, Bland Altman showed a bias of 2.12 with IOPcc and 0.48 with IOPg in comparison with GAT. Limits of agreement were -3.60 to 7.85 (GAT *vs* IOPcc) and -4.64 to 5.59 (GAT *vs* IOPg). Association of CCT with IOP was least with IOPcc (r^2 = 0.01) than with GAT (r^2 =0.05) and IOPg (r^2 =0.04).
Conclusion: ORA and GAT have a very good correlation however the agreement between the two was not found to be significant, hence they can not be used as alternative to each other. ORA (IOPcc) has the least influence of CCT over the measurement of IOP.
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P138 COMPARISON OF 3 METHODS OF IOP MEASUREMENT AND THEIR RELATION TO CCT

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Purpose: Elevated intraocular pressure (IOP) is the principal modifiable risk factor for the development and progression of open-angle glaucoma. We set out to compare the reliability of the Goldmann applanation tonometer, the Ocular Response Analyser and the Dynamic Contour Tonometer and to assess whether they are inter-changeable.
Design: Cohort study
Participants: Six hundred ninety-four subjects were recruited from the TwinsUK Adult Twin Registry at St. Thomas' Hospital, London.
Methods: IOP was measured twice per eye for each individual, using Goldmann applanation tonometry (GAT), Ocular Response Analyser and the Dynamic Contour Tonometer. Agreement between the three methods was assessed using the Bland-Altman method. Relaibility was assessed using intra-class correlation coefficients (ICC) and coefficient of variation (CV) between first and second readings of the same.
Main outcome measure: Intraocular pressure, coefficient of variation and limits of agreement between the tonometers. Correlation between IOP readings and central corneal thickness.
Results: Mean age was 57.5 years (SD: 13.1, range: 16.1 to 88.5). The mean IOPs were: Goldmann (GAT): 14.1 ± 2.8 mmHg, IOPg (ORA): 15.9 ± 3.2 mmHg, IOPcc (ORA): 16.6 ± 3.2 mmHg and for DCT: 16.9 ± 2.7 mmHg. The 95% limits of agreement were for ORA-GAT: 5.63 mmHg to -1.94 mmHg, for DCT-GAT: 6.21 mmHg to -0.49 mmHg and for DCT-ORA: -2.83 mmHg to 4.85 mmHg. Coefficient of variation (CV) for the 3 tonometers were GAT: 8.3%, ORA: 8.2%, DCT: 6.3%. The intraclass correlation coefficients (ICC) were found to be, for GAT: 0.85 (95% CI: 0.81 - 0.86), ORA: 0.86 (95% CI: 0.82 - 0.89), DCT: 0.86 (95% CI: 0.79 - 0.91).
Conclusion: This comparison study of all three tonometers in an unselected group of subjects showed them to have similar reliability. GAT measurements were found to be significantly lower than the two newer instruments, and given the measurement variation for GAT, clinicians should consider using the mean of several readings to reduce measurement error.
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P139 CLINICAL RESULTS WITH DYNAMIC CONTOUR TONOMETRY

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Purpose: To compare dynamic contour tonometry with Goldmann tonometry.
Method: Dynamic contour tonometry DCT was compared to Goldmann applanation tonometry in a group of patients with healthy corneas, glaucoma and in eyes with LASIK. I studied the correlation between tonometry and pachymetry with both technologies. The statistical analysis was done with t-student formula.
Results: Six hundred-seven eyes average Goldmann 13.6 mmHg and DCT 16.9 mmHg, 3.3 mmHg difference. Average pachymetry 541 mm (416-622). Fifty-one percent of the eyes had healthy corneas, 23% glaucoma and 21% previous LASIK. Comparing a no LASIK with a LASIK group we found the difference with Goldmann was 1.7 mmHg and with DCT 0.1 mmHg.In the no LASIK group the difference between both technologies was 3 mmHg and in the LASIK group 4.6 mmHg. Thirty-nine eyes pre and post LASIK 15.1 mmHg pre and 16.7 mmHg post with dynamic contour tonometry difference p = 0.12 and 13.4 mmHg pre and 11.6 with Goldmann p = 0.004. The difference between DCT and Goldmann pre LASIK was 1.7 mmHg (p = 0.12), while the difference in post LASIK was 5.1 mmHg (p = 0.0001). Analyzing pachymetry with tonometry in 64 eyes with thin corneas 489 mm (416-531) the difference was 4.4 mmHg between dynamic contour tonometry and Goldmann 17.6 mmHg and 13.2 mmHg respectively. In 76 eyes with thick corneas 594 mm (574-622) the difference was 4.1 mmHg, 19.8 mmHg DCT and 15.7 mmHg Goldmann.
Conclusion: Dynamic contour tonometry appears to be less affected by changes in corneal biomechanics and has a great value in intraocular pressure measurements after LASIK. It is not clear if its totally independent of pachymetry. It seems to be a reproducible and promissory technology.
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P140 CORNEAL HYSTERESIS AFTER CATARACT AND GLAUCOMA SURGERY

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Purpose: To evaluate corneal hysteresis and intraocular pressure (IOP) changes measured by an ocular response analyzer (ORA) after phacoemulsification and glaucoma surgery.
Methods: Thirty-one eyes scheduled for cataract surgery, 22 for trabeculectomy and 34 for deep sclerectomy were included in the study. Corneal hysteresis (CH) corneal-compensated intraocular pressure (IOPcc) were measured by ORA preoperatively and 1 week and 3 months postoperatively.
Results: The mean preoperative IOPcc (19.2 ± 3.4 mmHg) decreased significantly by 3 months postoperatively (17.2 ± 3.1 mmHg). The mean CH decreased from 10.36 ± 1.48 mmHg preoperatively to 9.64 ± 1.26 mmHg at 1 week (p = .015); it increased to preoperative values at the end of 3 months (10.74 ± 1.54) (p > 0.05). It was similar in the group of deep sclerectomy, where IOPcc (26,25 ± 5.4) decreased significantly by three months (18.25 ± 5.4). The mean CH increased from 8.44 ± 2.01 preoperatively to 9.64 ± 1.4 in the first week (p: 038) and it decreased in three months 8,72 ± 1.2 (p > 0.05). In trabeculectomy group, the mean preoperatively IOPcc decreased from 29.12 ± 4.8 to 13.12 ± 2.4 in three months (p = 004). The mean CH increased from 8,04 ± 3,4 to 9,87 ± 2.3 in 1 week (p = 026) and it kept in three months with a mean CH 9,64 ± 1,8 mmHg.
Conclusions: Although CH decreased in the early postoperative period in cataract group and, the parameters reached preoperative values by 3 months postoperatively in both cataract and deep sclerectomy groups, while it kept in a similar way in trabeculectomy group. All surgeries induced changes in the first week, but they only mantained in trabeculectomy group. We need more studies to know if this is because of permanent changes in biomechanical properties or it is influenced by a higher descent of IOP.
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P141 COMPARISON OF THE REBOUND TONOMETER AND GOLDMANN APPLANATION TONOMETRY IN BULLOUS KERATOPATHIC EYES

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Objective: To compare rebound tonometer (RBT) and Gold-

mann applanation tonometry (GAT) in bullous keratopathic eyes.
Design: Prospective comparative study.
Participants: Thirty-two bullous keratopathic eyes of 20 (62.5%) male and 12 (37.5 %) female were included in the study. The mean age of the patients was 59.2 ± 4.9 years.
Methods: Intraocular pressure (IOP) was measured with RBT and GAT respectively. One assistant obtained IOP readings using RBT without topical anesthetic. A GAT reading was subsequently obtained by consultant ophthalmologist without the knowledge of the RBT readings.
Main outcome measure: Six rapidly consecutive measurements were obtained in each eye with RBT. At least three measurements were recorded with GAT in each eye. After, IOP measurement patients asked to compare the comfort of the 2 methods.
Results: The mean IOP readings were 29.8 ± 4.0 mmHg using RBT and 23.0 ± 2.7 mmHg using GAT. Rebound tonometer measured IOP values greater than of the GAT values (P= 0.000). The mean difference was 6.5 ± 8.6 mmHg between RBT and GAT readings. Rebound tonometer found to be more comfortable than GAT by all of the patients.
Conclusions: Intraocular pressure measurements with RBT are significantly higher than GAT in bullous keratopathic eyes. Rebound tonometer found to be more comfortable than GAT. Larger controlled clinical trial may clarify which device appropriate for measure true IOP in bullous keratopathic eyes.
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P142 IS THERE A RELATIONSHIP BETWEEN CORNEAL BIOMECHANICS AND MODULUS OF ELASTICITY OF CORNEA: A NEW APPROACH

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Purpose: To define the relation between modulus of elasticity (ME) of cornea, corneal hysteresis (CH) and corneal resistance factor (CRF).
Design: Prospective interventional study.
Participants: Fifty healthy subjects were enrolled in this study.
Methods: All study subjects underwent detailed ophthalmic examination as well as Goldmann applanation tonometry (GAT), central corneal pachymetry, and corneal radius measurements. CH and CRF were obtained by Ocular Response Analyzer (ORA). ME was calculated using the Young's modulus of elasticity formula: ME = 0.0229*IOPT, where IOPT is the true intraocular pressure (IOP). IOPT is derived from the formula IOPT = GAT IOP/K, where K is a correction factor. Linear regression analysis was used to investigate the effect of CH and CRF on IOPT and ME of cornea. $P < 0.05$ was considered as statistically significant.
Main outcome measures: Corneal hysteresis, corneal resistance factor, Young's modulus of elasticity, true intraocular pressure, Goldmann applanation tonometer measured intraocular pressure.
Results: The mean patient age was 48.3 ±10 years (range: 21 to 77 years). Mean CH, CRF, GAT IOP, IOPT, CCT, corneal radius values were 10.4 ± 1.6 mmHg, 10.2 ± 1.8 mmHg, 14.3 ± 2.9 mmHg, 13.5 ± 2.3 mmHg, 534.6 ± 41 micrometers, 7.7 ± 0.2 mm, respectively. ME of cornea significantly correlated with CRF ($r = 0.306$, $p < 0.0001$) but not with CH ($r = -0.009$, $p>0.05$). In linear regression analysis, CH and CRF significantly associated with ME (both $p < 0.0001$).
Conclusion: It was found that ME of cornea is related to CRF. Since CRF is derived empirically and found to be strongly associated with CCT, a parameter correlated with elasticity, our results further confirm this theory. Our results also support the theory that thicker corneas exhibit greater viscoelastic properties, thus greater CRF values.
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P143 CORRELATION OF IOP MEASUREMENT USING TONOPEN AVIA AND GOLDMANN APPLANATION TONOMETER

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Purpose: To compare the IOP readings taken by Tono-Pen Avia (TPA) with the Goldmann Applanation Tonometer (GAT).
Study design: Prospective, observational, comparative case series
Participants: Ninety eyes of 90 healthy subjects.
Methods: All eyes underwent GAT and TPA measurements in random order after a 15 min break. Central corneal thickness was measured by ultrasonic pachymetry. The agreement between IOP readings from GAT and TPA was assessed using the Bland-Altman plots.
Results: Mean age of subjects was 43.41 ±18.48.The mean central corneal thickness was 503.4 ± 54.4 micron. There was no significant difference between mean IOP readings: 14.46 ± 3.17 mmHg with GAT and 14.13 ± 3.2 mmHg with

TPA. The correlation between the IOP readings using both these methods were found to be highly significant (intraclass correlation coefficient for GAT and TPA was 0.9310). Ninety-five percent limits of agreement for IOP readings from GAT and TPA, assessed using the Bland-Altman plots, ranged from +5.75 to -4.67 mmHg with a mean difference of 0.54 ± 2.66 mmHg.

Conclusion: There was a good agreement between TPA and GAT in measuring IOP in a normal population.

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P144 AGREEMENT BETWEEN DYNAMIC CONTOUR TONOMETRY (DCT) AND GOLDMANN APPLANATION TONOMETRY (GAT) IN HEALTHY MALAYSIAN EYES

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Purpose: To study the agreement between Dynamic Contour Tonometry (DCT) and Goldmann applanation tonometry (GAT) in the measurement of intraocular pressure (IOP) in healthy Malaysian eyes with different corneal thickness.

Design: Single centre prospective observational study of Malaysian subjects with healthy eyes, attending the eye clinic of University Malaya Medical Centre, Kuala Lumpur.

Methods: In a prospective observational study of 142 healthy eyes of 77 Malaysian subjects, three consecutive IOP measurements of GAT followed by DCT were performed by a single examiner, including the measurements of CCT using an ultrasound pachymeter.

Results: The mean IOP by DCT and GAT was 16.9 ± 3.05 mmHg and 16.11 ± 4.12 mmHg respectively. There was a strong correlation between the IOP readings obtained by DCT and GAT (Pearson correlation = 0.672; $p < 0.001$). However, IOP readings were consistently higher with DCT than with GAT (mean difference: +0.7 mmHg; $p = 0.009$). Mean central corneal thickness (CCT) was 548.49 µm ± 32.95 µm (range: 471- 650 µm; median: 563 µm). However, both Pearson's correlation and linear regression analysis failed to find any associations between CCT and IOP readings of both DCT and GAT. The DCT-GAT IOP differences were also not correlated with CCT. Multivariable regression analysis failed to show any significant correlation of age, ocular pulse amplitude (OPA), and IOP readings of both DCT and GAT to CCT. For repeated measurements, the intraclass correlation coefficient (ICC) of intra-observer agreement of IOP measurements by GAT (ICC = 0.959) was higher compared to DCT (ICC = 0.790) but both were statistically acceptable. Agreement analysis with the Bland and Altman bias plot revealed a small constant bias of 0.67, a narrow 95% confidence interval (upper limit: 5.61 - 7.32 mmHg; lower limit: -5.98 - 4.25 mmHg), but wide 95% limits of agreement between DCT and GAT (-5.11 to 6.47 mmHg).

Conclusions: IOP measurements by DCT are strongly correlated with IOP readings of GAT and both do not vary with CCT. However, compared to GAT, DCT appears to have higher intraobserver variability. Although both GAT and DCT are strongly correlated, the wide 95% limits of agreement imply that they are not fully concordant and thus clinically, not interchangeable. Other factors other than the CCT may be responsible for the disagreement between these devices among Malaysian eyes.

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P145 TEST-RETEST VARIABILITY OF INTRAOCULAR PRESSURE AND OCULAR PULSE AMPLITUDE FOR PASCAL TONOMETER: A MULTICENTER STUDY

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Purpose: To assess the test-retest repeatability of intraocular pressure (IOP) and ocular pulse amplitude (OPA) measurements by Pascal tonometer (PT) and evaluate possible influential factors.

Methods: The study included 200 consecutive subjects (100 normal, 100 POAG) from 5 different Italian clinics. IOP was measured once by Goldmann applanation tonometer (GAT) and twice by PT (PT1, PT2) in randomized sequence. Difference between PT1 and PT2, OPA1 and OPA2, and GAT and PT1 and 2 was assessed by t-test. The percentage of PT2 and OPA2 falling respectively within 1.0 mmHg from PT1 and within ± 0.5 mmHg from OPA1 was calculated. Regression analysis was used to assess the influence of demographic

factors (age, sex), ophthalmic data (diagnosis, refraction), and ocular biometrics (corneal curvature; central corneal thickness, CCT; axial length; anterior chamber depth).
Results: PT1 was 0.7 ± 1.4 mmHg higher than PT2 (P < 0.001); OPA1 was 0.1 ± 0.6 mmHg higher than OPA2 (P = 0.16). Results were not influenced by randomization test order. Test-retest variability was 48% for IOP readings taken with PT, and 26% for OPA. PT readings were 3.52.5 mmHg higher than GAT (P < 0.001). Demographic and biometric factors (*i.e.*, CCT; R2 = 0.07, P = 0.48) did not significantly effect results; however, OPA tended to be higher in glaucoma patients (3.9 ± 1.2 *vs* 2.8 ± 1.0, P = 0.05).
Discussion: Tonometry readings taken with PT tended to be overestimated compared to GAT. PT test-retest variability was moderate for IOP and good for OPA. PT measurements were not effected by demographic or ocular factors.

P146 RECLASSIFICATION OF NORMAL- AND HIGH-TENSION GLAUCOMA EYES USING CORNEAL COMPENSATED INTRAOCULAR PRESSURE

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Purpose: The accuracy of Goldmann applanation tonometry (GAT) in measuring intraocular pressure (IOP) is affected by material properties of the cornea. We measured IOP by GAT and corneal compensated IOP (IOPcc) using Reichert's Ocular Response Analyzer (ORA) to evaluate whether use of IOPcc would affect the classification of eyes into normal- and high-tension categories.
Design: Cross-sectional observational review.
Participants: IOP measurements of 1875 consecutive patients in a general ophthalmology practice.
Methods: Corneal hysteresis (CH), corneal resistance factor (CRF) and central corneal thickness (CCT) of randomly selected one eye of 357 normal, 155 high tension glaucoma (HTG) and 102 normal tension glaucoma (NTG) were compared. Eyes were classified as normal or glaucomatous based on the absence or presence of glaucomatous optic neuropathy (GON). The highest GAT recorded in a patient in an untreated state was used to divide patients into HTG (> 21 mmHg) and NTG (< or = to 21 mmHg) categories.
Results: The mean IOPcc and GAT were similar in normal eyes and HTG eyes. In NTG eyes, the mean IOPcc of 19.8 mmHg was considerably higher than the mean GAT of 14.4 mmHg. In addition, NTG eyes had significantly thinner mean CCT of 513 µm, a lower CH of 5.96 mmHg, and a lower CRF of 6.31 mmHg (p < 0.001) when compared to normal eyes which had a mean CCT of 541 µm, CH of 10.6 mmHg, and CRF of 10.15 mmHg. Many eyes (72%) considered to have NTG by traditional GAT threshold of 21mmHg were reclassified as HTG by IOPcc threshold of 18 mmHg.
Conclusions: In NTG eyes, corneal compensated IOP measurements reveal a higher IOP than traditional GAT measurements.
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P147 COMPARISON OF INTRAOCULAR PRESSURE MEASUREMENTS WITH THE PORTABLE PT100 NON-CONTACT TONOMETER AND GOLDMANN APPLANATION TONOMETRY

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Purpose: Non-contact tonometers are useful when regulations preclude use of contact tonometers by medical students and other non-ophthalmologists. Our study compared the measurements by a recently-developed, portable, non-contact tonometer (PT100) with Goldmann applanation tonometry (GAT).
Methods: This was a prospective study of 119 normal eyes. IOP was measured by GAT and the PT100 (Reichert, Buffalo, NY).
Results: Mean IOP measurements showed no significant differences in measurements performed by the two tonometers (P = 0.15). Linear regression analysis of PT100 *vs* GAT measurements revealed a slope of 0.84 with R2 = 0.71. Bland-Altman analysis showed a mean difference of measurements by GAT and PT100 of 0.5 mmHg with 2 SD = 7.4 mmHg.
Conclusion: The portable non-contact PT100 tonometer provides IOP measurements comparable to Goldmann applanation tonometry within the normal range of IOP.
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P148 REPEATABILITY OF THE TONOMETRIC RECORDINGS OF TONOPEN AVIA (TPA) AND ITS COMPARISON WITH IOP RECORDINGS WITH GOLDMANN APPLANATION TONOMETER (GAT) AND NON-CONTACT TONOMETER (NCT) .

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Objective: To evaluate the repeatability of the tonometric recordings of the Tonopen Avia (TPA) and compare it with IOP recordings done with Goldmann Applanation Tonometer (GAT) and non-contact tonometer (NCT) .
Design: Cross-sectional comparative prospective case series.
Participants: One hundred forty eyes of 140 consecutive patients with an age related cataract and no other ocular pathology.
Methods: This prospective, observational, comparative case series consisted of 140 eyes of 140 patients with an age-related cataract. NCT was performed first, followed by GAT and TonoPen Avia measurement after a 10 min break. The TPA readings were repeated twice in succession at 5 minute intervals. Patients with any corneal pathology or previous refractive surgery were excluded from this study.
Main outcome measure: IOP measured with Tonopen Avia, GAT and NCT.
Results: The mean age of patients enrolled in the study was 44.2 ± 16.6 years (range 25 to 75 years). The mean IOP measured by NCT and GAT was 16.2 ± 5.1 and 15.8 ± 4.1 mmHg respectively. The mean IOP recorded with TPA was 15.6 ± 4.2, 15.4 ± 4.3 and 15.6 ± 4.3 mmHg, respectively in the first, second and third instances. The reliability analysis showed good repeatability of the IOP measurement using TPA (Intraclass Correlation Coefficient a = 0.87 and repeatability coefficient = 2.37). The coefficient of variation for these intersession IOP recordings was 16.32. The mean difference between TPA and NCT was 0.6 (with 95% limits of agreement between -5.1 and 6.3 mmHg). The mean difference for TPA and GAT was 0.2 (with 95% limits of agreement between -5.2 and 5.7 mmHg) while that between GAT and NCT was 0.39 (-7.2 and 6.4 mmHg) respectively. The Karl Pearsons correlation coefficient between GAT and TPA, NCT and GAT, and TPA and NCT was statistically significant (0.768, 0.737 and 0.821 respectively, $p < 0.01$)
Conclusions: The Tonopen Avia shows a good intersessional repeatability of IOP and correlates well with both GAT and NCT.
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6.1.2. Clinical examination methods: Intraocular pressure measurement; factors affecting IOP: Fluctuation, circadian rhythms

P149 THE RELATION BETWEEN WATER-DRINKING TEST RESPONSE AND CIRCADIAN IOP CURVE FLUCTUATION IN SUSPECT GLAUCOMA

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Objective: To determine whether there is a correlation between IOP fluctuations measured by water drinking test (WDT) and circadian IOP curve.
Design: Observational study.
Participants: Suspect POAG patients without clinical therapy.
Intervention: Subjects were submitted to circadian IOP curve (measurements at every 4 hours) firstly and then given 1000 ml water to drink over 5 min; IOP was measured every 15 min for an hour.
Main outcome measure: IOP variability of circadian IOP curve, diurnal IOP curve (8AM~6PM) and WDT.
Results: The mean IOP fluctuations of circadian IOP curve, diurnal IOP curve and WDT were 8.4 ± 4.6 mmHg, 4.9 ± 3.9 mmHg and 5.6 ± 3.7 mmHg separately. The difference between circadian IOP curve and WDT was significant ($t = 3.6$, $P = 0.001$) and there was no correlation between them ($r = 0.287$, $P = 0.069$). The difference between diurnal IOP curve and WDT was not significant ($t = 1.2$, $P = 0.238$) and the correlation was significant ($r = 0.436$, $P = 0.004$). The circadian IOP curve, diurnal IOP curve and WDT revealed IOP fluctuation > 5 mmHg in 32 (78.0%), 13 (31.7%) and 21 eyes (51.2%) separately. The agreement between diurnal IOP curve and WDT was significant (Kappa = 0.323, $P = 0.025$), but there was not a significant agreement between circadian IOP curve and WDT (Kappa = 0.159, $P = 0.224$).
Conclusions: There was no correlation between IOP fluctuations measured by water drinking test (WDT) and circadian IOP curve. Although WDT can predict the fluctuation in daytime, it could not predict the IOP fluctuation in the night accurately.
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P150 IOP FLUCTUATIONS AS AN INDEPENDENT RISK FACTOR: IS IT A CORRECT OPINION?

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Background: Intraocular pressure is a primary risk factor for glaucoma progression, which is why measurement of IOP is very important for risk assessment and patient management. It is well known that many human systems have normal diurnal rhythm. The structures of ONH (disc area, rim, cup, RNFL), diurnal rhythm of CCT and others, like blood pressure, glucose or cholesterine level) have a very large variability in healthy population.
Purpose: In previous studies, the author investigated the daily fluctuations of ONH morphometric structure in normal subjects and in glaucoma-suspect patients and established correlation between these changes and IOP level.
Results: Statistically significant changes in rim area/volume and mean RNFL were observed in healthy and glaucoma suspect patients correspondingly. It was found that the 5 mmHg was a statistically significant IOP level for morphometric changes, and 2 mmHg (daily IOP fluctuations) was a not statistically significant one. RNFL parameters have been shown prognostically valid in daily monitoring and at first to react on IOP fluctuations ($p < 0,001$). Dynamic monitoring of ONH parameters accompanied with every hour tonometry allows to diagnose statistically significant differences in ONH parameters (including mean deviation fluctuation) in fellow eyes in cases of early manifest glaucoma with no apparent functional changes. But in other study the ONH structures is not changes and were not found, when the IOP level was degreed for 7 mm Hg and more.
Conclusion: We suggest that if a patient is in the high IOP zone, the daily IOP fluctuations more than 6-8 mmHg are the risk factors for development and progression of glaucoma and the daily IOP fluctuations more than 4-5 mmHg are the risk factors too. We suppose that the ONH tolerant condition seems to be more important for glaucoma progression than IOP fluctuations. We come to a conclusion that the considerable IOP fluctuations are the independent risk factors in glaucoma patients (during long-term period).
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P151 DAILY INTRAOCULAR PRESSURE CURVE. UNMASKING PEAKS AND FLUCTUATION WITH A NEW METHODOLOGY IN SUSPECT GLAUCOMA PATIENTS

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Purpose: To evaluate the practical usefulness of a new methodology of Daily Intraocular Pressure Curve (DIOPC) in a sample of suspect glaucoma patients.
Design: Observational-descriptive, transversal, retrospective and comparative intra-subject study.
Participants: A sample of 20 consecutive DIOPC performed in suspect glaucoma patients with IOP superior to 21 mmHg (in at least one eye) in supine position in the morning.
Method: The first measure of intraocular pressure (IOP) was recorded at 8 a.m. in supine position after 45 minutes of rest in this situation. The other measures were made as usual, every 3 hours, in sitting position from 11 am to 8 p.m.
Main outcome measure: The new method's usefulness is analyzed by comparing the peaks, range of fluctuation, means and standard deviation of IOP with and without the first value in supine position ('CURVE A' *vs* 'CURVE B').
Results: a) High daily mean: Curve A 65% of eyes *vs* Curve B 37.5%; b) Pressure peaks: Curve A 70% of eyes *vs* Curve B 5%; c) High range of fluctuation: Curve A 77.5% *vs* Curve B 15%; d) High standard deviation: Curve A 90% of eyes *vs* Curve B 25%. Of the 29 eyes with optic nerve injury that the sample presented: a) 58.62% (17/29) had high daily mean. b) 65.51% (19/29) presented a peak of pressure; c) 86.20% (25/29) had a high range of fluctuation; d) 89.65% (26/29) presented a high standard deviation. Of these 29 eyes with structural and or functional optic nerve damage, 21 would have been erroneously classified as normal tension glaucoma according to curve 'B' (tonometry in sitting position).
Conclusions: The IOP registered at 8 am with the patient in supine position after 45 minutes of rest as the first measure of the DIOPC enables peaks and fluctuations, the main risk factors of glaucomatous optic neuropathy, to be identified. The new strategy for the DIOPC would could be used in daily practice when admission or home tonometry are not possible.
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P152 CORRELATION BETWEEN DAILY IOP-PROFILE AND MORPHOMETRIC STRUCTURE OF ONH IN NORMAL SUBJECTS AND IN GLAUCOMA SUSPECT PATIENTS

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Purpose: To investigate the daily fluctuation of optic disc morphometric structure in normal subjects and in glaucoma-suspect patients and to establish possible correlation between these changes and the IOP level.
Participants: Thirty-eight patients (76 eyes) in the first group and 32 patients (63 eyes) in the second group were in this study.
Methods: Daily HRT-monitoring was held at 08-30, 10-30, 12-30, 14-30, 16-30, 18-00 parallel with tonometry once an hour. The following parameters of ONH were evaluated (RIM area, RIM volume, mean RNFL thickness, CUP/DISC area ratio and CSM).
Results: RIM and RNFL parameters have been shown prognostically valid in daily monitoring and the first to react on IOP fluctuations.
Conclusion: Dynamic monitoring of ONH parameters accompanied with every hour tonometry allows to diagnose statistically significant differences in ONH parameters (including mean deviation fluctuation) in cases of early manifest glaucoma with no apparent functional changes.
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6.1.3. Clinical examinatioin methods: Intraocular pressure measurement; factors affecting IOP: Factors affecting IOP

see also P161

P153 CENTRAL CORNEAL THICKNESS IN PATIENTS WITH DIFFERENT STAGES OF PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: To compare central corneal thickness (CCT) in patients with different stages of primary open-angle glaucoma (POAG).
Design: Prospective study.
Participants: CCT was measured in 135 patients (267 eyes) with POAG, divide in three groups according to stage of damage: 45 persons (88 eyes) with intial POAG, 45 person (90 eyes) with developed POAG and 45 persons (87 eyes) with advanced POAG.
Methods: CCT was measured with the help of ultrasound pachymeter. The intraocular pressure (IOP) is measured with the standard automatic Goldmann tonometer. All other routine diagnostic methods used in the ophthalmology practice were made: biomicroscopy, ophthalmoscopy, gonioscopy, computer perimetry. The statistical analysis was performed using ANOVA, the Student-Newman-Keuls test being then implemented for multiple comparisons.
Main outcome measure: The mean CCT in patients with initial POAG was 540.85 ± 27.56 μm, in patients with developed POAG was 533.62 ± 24.35 μm, in patients with advanced POAG was 530.76 ± 37.13 μm.
Results: Results have been analyzed, discussed and compared to those of other authors. CCT was thinner in patients with advanced POAG compared to those with initial POAG, but the difference is not statistically significant ($p > 0.05$).
Conclusions: This fact proves that CCT is a significant risk factor for glaucoma whose meaning should not be ignored.
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P154 FACTORS AFFECTING OCULAR PULSE AMPLITUDE IN GLAUCOMATOUS AND GLAUCOMA-SUSPECTED EYES

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Purpose: To investigate the association of ocular pulse amplitude (OPA) measured by dynamic contour tonometer (DCT) with patient demographics, ocular biometric parameters, visual field examination, blood pressure (BP), and survey data on systemic vascular morbidity in glaucomatous and glaucoma-suspected eyes.
Design: A prospective, observational, cross-sectional study.
Participants: Three hundred and fifty glaucoma-suspected eyes of 179 subjects were consecutively enrolled.
Methods: All subjects had intraocular pressure (IOP) measurements by Goldmann applanation tonometer (GAT) and by DCT, OPA measurements by DCT, and central corneal thickness (CCT) measurements by ultrasonic pachymeter. They also completed the Humphrey visual field (HVF) examination, and the systemized questionnaire on the systemic vascular morbidities. Eighty-one of 179 subjects had arterial BP measurements.
Main outcome measure: The associations of OPA with ocular and systemic parameters were sought using univariate and multivariate linear regression models.
Results: Two hundred twenty-three of 350 glaucoma-suspected eyes were diagnosed as having open-angle glaucoma based on the HVF results. In overall eyes, OPA showed positive associations with age, spherical equivalents, and IOP by GAT and by DCT using multivariate regression model ($p < 0.05$). Subgroup analysis in eyes with BP parameters revealed that OPA was positively associated with IOP by GAT and arterial pulse pressure ($p < 0.05$). OPA tended to be higher in subjects with higher vascular risk than in those with low or intermediate risk.
Conclusions: OPA was associated with ocular and systemic parameters such as age, IOP, or arterial pulse pressure in glaucomatous and glaucoma-suspected eyes. The possible association of OPA with systemic vascular risk suggests that OPA may serve as a surrogate ocular parameter reflecting systemic vascular condition.
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P155 SELF-TONOMETRY IN MODERN GLAUCOMA MANAGEMENT

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Purpose: To describe the methods of self intraocular pressure (IOP) measurement and their role in glaucoma management.
Methods: This literature review was performed using Medline and the IEEE database using the search terms 'self-tonometry', 'Proview', 'pressure phosphene', 'Ocuton S', 'ICare', and combinations of 'self', 'intraocular pressure', 'glaucoma', 'tonometer' and 'monitor'.
Results: One hundred twenty-eight articles were identified, spanning a period from 1955 to 2008.
Conclusions: It is a challenge to conceive a device for self-tonometry that would serve both in diagnosis and long-term monitoring. In general, the ideal device needs to be safe, reproducible, reliable and easy to use. It should be accurate over a wide range of IOPs, or alternatively, be able to be calibrated individually for accurate correlation with GAT. A diagnostic device, in addition, needs to be minimally invasive, removable and require minimal patient and/or doctor training. Such a device could be loaned to a patient, for example to take diurnal measurements over a period of 1-2 weeks that could potentially distinguish normal tension glaucoma from primary open-angle glaucoma with fluctuation of IOP. In contrast, a long-term monitoring device is ideally implantable, biocompatible, low maintenance and durable. This device could be useful in established glaucoma patients who appear to be progressing despite IOPs measured in the normal range during office hours. However, the ideal device will need to address the issue of changes in IOP upon waking from sleep. A single device is not capable of fulfilling all these criteria and thus it is envisaged a range of devices will need to be developed. There is much progress in technology required. Furthermore, commercialization of this technology and its affordability are hurdles that are no less difficult to overcome. However, if 'necessity is the mother of invention' then realization of these self-tonometers will be in the not too distant future.
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P156 CENTRAL CORNEAL THICKNESS, ABLATION AND CORNEAL CURVATURE AFTER CORNEAL REFRACTIVE PROCEDURE AND ITS IMPACT ON INTRAOCULAR PRESSURE MEASURES

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Purpose: The objective is to assess the effects of central corneal thickness (CCT), ablation depth and keratometry after excimer laser corneal surgery on intraocular pressure (IOP) measured by Goldmann applanation tonometry (GAT).
Methods: This prospective study comprised 140 eyes of 75 patients who underwent a corneal refractive surgery. IOP, mean keratometry (Km), CCT and posterior curvature (postC) were measured preoperatively and postoperatively. A linear mixed-effect model allowing for random effects at the patient level was used to analyze the effect of corneal refractive surgery on IOP.
Results: The IOP was reduced from 14.8 ± 2.7 mmHg preoperatively to 12.7 ± 2.8 mmHg postoperatively. The difference between pre- and post-operative measurements were statistically significant ($p < 0.001$). Between eyes correlation for the change in IOP was 0.95. When possible predictor variables were included in a random effects model, two different models were obtained. Model 1, includes preoperative IOP and ablation, model 2 preoperative IOP and the difference between pre and postoperative pachymetry. According to models 1 and 2 the magnitude of the decrease in IOP after refractive procedure depends on the magnitude of preoperative IOP. To achieve a better understanding we calculated the estimated mean decrease of IOP after refractive procedure for different combinations of preoperative IOP and ablation and different combinations of pre-operative IOP and difference between pre and post operative pachymetry.
Conclusions: In this study we analysed the change in IOP after corneal refractive surgery using a constellation of various parameters evaluated with corneal topography before and after surgery. Higher preoperative IOP and ablation volumes are associated with a greater decrease in IOP postoperatively.
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P157 QUALITY CONTROLLED COLOR CODED COMPUTERIZING SYSTEM INCORPORATING CENTRAL CORNEAL THICKNESS MEASUREMENTS INTO GLAUCOMA PATIENTS' MANAGEMENT

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Purpose: Central corneal thickness (CCT) has been recently recognized as a risk factor for the development of primary open-angle glaucoma. Thus accurate measurement of CCT is of utmost significance in the evaluation of patients with ocular hypertension. Our aim was to develop a quality controlled computerized system for record keeping of patients' CCT measurements, so that raw data entered by technicians for calculation of mean value can be viewed on demand by the clinician.
Design: Evaluation of technology.
Participants: Sixty-seven glaucoma patients (126 eyes).
Methods: CCT was determined using Topcon SP2000P pachymeter by trained technicians. Three measurements of CCT were acquired consecutively and the mean value was calculated. CCT measurement was repeated beyond three times if differences greater than 4% from the initial measurement occurred. All values were entered into the computerized system. Data entered by the technicians were reviewed by the glaucoma specialist as part of quality control practice. A qualitative color-coded system incorporated into the clinical chart served as a constant reminder of the CCT to the clinician. Consistency of the measured CCT values was calculated using intraclass correlation coefficient.
Main outcome measure: Rate of adequate technician measurements (differences of 4% or less compared to the initial measurement).
Results: Quality control was performed in 126 eyes of 67 glaucoma patients, 32 males and 35 females. The mean age of all patients was 64.1 ± 13.4 years. The mean CCT was 521.2 ± 45.4 micron, the median was 516 micron. The intraclass correlation coefficient of CCT values measured by the technicians was 0.928 (95% confidence interval 0.903-0.947). In only two cases (2.5%), the second and third measurements differed by more than 4% from the first value. Thus the technicians' performance was adequate in 97.5% of the cases.
Conclusion: The ability to periodically evaluate CCT data entered by technicians is important for the clinician. The quality control system that we developed is a reliable and helpful device that addresses this issue.
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P158 THE EFFECT OF REFRACTIVE SURGERY (LASEK) ON IOP MEASUREMENTS

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Purpose: The aim of this study was to evaluate three tonometry methods –the gold standard Goldmann Applanation Tonometry (GAT), a new method, Dynamic Contour Tonometry (DCT) and a method under development, Applanation Resonance Tonometry (ART) –with respect to IOP measurements before and three and six months after laser subepithelial keratomileusis (LASEK).
Design: A prospective, single-centre clinical study.
Participants: Fifty-three healthy subjects who underwent LASEK surgery to correct refractive errors were included in this study. Left or right eye for each subject was randomized into the study.
Methods: Visual acuity, central corneal thickness (CCT), corneal curvature (CC) and IOP were measured at each visit. Six repeated IOP measurements per method with 5 min between methods. The ART technique offers two possible analysis procedures: one focuses on the dynamic phase during the indentation, the other on the fully applanated phase which causes a Goldmann-like static condition. Results are presented as mean + SD.
Main outcome measure: Change in measured IOP after LASEK
Results: All tonometers underestimated IOP significantly after LASEK. The IOP reduction was largest after six months for GAT (-1.7 ± 1.8 mmHg) followed by ARTstat (-1.2 ± 1.5 mmHg) and DCT (-1.1 ± 1.6 mmHg). The smallest reduction was for ARTdyn (-1.0 ± 1.5 mmHg). There was a trend toward IOP reduction for all tonometers between three and six months, although this was only significant for DCT (-0.5 ± 1.0 mmHg). The mean spherical equivalent preoperatively was -3.1 diopters (range -1.0 to -7.1). The mean ablation depth was 48 ± 19 µm. CCT6 months was reduced by 44 ± 29 µm, and CC6 months was increased by 0.16 ± 0.11mm. Uncorrected visual acuity improved significantly between three and six months postoperatively from 1.35 ± 0.28 to 1.46 ± 0.27.
Conclusions: All tonometers measured a significant reduction of IOP three and six months after LASEK. DCT and ART showed a similar reduction in measured IOP, whereas GAT showed a larger underestimation. The results indicated that DCT and ART measurement techniques are less dependent on corneal properties and are therefore potentially more suitable for tonometry in LASEK-treated eyes. The new ART method has two possible analysis procedures with similar results, and future studies will ascertain which one is preferable. Furthermore, both visual acuity and IOP measurements between three and six months suggest a still ongoing postoperative process at six months.

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P159 THE INFLUENCE OF CEREBROSPINAL FLUID PRESSURE ON THE INTRAOCULAR PRESSURE

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Purpose: To determine the effect of cerebrospinal fluid pressure (CSFP) on intraocular pressure (IOP).
Design: A prospective, case-controlled study.
Participants: Thirteen subjects underwent diagnostic lumbar puncture (LP) between November 2008 and January 2009 at the Neurology Clinic, Ondokuz Mayis University of Faculty of Medicine, Samsun, TURKEY.
Methods: All patients had different neurological disease, such as multiple sclerosis, polineuropathy, and these patients did not have glaucoma. In this prospective study, demographics (age and gender), medical history, medication use, indication for LP and intraocular pressure (IOP) were recorded. Opening CSFP and closing CSFP was calculated. Before and after LP (at 5 min, 30 min and 2 hours) IOP was measured by Tonopen and Schitz tonometry.
Main outcome measures: The influence of varying of CSFP on IOP was investigated.
Results: The mean of opening CSFP was 19.38 ± 10.09 cm H20 and 12.46 ± 4.03 cm H20 closing CSFP (P < 0.001). The mean pre LP IOP was 14.2 ± 2.7 mmHg in right eyes and 15.2 ± 2.16 mmHg in left eyes by Tonopen, and 13.4 ± 2.8 mmHg in right eye and 13.4 ± 2.19 mmHg in left eye by Schiötz tonometer. There were found significant correlation between right and left eye in IOP(Pearson's correlations coefficient r = 0,939, P < 0.000) and Tonopen and Schiötz tonometer (r = 0.751, P < 0.005). The mean difference of IOP between before and after LP, was 3.38 ± 2.93 mmHg (95% CI, 5.24-1.52) higher in 5 min (P = 0.002), 1.25 ±1.9 mmHg (95% CI 2.49-0.004) in 30 min (P = 0.049) and 0.16 ± 2.12 mmHg (95% CI 1.5-1.18) in 2 hours (P = 0.791) by Tonopen, 2.69 ± 3.23 (95% CI 4.64-1.48) 5 min (P = 0.01), 1.53 ± 4.9 (95% CI 4.5-1.48) in 30 min (P = 0.289), 0.07 ± 4.2 (95% CI 2.6-2.5) in 2 hours (P = 0.949) by Schiötz tonometer. Multivariate analysis demonstrated that low CSFP was associated higher intraocular pressure (P = 0.001).
Conclusions: Decreased cerebrospinal fluid pressure after LP is significantly associated increased IOP in the first 30

minutes after LP. CSF pressure may play an important role in the pathogenesis of primary open-angle glaucoma.

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P160 COMPARISON OF INTRAOCULAR PRESSURES IN SUPINE AND SITTING POSITIONS IN PATIENTS WITH AND WITHOUT GLAUCOMA

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Objective or purpose: To evaluate postural IOP changes in patients with and without glaucoma. To compare these postural IOP changes in patients with glaucoma to that of patients without glaucoma.

Design: Prospective, comparative case controlled study with patients randomized to IOP measured either in sitting first or in supine first positions.

Participants and controls: Two hundred-fourteen eyes of 107 patients with a mean age of 54 years (SD 9.9 years). Group A: Patients with POAG or PACG (n = 54 patients or 108 eyes) and Group B: Normal or controls, without disease (n = 53 patients or 106 eyes). Exclusion criteria: Group A: Patients with secondary glaucomas, previous ocular surgery except laser PIs, any anterior or posterior segment pathology other than glaucoma likely to affect VF. Group B: Patients with IOP > 21 mmHg, VF defects, narrow angles, abnormal OCT findings.

Intervention or methods or testing: Age, sex, type of glaucoma, IOP was measured with Tonopen in supine and sitting positions, CCT was measured by US pachymeter, slit-lamp examination, gonioscopy, HFA and OCT were done to either confirm or rule out diagnosis of glaucoma.

Main outcome measure: In sitting first group, IOP is measured first in sitting position then asked to take supine position for 15 min before measuring IOP again and vice versa.

Results: Analysis of covariance (ANCOVA) model was used considering IOP measurement as response & age, sex, glaucoma, sitting-supine and CCT as covariates where eye was considered as block. IOP, age and CCT variables were continuous; sex, glaucoma and sitting or supine variables were categorical. Normality assumption was checked by plotting histogram of response variable IOP and normal QQ plot. M:F% was 57:43%. Mean CCT was 543.53 µ (SD ± 37.36). Mean IOP was 17.12 mmHg (SD ± 4.89) in controls in sitting position. Estimated coefficient of supine was 1.75 units which implies that supine position increased IOP 1.75 units more than sitting position after adjusting for age, sex, glaucoma and CCT. Coefficients for POAG and PACG were 3.68 and 6.68 units implying IOP increases 3.68 or 6.68 units respectively where controls were reference category ($p < 0.01$)

Conclusions: There is a significant postural change in IOP and it also depends upon type of glaucoma (PACG > POAG). IOP measured in supine positions was greater in glaucomatous eyes than normal eyes and damage to optic nerve may occur when patient is asleep. Higher supine IOP may be important for patients with progressive GON despite apparently controlled IOP. The results of this study underline fact that ophthalmologists treating patients of glaucoma should not continue to ignore IOP response due to changes in posture.

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P161 POSTURAL IOP CHANGES IN POAG PATIENTS ON DIFFERENT TOPICAL MEDICATIONS

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Purpose: To analyse the effects of topical antiglaucoma eye drops Timolol, Brimonidine and Latanoprost on the intraocular pressure (IOP) changes in supine and sitting positions in patients with primary open-angle Glaucoma (POAG).

Design: Prospective randomized crossover single-blind study.

Participants: Three groups of patients, all newly-diagnosed POAG patients. They were put randomly on one of the three topical medications for glaucoma for at least three months. Each group consisted of 20 patients.

Methods: Age, sex, and IOP were measured with Perkin's Tonometer, CCT measurement was done, slit-lamp examination, gonioscopy, HFA and OCT were done to confirm diagnosis of glaucoma. IOP is measured first in sitting position, then patients were asked to take supine position for 15 min before measuring IOP again. The IOP at baseline and after each treatment was measured in both sitting and supine positions.

Exclusion criteria: Patients with secondary glaucomas, previous ocular surgery, narrow angles, any anterior or posterior segment pathology other than glaucoma likely to affect VF or OCT findings.

Main outcome measure: Analysis of covariance (ANCOVA) model was used considering IOP measurement as response and age, sex, sitting-supine and CCT as covariates where eye was considered as block. Normality assumption was checked by plotting histogram of response variable IOP and normal QQ plot. One hundred twenty eyes of 60 patients. Mean age of patients was 59 years (SD ± 9.9 years). M:F% was 58:42%. Mean CCT was 543.53 µ (SD ± 37.36).

Results: Mean IOP at baseline was 24.32 (± 2.89) in sitting

position and 27.95 (± 4.14) in supine position. The change was 3.68 units (± 1.2). After 3 months of medication, the mean IOP in sitting position was 18.64 (± 2.43) and in supine position 22.18 (± 3.73). The change was 3.54 units (± 1.3). Compared with the baseline level, the magnitude of IOP elevation associated with the postural change did not alter significantly by the application of any eye drops. ***Conclusions:*** The mechanism of action underlying the IOP change with the postural change looks to be different from the pharmacologic action of these hypotensive agents. Higher supine IOP may be important for patients with progressive GON despite apparently controlled IOP. The results of this study underline fact that ophthalmologists treating patients of glaucoma should not continue to ignore IOP response due to changes in posture.

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P162 THE EFFECT OF ACCOMMODATION ON INTRAOCULAR PRESSURE IN YOUNG ADULTS

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Purpose: To evaluate the effect of accommodation on intraocular pressure in young adults.
Design: Prospective non-randomized study.
Participants: Ten healthy young adults 12 to 25 years old.
Methods: Intraocular pressures were measured using piezoelectric tonometer while subjects were focusing at their far point and near point of accommodation. Measurements were performed three times alternating the focus at far-point and near-point approximately 15 seconds apart. Series of these six measurements were performed first in the center of the cornea and subsequently another six measurements on the sclera 4 mm from the temporal limbus. Video recording of some of the series of measurements was performed.
Main outcome measure: The intraocular pressure measured while focusing at near-point was compared to the control of intraocular pressure at the far-point for the corneal and separately for scleral measurements of IOP.
Results: Intraocular pressure was in average 2.7 mmHg lower during accommodation in subjects less than 25 years old with piezoelectric measurement on the corneal surface and this difference was statistically significant.
Conclusions: These results indicate that the intraocular pressure decreases in accommodation repeatedly within seconds in young adults and should be considered in clinical measurements of IOP. This effect is surprising and not explained by Helmholtz theory of accommodation. The pathogenesis of this effect is not known but aqueous humor dynamics and convergence are considered as potential causes. The fluid mechanics of aqueous and its changes with accommodation may be important in our understanding of mechanisms of different types of glaucoma.

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P163 EFFECT OF SLEEPING POSITION ON IOP IN PROGRESSIVE GLAUCOMA

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Purpose: To determine if a 30-degree sleeping position improves nocturnal IOP control in patients with progressive glaucoma.
Methods: Patients with progressive NTG or POAG as evidenced by disc hemorrhage despite well-controlled IOP were evaluated in a sleep laboratory on two separate nights one week apart. During the first night patients were evaluated lying flat and during the second night they were elevated to 30 degree head up. IOP and blood pressure (BP) were measured at 10 pm as the baseline measurement and at 12 pm, 2 am, 4 am and 6 am. IOP was measured as the average of two reading with less than 5% error using a Tonopen. Ocular perfusion pressure was calculated using mean arterial BP - IOP. Data were analyzed with profile analysis to take into account the correlation of repeated IOP readings from the same individuals.
Results: Seventeen eyes of 17 patients were included. There were no significant differences between the IOP levels at baseline and the two sleeping positions (flat versus elevated) ($p = 0.6131$). Between 2400 and 0600 IOP was a mean of 3.2 mmHg lower in the 30 degree elevated position ($p = 0.03$). 16 of 17 patients (94.1%) had lower IOP in the 30 degrees position and this reduction was 20% or more in 35% of patients. There was no statistically significant difference comparing the two sleeping positions in mean ocular perfusion pressure over time.
Conclusions: A 30-degree sleeping position lowers nocturnal IOP in patients with progressive glaucoma. Although this benefit varies between individual patients, mean IOP was 20% lower in a third of patients in this series.

6.2. Tonography, aqueous flow measurement (*see also* 2.6)

see also P372

P164 TONOGRAPHIC, INTER AND INTRA-OBSERVER VARIABILITY OF GAT, DCT AND ORA

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Aim: To evaluate the tonographic (TNG) effect and to compare the inter/intra-observer variability (VRBL) of IOP measures of 3 tonometers: GAT, DCT and ORA.
Methods: TNG effect was evaluated with 10 repeated measures. IOP was measured with GAT, DCT and ORA in 120 POAG, in a randomized order, by 2 independent observers.
Results: IOP was significantly reduced from the 4th measure with GAT (t: 2,5; p: 0,01) and DCT (t: 3,5; p: 0,001), and from the 8th with ORA (t: 2; p: 0,04). Mean intra-observer VRBL were 0,6 mmHg for GAT, -0,2 mmHg for ORA and 0,5 mmHg for DCT. Mean inter-observer VRBL for GAT were 0,5 mmHg; for ORA 0,7 mmHg and for DCT 0,2 mmHg.
Conclusions: a TNG-effect was demonstrated after repeated measurements. ORA had the higher inter and intra-observer variability.

6.4. Clinical examination methods: Gonioscopy

see P277

6.5. Clinical examination methods: Ophthalmoscopy

P165 HOW SENSITIVE IS OPHTHALMOSCOPY IN DETECTING OPTIC DISC HEMORRHAGES IN CLINICAL PRACTICE?

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Purpose: To determine the sensitivity of the clinician in detecting optic disc hemorrhages on clinical examination using ophthalmoscopy in patients with glaucoma or ocular hypertension.
Methods: A glaucoma clinical fellow reviewed optic disc photos of 371 eyes of 188 patients with glaucoma or ocular hypertension. The same fellow reviewed charts of these same patients, whom he had not personally examined, for any disc hemorrhages that were documented by a glaucoma specialist's clinical examination using dilated indirect ophthalmoscopy with either a 60D or 66D lens.
Results: 4.3% of eyes had optic disc hemorrhages detected by review of disc photos. A total of 16 disc hemorrhages were detected by review of disc photos and all of them had been previously documented by clinical examination.
Conclusion: Our results demonstrate that a careful clinical examination using either a 60D or 66 D indirect lens with a dilated pupil is highly sensitive and cost effective in detecting optic disc hemorrhage.
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P166 CLINICAL ASSESSMENT OF STEREOSCOPIC OPTIC DISC PHOTOGRAPHS FOR GLAUCOMA: THE EUROPEAN OPTIC DISC ASSESSMENT TRIAL (EODAT)

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Purpose: To determine the diagnostic accuracy of judging optic disc photographs for detecting glaucoma by ophthalmologists.
Design: Evaluation of diagnostic test and technology.
Participants: Two hundred forty-three of 875 invited ophthalmologists in 11 European countries.
Methods: We determined how well each participant classified 40 healthy and 48 glaucomatous eyes on stereoscopic slides. Duplicate slides were provided for determining intraobserver agreement. All eyes were also imaged with the GDx VCC and the Heidelberg Retina Tomograph (HRT) I. Diagnostic accuracies of clinicians were compared to those of the best machine classifiers.
Main outcome measures: Accuracy of classification, expressed as sensitivity, specificity, and overall accuracy. Intraobserver agreement (K).
Results: The overall diagnostic accuracy of ophthalmologists was 80.5% (SD, 6.8; range, 61.4%-94.3%). The machine classifiers outperformed most observers in diagnostic accuracy; the GDx VCC NFI and the HRT's best classifier correctly classified 93.2% and 89.8% of eyes, respectively. The intraobserver agreement (K) varied between -0.13 and 1.0 and was on average good (0.7).
Conclusions: In general, ophthalmologists classify optic disc photographs moderately well for detecting glaucoma. There is, however, large variability in diagnostic accuracy between and agreement within clinicians. Common imaging devices outperform most clinicians in classifying optic disc photographs.
The EODAT study group: Nicolaas J. Reus, Hans G. Lemij, David F. Garway-Heath, P. Juhani Airaksinen, Alfonso Anton, Alain M. Bron, Christoph Faschinger, Gabor Holl, Michele Iester, Jost B. Jonas, Andrea Mistlberger, Fotis Topouzis, and Thierry G. Zeyen.

6.6. Clinical examination methods: Visual field examination and other visual function tests

see also P072

P167 THE EFFECTS OF SIMULATED CATARACT ON THRESHOLD MEASUREMENTS OF STANDARD AUTOMATED PERIMETRY, FREQUENCY DOUBLING TECHNOLOGY, HEIDELBERG EDGE PERIMETRY AND THE MOORFIELDS MOTION DISPLACEMENT TEST

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Purpose: To explore the effects of simulated cataract on threshold measurements with four psychophysical stimuli, each used for the perimetric detection of glaucoma.
Design: Experimental study.
Participants: Six psychophysically experienced healthy volunteers were recruited [mean age 26, range 21 to 29, years; distance refractive correction plano to - 4.25 DSph].
Methods: Cataract was simulated by one of five white opacity filters (WOFs) of increasing density, inserted into wide-framed spectacles. A baseline measure (no WOF) of intraocular stray light (ISL) was estimated for each subject using a C-Quant straylight meter (Oculus, Wetzlar, Germany). This was repeated for each grade of filter. Each subject underwent 6 test sessions over a 2-week period. For each session, one of the filter conditions was randomly selected and the subject was tested on the 4 perimeters [Standard Automated Perimetry (SAP), 24-2 SITA; Frequency Doubling Technology (FDT) Matrix, N-24-2; Heidelberg Edge Perimeter (HEP), ASTA; Moorfields Motion Displacement Test (MDT), WEBS1-2], in a randomised order.
Main outcome measure: pointwise comparison of the threshold (standardised z) measurements with each grade of filter to the baseline, for each instrument.
Results: SAP thresholds were unaffected by low grade WOF. However, SAP, FDT and HEP each showed a highly significant ($p < 0.001$) increase in thresholds for moderate to large increases in straylight (50-150%). There was no statistically significant change in average MDT thresholds across all filters.
Conclusions: SAP, FDT and HEP thresholds were all affected by induced ISL levels equivalent to mild to moderate cataract. The stimulus used in the Moorfields MDT has been shown to be resistant to the effects of simulated cataract, which is consistent with earlier reports of the original single line MDT. 3-5 This is an important feature of a glaucoma case-finding device, helping to maintain test specificity.
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6.6.2. Clinical examination methods: Visual field examination and other functional tests: Automated

see also P218, P410

P168 EFFECT OF CATARACT EXTRACTION ON THE GLAUCOMA PROGRESSION INDEX IN SITA PERIMETRY IN GLAUCOMA PATIENTS

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Purpose: To determine the effect of cataract extraction on the glaucoma progression index (GPI) in Swedish Interactive Threshold Algorithm (SITA) perimetry in glaucoma patients with coexisting cataract.
Participants: Consecutive eligible patients with stable glaucoma who underwent phacoemulsification cataract surgery alone or in combination with augmented trabeculectomy.
Methods: This is a retrospective non-comparative study. All eligible patients had SITA-standard 24-2 visual fields within 10 months before and after surgery. Exclusion criteria included other ocular morbidity, intraoperative complications, and perimetric reliability indices greater than 33%. Comparison of means was performed with the paired t test.
Main outcome measure: Change in the glaucoma progression index (GPI), mean deviation (MD) and pattern standard deviation (PSD) indices following cataract extraction
Results: Thirty-four eyes of 34 patients (all Caucasians) were analysed. The mean age at surgery was 77.4 ± 8.8 years. Visual field tests were performed 3.4 ± 3.0 months SD before surgery and 5.4 ± 2.5 months after surgery. There was a statistically significant increase in the GPI after cataract surgery (from 72.1 ± 18.5% to 75.3 ± 17.2%; $p = 0.02$). The improvement in mean deviation was also statistically significant (from -11.5 ± 5.5 dB to -10.0 ± 5.3 dB; $p < 0.01$), but the change in pattern standard deviation did not reach statistical significance (from 7.3 ± 3.4 dB to 7.5 ±3.7 dB; $p = 0.57$).
Conclusions: In this cohort of patients, uncomplicated cataract extraction resulted in a statistically significant improvement in the 24-2 SITA-standard GPI and MD, but not in PSD. Both the MD and the GPI may be influenced by lens opacities, which could make detection of glaucoma visual field progression more difficult for clinicians.
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P169 STANDARD AUTOMATED PERIMETRY VERSUS MATRIX FREQUENCY DOUBLING TECHNOLOGY PERIMETRY IN PATIENTS WITH OCULAR HYPERTENSION AND NORMAL SUBJECTS

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Purpose: To evaluate the relationship and agreement between standard automated perimetry (SAP) and Matrix frequency doubling technology (FDT) in patients with ocular hypertension and healthy subjects.
Design: Prospective clinical study.
Participants: Ocular hypertensives and healthy control subjects.
Methods: Fourty-five eyes of fourty-five ocular hypertensives and thirty eyes of thirty healthy control subjects were included in this prospective study. All subjects underwent complete ophthalmic examination, including slit-lamp biomicroscopy, intraocular pressure measurement, pachymetry measurement, and dilated fundus examination, and showed reliable visual field tests. One randomly selected eye of each participant was examined with SAP (Swedish Interactive Threshold Algorithm [SITA] Standard 24-2 test) and Matrix-FDT (24-2 threshold test), in random order. Mean deviation, pattern standard deviation, each visual field test location, and specific sectors of the visual field were compared between both techniques.
Main outcome measure: Agreement between both visual field testing methods.
Results: In both groups, mean deviation values of SAP and Matrix-FDT correlated significantly (r = 0.44 and 0.60, p-value < 0.005). Pattern standard deviation showed no significant correlation in healthy subjects but correlated significantly in patients (r = 0.47, p-value < 0.005). In the healthy subject group, a significant correlation between SAP and Matrix FDT was shown in the supero-temporal and infero-temporal sectors of the visual field (r = 0.46 and 0.37, p-value < 0.05). In patients, supero-temporal, supero-nasal and nasal sectors correlated significantly (r = 0.52, 0.61 and 0.35, p-values ≤ 0.02). The correlation pattern of individual visual field test locations appeared heterogenous in both groups.
Conclusions: In both the ocular hypertensive patients and healthy subjects SAP and Matrix-FDT correlate well. Further investigations should find out whether the missing corrrelation between both techniques in the temporal, infero-temporal and infero-nasal visual field sectors of OHT patients might be related to early retinal fiber layer damages in these regions of the disc and therefore could indicate probable conversion to glaucoma.
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P170 THE EFFECT OF VISCOUS EYE DROP CONTAINING POLYACRYLIC ACID ON COMPUTERIZED PERIMETRY RESULTS OF THE PATIENTS WITH GLAUCOMA AND TRACHOMATOUS DRY EYE

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Purpose: To evaluate the effects of a viscous eye drop containing Polyacrylic Acid (Carbomer 980) as a gelling agent on computerized perimetry FASTPAC test results of primary open-angle glaucoma (POAG) patients with trachomatous dry eye.
Design: Comparisons of the pre- and post-treatment tear functions and perimetric measurements in the same patient group were made in this open-label study at two visits.
Participants: Both eyes of 24 patients with bilateral POAG and trachomatous dry eye were included in the study.
Methods: Participants were treated with the same antiglaucomatous eye drop and experienced in computerized perimetry. Before and after the treatment with viscous eye drop for 2 weeks, tear function tests (tear film break-up time, corneal fluorescein staining), and FASTPAC test with computerized perimetry were performed.
Main outcome measures: Pretreatment and post treatment tear functions, visual field test global indices, reliability indices, test duration, and numbers of depressed points in pattern deviation plots were compared.
Results: We found significant improvements in tear function tests results, in computerized perimetry FASTPAC test indices, test duration and the number of depressed points in pattern deviation plots in the post treatment evaluations.
Conclusion: This study indicates that there was a benefit from viscous eye drop containing polyacrylic acid treatment on computerized perimetry FASTPAC test performance in POAG subjects with trachomatous dry eye. We assume that the positive effect of this therapy is probably due to a better tear film stability, resulting in a higher optical quality of the repaired integrity of the anterior corneal surface.
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P171 DETECTABILITY OF GLAUCOMATOUS VISUAL FIELD ABNORMALITIES IN CENTRAL 10-2 PROGRAM

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Purpose: To investigate the ability of the Humphrey Visual Field Analyzer central 10-2 (C10-2) program to detect central visual field abnormalities in glaucoma patients.
Design: Retrospective, Observational case series.
Participants: Fifty two primary open-angle glaucoma (POAG) patients examined between June and August 2008 were included in this study.
Methods: All patients underwent either SITA standard (SITA-S Humphrey) central 24-2 (C24-2) or SITA-S central 30-2 (C30-2) testing. Patients were found to have visual field abnormalities fulfilling the Anderson criteria, but were not found to have abnormalities at the four points in the pattern deviation plot within the central five degrees of the C24-2 or C30-2 visual field. The 52 patients chosen to participate in this study underwent SITA-S central 10-2 (C10-2) testing within the time period either six months before or after C24-2 or C30-2 testing. Cases with unreliable visual field test results or corrected visual acuity of less than 20/25 were excluded from the study. The 68 measurement points used in C10-2 testing were divided into five upper and five lower clusters demarcated along the locations of the retinal nerve fibers. The upper and lower clusters were symmetrical across the horizontal axis of the visual field. An analysis was performed to determine how frequently abnormalities occurred in each cluster. Abnormalities were defined as being present when the values of three adjacent points in the PD plot in one cluster were less than 5% and one of these values was less than 1%, or when the values of two adjacent points were less than 1%.
Main outcome measures: Visual field abnormalities detected by C10-2.
Results: Abnormal PSD values ($p < 0.05$) were found in 34 of the 52 eyes (65.4%) using the C10-2 test. Analysis of the C10-2 clusters showed that abnormalities were found at a high frequency in the peripheral clusters (upper cluster: 48.1%, lower cluster: 32.7%), whereas clusters located in the centrocecal region showed abnormalities at a low frequency (upper cluster: 0%, lower cluster: 3.8%). When an abnormality was found at one of the measurement points on the upper half of the circumference of the area 10 from the center of the C30-2 or C24-2 visual field excluding the point closest to the blind spot, the probability of finding an abnormality in the upper peripheral cluster of the C10-2 visual field was high. ($p = 0.0282$; Odds ratio 3.6; 95% CI 1.2 ~11.9)
Conclusions: In some cases of POAG, although abnormalities may exist within the central ten degrees of the visual field, these abnormalities sometimes cannot be detected by the four measurement points in the central five degrees of the visual field used in C30-2 or C24-2 testing.
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P172 EXTENDED GLAUCOMA SCREENING ABILITIES WITH A PORTABLE PERIMETER

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Purpose: Portable automated perimetry devices play an important role in glaucoma screening, by design they function reliably even outside of traditional eye clinics, reaching out therefore to an increased number of patients. Moreover, they can be successfully used in regions with poor medical coverage or in mobile screening stations. Our objective is to combine fast threshold examination strategies with advanced software for interpreting visual field data based on expert systems, while fully maintaining the portability of the device.
Design: Fast threshold examination strategies and glaucoma staging software based on expert systems were implemented on the control unit of the portable perimeter, with no further need of a dedicated computer system, assuring the maximum portability of the device. Participants and methods of testing: The visual field of a group of 20 test persons chosen randomly from co-workers was tested using automated white on white perimetry, with both the available automated examination programs and the newly implemented system. The results obtained were compared to get a first estimate the sensitivity and specificity of the new program.
Results: Our preliminary study shows in the first place that combining fast threshold strategies with advanced visual field data interpretation software is possible on a compact, portable perimeter, even without using additional computer system. We found a significant reduction in the duration of the test (up to 40% compared to some other fast threshold methods), with minimal loss of sensitivity.

Conclusions: Combining fast threshold examination strategies with expert system-based visual field data interpretation software offers promising preliminary results while fully maintaining the portability of the compact perimetry device, expanding therefore its screening ability. For a more precise quantitative measure further clinical studies are planned.

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P173 QUANTIFYING FUNCTIONAL DAMAGE IN GLAUCOMATOUS PATIENTS: COMPARISON OF THE FIELD DAMAGE LIKELIHOOD SCORE (FDLS) WITH THE HODAPP-PARRISH AND ANDERSON (H-P-A)

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Standard automated perimetry is an accepted technique for quantifying functional damage in patients with glaucoma. The Hoddap-Parrish-Anderson (H-P-A), visual field staging system uses five stages from none to far- advanced damage. As such, it is probably not a sensitive method for detecting glaucomatous change. The Field Damage Likelihood Scale (FDLS) divides field abnormalities non-linearly into eight stages, with greater sensitivity in the earlier than the later stages. The FDLS can be relatively easily adapted to all methods of field examination. The purpose of the present study is to compare the H-P-A and the FDLS in a group of patients with a wide variety of glaucomatous field loss. In a Retrospective chart review, 43 cases from Glaucoma Care, Kolkata, India with the diagnosis of either ocular hypertension or chronic glaucoma, were reviewed. Both eyes (if eligible) of each patient were included .77 reliable visual field charts (24-2 threshold test) were analyzed, performed with Humphrey Field Analyzer. In this study visual field defect caused by glaucoma are included. Only reliable tests (fixation losses < 20% and a false positive and negative rate < 33%) were considered. Visual field defects caused by corneal opacity, small pupil, cataract, optic nerve disease other than glaucoma, retinal defects were excluded. Seventy-seven visual field charts were evaluated and classified according to clinical impression of a glaucoma specialist as 'no damage,' 'mild', 'moderate' and 'severe' glaucoma, until 6 examples of each level of damage were identified for inclusion in the study. Each field was staged according to the H-P-A method and the FDLS method. Levels of agreement between two scoring systems were tabulated. A comparative study between two visual field grading scales was done. The Mean Deviation value, the number of defective points in pattern deviation probability map, the defect proximity to the fixation point were considered. There was total agreement between these two classification methods in 35 charts (45%). There was a difference of 1 stage in 32 charts (41%). There was a difference of 2 stages in 7 charts. There was a difference of 3 stages in 3 charts. Seventeen (15+2) charts (22.01%), classified as stage 0 with the H-P-A staging: out of 17, 15 were classified as stage 1 and 2 were classified as stage 2 with the FDLS staging. The H-P-A is accurate with regard to localized defects but fails to consider an early glaucomatous damage and underestimate the field damage in early stage. Accurate categorization of visual field defects may be possible with 8 stage subdivision of the FDLS. Seventeen (15+2) charts (22.01%), classified as stage 0 with the H-P-A staging: out of 17, 15 were classified as stage 1 and 2 were classified as stage 2 in the FDLS. The 'Most minimal loss detectable', an intermediate stage in the FDLS is helpful in including borderline case/ early glaucomatous field defect as 17charts (22%) in this study demonstrate.

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P174 MAPPING PERIMETRIC NEURAL LOSSES ONTO THE TSNIT CURVE OF NERVE FIBER LAYER THICKNESS

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Purpose: Subjective methods of perimetry (SAP) and objective measures of RNFL thickness by OCT should provide equivalent assessments of glaucomatous neuropathy, but methods for quantitative correlation of the results of tests is needed. In the present study, a structure-function model was used to translate SAP data into a RNFL thickness parameter to map perimetric neural losses onto the TSNIT curve.

Participants: Clinical SAP and OCT data for 60 eyes (32 patients) from the University of Houston UH-data) and 53 eyes (53 patients) from the Bascom Palmer Eye Institute (BP-data).

Methods and Outcome measures: The structure-function model is a nonlinear, pointwise translation of SAP sensitivity to neuronal values and a linear transformation of RNFL thickness to axonal counts. The SAP and OCT data were divided into 8 corresponding sections and the model-predictions of RNFL thickness derived from patients' SAP measures were compared to their mean OCT-measured RNFL thickness values.

Results: The general agreement between predicted and measured OCT thickness was good with a mean residual deviation (MRD) across the 8 sectors, of -5.2 µm for the UH-data and -12.8 µm for the BP-data. The mean RNFL thickness derived from SAP data was within 10 µm of the measured thickness for 54 of the 112 eyes (48%) and within 20 µm for 84 (75%) of the eyes. The mean absolute deviation

(MAD) of the 8 sectors was 20.2 µm for the UH-data and 23.1 µm for the BP-data. The accuracy and precision of the sector-by-sector analyses were lower than an analyses of the superior and inferior hemifields (MRD = 1.4 µm, MAD = 15.1 µm, for the UH-data and MRD = -0.3 µm, MAD = 13.2 µm, for the BP-data).
Conclusions: The regional analysis should be clinically useful for direct comparisons of objective and subjective assessments of a patient's glaucomatous neuropathy. The overall accuracy of estimating RNFL from SAP data was good, but with relatively low precision. The lack of precision is likely to be the result of: 1) deriving RNFL thickness on a linear scale from SAP data measured on a logarithmic scale; and 2) inter-subject variations in the maxima of the TSNIT curve, which leads to variability in the map of the visual field onto the optic nerve head.
Support: NIH/NEI grants: R01 EY01139, P30 EY07751, K23 EY018329 and P30 EY014801.
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P175 THE INFLUENCE OF THE LEARNING EFFECT ON AUTOMATED PERIMETRY IN TURKISH PEOPLE

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Purpose: To evaluate the influence of the learning effect on the outcome of automated perimetry and to assess the factors associated with the learning effect in Turkish people.
Design: Experimental cohort study.
Participants: One hundred-two normal Turkish subjects who had not previously undertaken any form of perimetry.
Methods: The Swedish Interactive Threshold Algorithm (SITA) standard 30-2 was performed on a Humphrey Visual Field Analyzer in 102 normal Turkish subjects who had not previously undertaken any form of perimetry. Each subject completed three testing sessions, each separated by at least 1 day. The SITA standard 30-2 testing sessions consisted of both eyes. The right eye was always tested before the left eye.
Main outcome measures: The reliability parameters, test duration and visual field (VF) global indices (mean deviation (MD) and pattern standard deviation (PSD)) obtained from right eyes in the first and third sessions were compared to assess the learning effect. Change in these parameters between the first and third sessions was calculated and the effect of gender, age and educational level on this change was evaluated.
Results: The reliability parameters, test duration and VF global indices each improved between the first and third sessions (each P value less than or equal to 0.001). The change in the parameters was greater in subjects with an age over 50 years and with an educational level under high-school (each P value less than or equal to 0.01). No difference was detected in learning effect based on the gender.
Conclusions: In Turkish normal subjects, the SITA standard 30-2 VF test showed a significant learning effect on the reliability parameters, test duration and VF global indices. The learning effect was correlated with age and educational level.
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P176 TEMPORAL VISUAL FIELD ABNORMALITIES IN GLAUCOMA OR SUSPECTED GLAUCOMA

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Purpose: To investigate visual field abnormalities in the area including the 10 points located temporal to the blind spot in the Humphrey C 30-2 program (C30-2)
Design: Retrospective, observational case series.
Participants: Three thousand three hundred ninety-seven patients with glaucoma or suspected glaucoma who visited 4 facilities between October 2007 and March 2008 underwent SITA standard (SITA-S, Humphrey) C30-2 field testing.
Main outcome measure: Visual field abnormalities in the 10 temporal points of C30-2.
Methods: Temporal visual field abnormalities were defined as the existence of two adjacent pattern deviation (PD) plots within the 10 temporal points of the C30-2 field with values less than 5% where one of these values was less than 1%. Exclusion criteria were as follows: 1. MD value of -15dB or less; 2. Poor reliability of test results; 3. PD plots with values less than 5% were not found within the outermost 4 points of the C30-2 temporal region; 4. Corrected visual acuity of less than 0.3. Temporal field abnormalities were classified into 3 patterns based on the shape of the abnormal points in the PD plot: temporal wedge-shaped defect (wedge defect), supero-temporal sector defect (superior defect), and infero-temporal sector defect (inferior defect)
Results: Out of 6760 eyes in 3397 patients who completed visual field tests, 6127 fields fulfilled the present criteria and

were used for the analysis. Temporal field abnormalities were judged to be present in 266 eyes (4.8%) in 233 patients. In 33 patients (14.2%), temporal field abnormalities were observed in both eyes. The mean refractive error in the eyes with temporal field abnormalities was -3.3 ± 4.0 D (+4.38~-16.75 D) , and the intra-ocular pressure was 14.5 ± 3.3 mmHg (6~28 mmHg).Of the 3 temporal defect patterns, inferior defects were observed most frequently (114 eyes; 42.9%) followed by wedge defects (96 eyes; 36.1%) and superior defects (56 eyes; 21.0%). In eyes without typical nasal glaucomatous field defects, tilted discs were observed in eyes with inferior defects (11 of 37 eyes; 29.7%) at a significantly greater frequency (P = 0.0186, chi square = 7.969) than in eyes with wedge defects or superior defects (4 of 54 eyes; 7.4%)

Conclusion: When temporal visual field abnormalities were detected in cases of glaucoma or suspected glaucoma, inferior defects presumably influenced by optic disc morphological abnormalities were observed more frequently than wedge or superior defects.

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P177 LOW LEARNING EFFECT OF SHORT-WAVELENGTH AUTOMATED PERIMETRY USING THE NOVEL SITA PROGRAM

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Purpose: To evaluate the learning effect at Humphrey Short-Wavelength Automated Perimetry (SWAP) using the novel SITA program over the central 24 degrees on patients with ocular hypertension experienced with standard automated perimetry.

Methods: Twenty-seven patients underwent five SITA SWAP tests at intervals of 5 ± 2 days in a randomized eye. Learning effect was defined as an improvement at results for duration, perimetric indices, foveal sensitivity, Glaucoma Hemifield Test, number of points with a P < 5% and < 1% in the total and pattern deviation maps, total, central, paracentral, peripheral and quadrant sensitivity. Test-retest variability was also calculated for each repetition as the mean of the point-to-point interindividual standard deviations.

Results: Learning effect was shown for foveal sensitivity (P = 0.006, ANOVA). This parameter was significantly different only between the first (23.0 ± 4.1 dB) and the last test (24.7 ± 3.8 dB, P = 0.003, t-test) and was not affected by any demographic or ophthalmic characteristic of the population. All the other parameters did not show any significant learning effect. Test-retest variability ranged from 4.0 ± 1.0 to 4.3 ± 1.0 dB over repetitions.

Conclusions: The novel SITA SWAP program is affected by a small learning effect, which interferes only with the first test. This result is opposite to FT SWAP program, which was flawed by severe learning artefacts, and may induce reconsideration of the clinical utilization of SWAP for the early diagnosis of glaucoma.

P177.1 UNSUPERVISED MACHINE LEARNING WITH INDEPENDENT COMPONENT ANALYSIS IDENTIFIES PATTERNS OF GLAUCOMATOUS VISUAL FIELD LOSS IN SITA FIELDS

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Purpose: Our goal is to develop a more sensitive method to identify glaucoma progression. We previously showed that variational Bayesian independent component analysis-mixture model (VIM), a type of unsupervised machine learning, could separate normal full threshold visual fields from fields with different patterns of loss and by severity in patients with glaucoma, which then allowed development of a promising progression algorithm. Because SITA, the current clinical standard, uses a different thresholding protocol that could impact the convergence of VIM, we tested VIM on a six times larger dataset of SITA fields from the Diagnostic Innovations in Glaucoma Study (DIGS) and African Descent and Evaluation Study (ADAGES).

Methods: One field was used from each of 939 patients with repeatable abnormal SITA-standard fields (glaucoma Hemifield test 'outside normal limits' or pattern standard deviation at 5% or worse) and 1,146 normal eyes with normal fields. The input set into VIM was 52 absolute threshold values in dB from program 24-2 plus age. Without knowledge of class identity, VIM separated the fields into clusters while simultaneously positioning a set of statistically independent axes through the mean of each cluster. The optimum number of axes was determined and a limit was set beyond which no additional information was observed.

Results: VIM separated the fields into 3 clusters, Cluster N contained primarily normals (1089/1146; specificity 95%) and clusters G1 and G2 that together contained primarily glaucomatous fields (835/939; sensitivity 88.9%). For Clusters N and G1 the optimum number of axes was 2 each and for G2 it was 5. Post-hoc analysis found the patterns generated along axes in G1 were very mild and diffusely affected. Patterns at + 2 and -2 standard deviation directions from the G2 mean revealed 10 more specific patterns similar to those identified previously and by experts as indicative of glaucoma. SITA fields assigned to a given axis showed increasing severity as they were located farther from the normal mean.

Conclusions: VIM successfully identified glaucomatous patterns of loss in SITA fields. Pattern severity captured by VIM provided the information needed to update the individualized unsupervised progression algorithm, Progression of Patterns (POP), for use with SITA.

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6.6.3. Clinical examination methods: Visual field examination and other visual function tests: Special methods (*e.g.* color, contrast, SWAP etc.)

see also P039

P178 STANDARD AND SHORT-WAVELENGTH AUTOMATED PERIMETRY WITH SITA ALGORITHM IN GLAUCOMA SUSPECTS DETECTED WITH GDX-VCC AND HRT-III

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Purpose: to compare the ability of Standard Automated Perimetry (SAP) and Short-Wavelength (SWAP) with Swedish Interactive Threshold Algorithm (SITA) to point out early functional defects in glaucoma suspects picked up using confocal laser polarimetry (GDx-VCC) and confocal laser tomography (HRT-III).
Design: Cross-sectional clinical study.
Participants: Randomly selected 90 eyes of 90 patients screened by the glaucoma unit of the University Eye Clinic of Pavia (Italy) on the basis of clinical suspicion of having early glaucoma.
Methods: all subjects were submitted to complete ophthalmic examination, to confocal scanning laser polarimetry and tomography, to standard and short-wavelenght automated perimetry. Media opacities as Lens Opacities Classification System (LOCS) III > 1 were excluded.
Main outcome measure: Moorfields regression analysis (MRA), cup shape measure (CSM), rim area (RA) for HRT-III and nerve fiber indicator (NFI), superior and inferior TSNIT average for GDx-VCC were taken into account. If at least one of these parameters were found out of the normal limits compared to the normative database of each instrument, a 24-2 HFA SAP and SWAP tests were performed using the SITA algorithm in both cases. Mean defect (MD), pattern standard deviation (PSD), number of points significantly depressed < 5% and < 1% in the pattern deviation plot and test duration for SITA-SAP and SITA-SWAP were compared using the Wilcoxon signed rank test.
Results: SWAP gave a significantly larger MD and PSD defect than SAP ($p < 0.01$). This was confirmed by a larger number of depressed points in the pattern deviation plot with SWAP than with SAP, but only the number of points with $p < 1\%$ was significantly different ($p < 0.01$). The SWAP test duration was significantly shorter than SAP
Conclusions: SITA-SWAP can provide a useful identification of diffuse and focal functional loss in a shorter test time than SITA-SAP. The SITA applied to SWAP can improve the ability of the perimetric test to pick up early defects involving short-wavelength sensitive ganglion cells in cases of suspect early glaucoma damage using imaging techniques.
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P179 MODELLING NORMATIVE LIMITS FOR THE HEIDELBERG EDGE PERIMETER

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Purpose: The Heidelberg Edge Perimeter (HEP) uses a temporally driven illusory stimulus, flicker defined form, to generate visual function specific stimuli for the quantification of visual function. In order to determine whether a patient is showing early glaucomatous loss, it is important to clearly define normal limits and confidence intervals. Using a large sample of normal data we modeled these limits using quantile regression (QR) and the more commonly used optimal least square (OLR) regression models. QR has been proposed as being more robust to both non-Gaussian error distributions and the presence of outliers.
Design: Analytical.
Participants: A multi-centre clinical study was conducted involving 400 clinically normal' patients between 20 and 80 years of age.
Methods: Each subject had three study visits in which HEP was performed on both eyes using a 24-2 paradigm. Each location was analyzed to determine confidence limits (95%, 99% and 99.5%) around the mean score. Two different techniques (OLR and QR) were compared using GRETL, a free, open source program intended for econometric analyses, as ways to define these limits.
Main outcome measure: Confidence limits.
Results: HEP data showed that normal limits could be defined and that there was no asymmetry between right and left eyes and test-retest characteristics were similar to the HFA SITAstd 24-2 for normal subjects. Decreasing sensitivities were found with age. The two models were compared within this age range to determine which technique would provide a better assessment of normal limits. QR showed a greater robustness to outliers. As expected, OLS was found to assume a single function for the regression. A constant SE was calculated and applied throughout the distribution (*e.g.*, at 9, 9 slope: -0.12, SE of slope: 0.013). QR showed that depending on the quantile, the slope varied. The slopes define the 95, 99 and 99.5%ile cut-offs for each age group. Variations in slope mean that higher quantiles showed differ-

ent patterns with age than those in lower quantiles. This would suggest that an OLS approach would more likely misclassify older patients in the higher quantiles.
Conclusions: The two different limit-defining techniques were both able to model age-related HEP sensitivities, but the calculated limits were different. Quantiles showed significant variation in percentile limits that were unaccounted for by OLS. The ability of QR to account for variability in limits makes it a potentially useful limit-defining technique for HEP normal data classifiers.
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P180 SIMULTANEOUS MULTIFOCAL PUPILLOGRAPHIC VISUAL FIELD ASSESSMENT OF BOTH EYES

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Purpose: To investigate the diagnostic power and repeatability of 8 variants of multifocal pupillographic perimetry in open-angle glaucoma.
Design: Experimental design.
Participants: Eight stimulus protocols were examined in two blocks of experiments. Block 1 contained 40 normal and 39 glaucoma subjects; block two: 41 normal and 47 glaucoma subjects. Diagnosis was confirmed by examining all subjects with HFA achromatic, and Matrix 24-2 perimetry, Stratus OCT, slit lamp and tonometry. Informed written consent was obtained from all subjects under ANU ethics approval 238/04.
Methods: Independent multifocal stimuli were presented concurrently to both eyes with a dartboard layout, having 44 independent test regions/eye extending to 30 deg eccentricity. The recording duration for 5 protocols was 4 min, divided into 8 segments of 30 s each, and for the other 3 was 6 min, divided into 9 segments of 40 s. Stimuli in each protocol could differ in the presentation rate per stimulus region (0.25, 1, presentations/s), or luminosity (150, 180, 290 or 340 cd/m^2). Background luminance was 10 cd/m^2. Since both pupils responded to stimuli from both eyes, 88 responses/eye were obtained giving 176 contraction amplitudes and 176 delays per protocol, with SE for all 352 measures. Retest was done within 4 weeks. Visual fields were classified by HFA mean defects: moderate: 6 to 12 dB, severe: > 12 dB.
Main outcome measures: The relative diagnostic power of the 8 protocols was examined using areas under receiver operator plots (AUC). The signal qualities were quantified as the median t-static across regions and subjects for peak (relative) constriction amplitude. Test-rest quality was quantified by the width of the 25th to 75th and 5th to 95th percentiles on plots of visit 1 versus visit 2 defects.
Results: In Block 1, for severe fields, the mean of the 20 regional amplitudes that most deviated from the normative data gave an AUC of 0.98 ± 0.01 (mean ± SE), and for combined moderate and severe fields 0.86 ± 0.04. The median t-stat for that protocol was 2.79 ± 0.29. That protocol had a mean presentation rate of 0.25/region/s and luminance of 150 cd/m^2. These results were reproduced in Block 2 and a 6 min. version of the best protocol of Block 1 had a median t-stat of 3.26 ± 0.45, with a concomitant improvement in test-test variability.
Conclusions: This study indicates that multifocal pupil perimetry can yield acceptable diagnostic power, excellent median signal quality and test-retest variability comparable to the Matrix perimeter using a test duration equivalent to 3 min/eye. Data on efferent and afferent defects is obtained for all regions and data from blinks and fixation losses are automatically discarded.

P181 A TRIAL OF A VISUAL FIELD TEST APPLYING A PERIPHERAL STEREOPSIS

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Purpose: We studied two points about the peripheral stereopsis. Examination 1 (Ex.1): We measured the magnitude of stereopsis in normal volunteers in eight directions within 30 degrees. Examination 2 (Ex.2): Whether there would be a significant correlation between the difference of sensitivity in both eyes and the deterioration of stereopsis.
Participants and Methods: Ex.1 involved 20 normal young volunteers (21.1 ± 0.6 years old) and Ex.2 involved 9 normal young volunteers (21.8 ± 1.9 years old). Both subjects had visual acuity of 1.0 or more, stereopsis of 10 sec of arc or better in Titmus Stereo Test and showed a result within normal in glaucoma hemifield test with Humphrey Field Analyzer (HFA). We used Cyberdome (Panasonic) and measured stereopsis with polarizing glasses. There are 24 sites where targets are indicated at 10°, 20° and 30° in 8 meridians. Parallax were set up at 420, 840, 1800, 3600, and 7200 sec. We used Scheffe's test for a statistical analysis for Ex.1. For Ex.2, we measured HFA and peripheral stereopsis using Cyberdome patched with the ND- filter which decreased sensitivity on the right of the glasses. We used Spearman's test for examination 2. When the p value showed 5% or less, the result was considered as a statistically significant in both examinations.
Results: In the Ex.1, a significant difference in stereopsis was detected between 10 and 20 degrees, 20 and 30 degrees, 10 and 30 degrees, respectively. The average of the parallax in each 8 direction, the significant difference was not detected. At the site of 30 degree, the parallax of stereopsis was variable and deteriorated. In the Ex.2, a statistically significant negative correlation between the retinal sensitivity (dB) and the parallax of stereopsis was detected only at 10 degrees ($p = 0.456$).
Conclusion: In this study, at the site of 10 degrees, good stereopsis and a significant correlation between retinal sensitivity and stereopsis could be obtained, indicating that the area where the visual field defect could be detected using stereopsis was within 10 degrees. It was thought that the further investigation should be needed to improve a stereo target to detect visual field defects at 20 and 30 degrees.

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P182 CORRELATION OF FDT DEFECTS WITH RNFL THICKNESS MEASURED BY OCT, GDX AND HRT II IN EARLY GLAUCOMA PATIENTS WITH NORMAL STANDART AUTOMATED PERIMETRY

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Purpose: To determine whether FDT defects corrolate with RNFL thickness measured by OCT, GDx and HRT II.
Design: Observational case-control study.
Participants: Twenty newly early glaucomatous detected patients in the Clinique Ophthalmologique de Tunis and thirty control normal subjects.
Methods: All participants had at least one SAP SITA 24-2 normal test, with one FDT, one Cirrus OCT, one GDx and one HRT II tests.
Main outcome measures: PSD from FDT, RNFL thickness from OCT, GDx and HRT II.
Results: Mean RNFL thicknes is lower in glaucoma in comparaison with normal group, specially with GDx.
Conclusions: RNFL thickness decreases in early glaucoma patients with normal SAP and FDT loss. These results validate the FDT as a tool for earlier glaucoma detection.
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P183 COMPARISON OF WHITE-ON-WHITE PERIMETRY WITH BLUE-ON-BELLOW PERIMETRY PERIMETRY ON VISUAL FIELD LOSS IN DIFFERENT PHASES OF GLAUCOMA

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Objective: To compare the sensitivity of white-on-white perimetry (W/W) and blue-on-bellow perimetry (B/Y) on the visual field loss of (VFL) in different phases of glaucoma.
Methods: The Humphrey-II-750 automated perimetry was used to examine 71 eyes of 42 patients of glaucoma with B/Y and W/W.CIGTS(collaborative initial glaucoma treatment study, CIGTS) scores were used to determine severity of VFL. The patients were divided into early, moderate, and advanced groups according the different degree of MD. The MD, Pattern Standard Deviation and CIGTS scores were calculated and analyzed statistically by student t-test.
Results: MD was significantly lower in B/Y(-8.65 ± 3.89; -14.94 ± 3.22, respectively) dB than in W/W (-3.29 ± 2.40; -10.04 ± 2.73, respectively) dB in early and moderate groups ($t = -9.21, P < 0.001$; $t = -4.89$, $P < 0.001$, respectively). However, it was significantly higher in B/Y (-22.07 ± 2.64) dB than W/W(-25.20 ± 5.48) dB in advanced group ($t = 3.93$, $P < 0.001$). PSD was significantly higher in B/Y (4.17 ± 1.20) dB than in W/W (3.22 ± 2.90) dB in early group ($t = 2.12$, $P < 0.05$). However, it was significantly lower in B/Y (5.19 ± 2.43; 5.56 ± 3.09, respectively) dB than in W/W (7.98 ± 3.20; 8.19 ± 3.37, respectively) dB in moderate and advanced groups ($t = -3.04$, $P < 0.01$; $t = -2.96$, $P < 0.001$, respectively). CIGTS scoring system was significantly higher in B/Y (5.35 ± 3.83) than in W/W (3.36 ± 3.12) in early group ($t = 2.67$, $P < 0.05$). Howerer, it was significantly lower in B/Y (10.96 ± 3.39; 16.93 ± 1.49, respectively) than in W/W (14.51 ± 2.44; 18.78 ± 1.95, respectively) in moderate and advanced groups ($t = -4.31$, $P < 0.05$; $t = -4.02$, $P < 0.001$, respectively).
Conclusions: B/Y perimetry is more sensitive than W/W perimetry in detecting early glaucoma. On the contrary, W/W perimetry is more sensitive than B/Y perimetry in detecting moderate and advanced glaucoma. This indicates that B/Y perimetry be applied in early glaucoma detection, while W/W would be better in monitoring the progress of moderate and advanced glaucoma.
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6.7. Clinical examnination methods: Electro-ophthalmodiagnosis

P184 ROLE OF PATTERN ELECTRORETINOGRAM (PERG) AND VISUAL EVOKED POTENTIALS (PEV) IN GLAUCOMA: MORPHOLOGICAL AND FUNCTIONAL CORRELATIONS

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Purpose: To assess the role of pattern electroretinogram (PERG) and visual evoked potentials (VEP) in detection of visual function impairment in glaucomatous neuropathy; to verify the correlation between visual function (studied by visual field-VF-, PERG and VEP), and anatomical damage (detected by confocal laser polarimetry, GDx-VCC).
Design: Cross-sectional clinical study.
Participants: Thirty-five eyes of 18 glaucoma patients were selected and classified, on the basis of visual field (VF) defect, in early, moderate, and advanced (21, 6, and 8 patients, respectively).
Methods: All patients underwent a complete ophthalmic examination to determine the presence of: clear optical media, best corrected visual acuity > 0.8, no macular disease, open angle. All subjects were submitted to the following examinations: VF, GDx-VCC, PERG and VEP.
Main outcome measure: The average of the 16 central threshold values Central Mean Differential Light Sensitivity (DLS) for VF; the Nerve Fiber Indicator (NFI) for GDx; P50 and N95 latency for PERG, and P100 for VEP have been considered. The Pearson correlation coefficient has been applied as a measure of the correlation among different parameters.
Results: All patients with moderate or advanced VF defect presented abnormal DLS and pathological VEP P100; NFI and PERG values were discordant since NFI resulted normal in 28,5% of these patients, and both PERG P50 and PERG N95 were normal in 57,1% and 42,8% of patients, respectively. A good correlation was found between NFI and VEP P100 ($r = 0,48$, $p = 0,07$ for latency, and $r = 0,71$, $p = 0,003$ for amplitude). About function, all early glaucoma patients presented normal DLS values, but only 28,6% had a normal VEP P100, and 19% recorded normal PERG P50 and N95. About anatomy, NFI was normal in 50% of patients. Anatomical and functional data did not correlate in early glaucomatous. All patients with an evident asymmetry (7 subjects out of 18) between the eyes (early defect in one eye and advanced defect in the other) presented abnormal PERG N95, but normal NFI.
Conclusions: Electro-functional tests may play a role in the diagnosis of glaucoma. PERG records the ganglion cell response and is therefore able to detect early defects in these cells that are principally and early involved in the glaucomatous opticopathy. Our data pointed out that PERG N95 is able to record a retardation before the defect is detectable anatomically. The function is altered before the anatomy in glaucoma patients? Our data seem to suggest this consideration. Further studies with more patients are required.
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P184.1 FAST TRANSIENT VISUAL EVOKED POTENTIAL CORRELATES WITH FUNCTIONAL AND STRUCTURAL DAMAGE IN GLAUCOMA

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Purpose: To investigate the correlation between structural and functional damage in patients with asymmetric glaucoma using a newly-developed fast transient visual evoked potential (ftVEP) device.
Design: Prospective, cross-sectional study.
Participants: Twenty-five glaucoma patients with visual acuity ≥ 20/30 and asymmetric visual field (VF) loss [difference in mean deviation index (MD) of at least 3 dB] were enrolled.
Methods: Patients underwent optical coherence tomography for macular thickness measurement, scanning laser polarimetry with variable corneal compensation for retinal nerve fiber layer measurement and ftVEP (10% and 85% Michelson of contrast, acquisition time of 20 seconds) in both eyes within 2 months. We correlated VF MD and structural test results with ftVEP P100 latency and delta P100-N75 amplitude.
Main outcome measure: Linear regression coefficients between structural and functional parameters.
Results: Using 10% contrast, there was a significant difference in ftVEP latency and amplitude between eyes with better and worse VF MD ($p < 0.001$) and MD values correlated significantly with both ftVEP parameters ($r > 0.33$, $p \leq 0.01$). When using 85% contrast, ftVEP amplitude differed between eyes ($p = 0.01$) and MD values correlated significantly with amplitude results ($r = 0.32$, $p = 0.01$), but not with latency ($p = 0.46$). In the eyes with more advanced VF loss, there was a positive and significant correlation between ftVEP amplitude (85% contrast) and macular thickness on OCT ($r = 0.47$, $p = 0.01$), but not with polarimetry ($p = 0.26$). No other significant structure and functional correlation was observed.
Conclusions: In cases of asymmetric glaucoma, ftVEP results correlate significantly with the level of VF damage as measured by MD. In the eyes with more advanced VF loss, reduced ftVEP amplitude was associated to decreased macular thickness on OCT. These findings suggest that ftVEP may be a fast and objective method to assess or screen for functional damage in glaucomatous eyes.
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6.8. Clinical examination methods: Photography

P185 PATTERNS OF LOCALIZED RETINAL NERVE FIBER LAYER DEFECT PROGRESSION ON RETINAL NERVE FIBER LAYER PHOTOGRAPHS IN NORMAL-TENSION GLAUCOMA

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Purpose: To investigate patterns of localized retinal nerve fiber layer (RNFL) defect progression on RNFL photographs and to quantify extents of progression in normal-tension glaucoma patients.
Methods: Sixty-six eyes of consecutive 66 normal-tension glaucoma patients showing localized RNFL defect progression on serial RNFL photographs were selected for this study. All subjects completed refraction, diurnal intraocular pressure measurements, central corneal thickness measurement, stereoscopic disc photography, RNFL photography, and automated perimetry. Patterns of localized RNFL defect progression were investigated and extents of progression were quantified on RNFL photographs. Serial assessments of stereoscopic disc photographs and visual fields were also performed to detect progression.
Results: The most common pattern of progression was widening of the defect toward the macula (37 eyes; 56.1%) followed by deepening of the defect (26 eyes; 39.4%), appearance of a new defect (6 eyes; 9.1%), and widening of the defect away from the macula (5 eyes; 7.6%). Eight eyes simultaneously showed two patterns of progression. Mean angular widening of the defect toward the macula and away from the macula were 7.6 ± 3.7 degrees (range: 2.4 ~ 17.1 degrees, n = 29) and 4.9 ± 0.4 degrees (range: 4.5~ 5.2 degrees, n = 3), respectively. No progression was observed in the stereoscopic disc photographs or in the visual fields in 60 eyes (98.4%) and 47 eyes (83.9%), respectively.
Conclusions: There were four patterns of localized RNFL defect progression. Serial RNFL photography has the advantage of detecting subtle progression of localized RNFL defect which could not be detectable using other imaging devices.
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P186 AGREEMENT BETWEEN SLIT LAMP BIOMICROSCOPY, HRT AND OPTIC DISC PHOTOGRAPHY IN OPTIC DISC DIAMETER MEASUREMENT

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Purpose: To assess the agreement in vertical optic disc diameter measurements between slit lamp biomicroscopy (clinical), HRT and optic disc photography in clinical practice.
Design: Prospective, non-randomized clinical study.
Participants: Fifty-five eyes of 55 subjects who underwent optic disc diameter measurements.
Methods: Optic disc diameters were measured with +90 D lens on slit lamp biomicroscopy, HRT and optic disc photography. Agreement between the methods of vertical disc diameter measurements were assessed using Intraclass correlation and Bland and Altmann plots.
Results: Mean (± SD) vertical disc diameter was 1.93 ± 0.28, 1.69 ± 0.20 and 1.9 ± 0.22 mm on clinical, HRT and disc photo measurements respectively. ICC for clinical and HRT measurement was 0.72 (95% CI 0.52, 0.83). ICC for clinical and disc photo measurements was 0.92 (95% CI 0.86, 0.95) and for HRT and disc photo measurements 0.64 (95% CI 0.38, 0.79). 95%-limits of agreement on Bland and Altmann plots were -0.23 to 0.69 for clinical and HRT measurements, -0.25 to 0.29 for clinical and disc photo measurements and -0.63 to 0.21 for HRT and disc photo measurements.
Conclusion: Agreement between clinical and disc photo measurement for vertical optic disc diameter is excellent and is better than the agreement between these two methods with HRT measurement.
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6.8.1. Clinical examination methods: Photography: Anterior segment

P187 SCHEIMPFLUG PENTACAM DETECTS CHANGES IN THE ANTERIOR CHAMBER AFTER LASER PERIPHERAL IRIDOTOMY

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Purpose: To determine which parameters recorded by the Scheimflug Pentacam can be used to detect changes after laser periopheral iridotomy.
Methods: Twenty-seven eyes of 14 patients with narrow-angle glaucoma were enrolled in study. Anterior chamber parameters were evaluated by the Scheimpflug Pentacam pre- and post- laser peripheral iridotomy. The anterior chamber depth at the apex (ACD-A), at the periphery 2 mm (ACD-PA), 4mm (ACD-NA), 6mm (ACD-MP), and 8 mm from apex (ACD-FP), the anterior chamber volume (ACV), and angle (ANG) were compared pre and post iridotomy.
Results: Analysis revealed an average post-iridotomy increase of ACD-A by 0.7% (p = 0.8253), ACD-PA by 1.7% (p = 0.5703), ACD-NA by 5.9% (p = 0.1266), ACD-MP by 17.9% (p = 0.0001), ACD-FP 28.3% (p = 0.0000), ACV change of 25.1% (p = 0.0000), and an average ANG increase in angle of 25% (p = 0.1178).
Conclusions: The Pentacam Scheimpflug is most commonly used for evaluation of corneal parameters and in refractive surgery. In our study, it proved to be a promising imaging system for the evaluation of narrow angled glaucoma. Although no significant differences pre-and post iridotomy were observed for the anterior chamber angle and depth at the apex and 2 mm from apex, our analysis shows significant increases in the anterior chamber volume and depth at 4 mm, 6 mm, and 8 mm from the apex after laser peripheral iridotomy. Therefore, Pentacam is a quick, objective tool for detecting and validating post-laser iridotomy changes in anterior chamber of patients with narrow angle glaucoma.
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P188 A PROSPECTIVE ROTATING SCHEIMPFLUG CAMERA EVALUATION OF CHANGES IN ANTERIOR SEGMENT MORPHOLOGY AFTER LASER PERIPHERAL IRIDOTOMY IN CHINESE EYES

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Purpose: To investigate the three dimensional morphology changes of anterior segment in primary angle-closure suspect (PACS) and primary angle closure (PAC) after laser peripheral iridotomy (LPI) using Rotating Scheimpflug Camera.
Design: Prospective observational case series.
Participants: Thirty-seven eyes of 25 PACS or PAC patients were enrolled in the study.
Intervention: Rotating Scheimpflug camera was performed on each selected eye of PACS or PAC patients just before and after LPI.
Main outcome measure: Anterior segment parameters before and after LPI such as central corneal thickness (CCT), central anterior chamber depth (CACD), peripheral anterior chamber depth (PACD), anterior chamber volume (ACV), pupil diameter (PD) and anterior chamber angle of cross-section photographs from 0° to 180° (ACG) were analyzed.
Results: Before and after LPI, average PD of all patients are 1.72 ± 0.42 mm and 1.63 ± 0.46 mm respectively, showed no statistic difference ($P > 0.05$). ACV increased from 55.54 ± 14.25 mm^3 to 82.65 ± 17.63 mm^3 ($P < 0.05$), PACD deepen from 0.89 ± 0.26 mm to 1.14 ± 0.26 mm ($P < 0.05$), ACG widen from 25.51 ± 5.66° to 28.11 ± 5.67° in 9 o'clock direction, and from 25.77 ± 5.15° to 27.91 ± 4.87° in 3 o'clock direction after LPI ($P < 0.05$), no statistic changes of ACD were found before LPI (1.72 ± 0.27 mm) and after LPI (1.70 ± 0.24 mm) ($P > 0.05$). CCT increased from 537.92 ± 27.92 μm to 541.49 ± 27.85 μm ($P < 0.05$).
Conclusion: LPI induce dramatic changes of three dimensional anterior segment morphology in PACS and PAC.
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P189 EYECAMTM FOR ANGLE IMAGING IN ASIAN EYES

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Purpose: To evaluate the use of EyeCam™, a novel wide field digital imaging modality, for angle imaging and to compare this with gonioscopy for detecting angle closure. To evaluate the effect of laser peripheral iridotomy on the angle width using EyeCam™.
Design: Prospective observational series.
Methods: Subjects recruited from a glaucoma clinic underwent gonioscopy by a single observer, and EyeCam™ imaging by a different operator. The EyeCam™ images were then graded by 2 glaucoma specialists working together who were masked to gonioscopy data. The anterior chamber angle in a quadrant was classified as closed on gonioscopy and EyeCam™ if the posterior trabecular meshwork (TM) could not be seen in that quadrant. Twenty four subjects underwent laser peripheral iridotomy (LPI) and EyeCam™ was used to study the angle widening in clock hours.
Main outcome measures: Eyecam™ and gonioscopic agreement on angle closure was analysed using AC1 statistic. Intra and inter observer reproducibility for angle closure using EyeCam™ (180° of TM not visible) was analysed using Kappa statistic.
Results: Of the 167 subjects recruited, 13 were excluded for missing data and 2 subjects were excluded due to poor quality of EyeCam™ images. Of the 152 subjects analyzed, 48% were female and the majority (82%) were Chinese. The agreement between EyeCam™ and gonioscopy in detecting angle closure in the superior, inferior, nasal and temporal quadrants based on AC1 statistics was good (0.81, 0.82, 0.81 and 0.86 respectively). Overall, EyeCam™ imaging had 76% sensitivity, 81% specificity and AUC 0.79 for detecting eyes with gonioscopic angle closure. Inter and intra observer variability for detecting angle closure were moderate (k = 0.43, 95% CI = 0.13-0.74 and 0.49, 95% CI = 0.20-0.79 respectively). The mean number of clock-hours of angle closure decreased significantly from 8.15 ± 3.47 clock hours before LPI to 1.75 ± 2.27 clock hours after LPI ($p < 0.0001$, Wilcoxon signed-ranked test) in 24 subjects.
Conclusions: EyeCam™ was able to image the angle structures clearly in majority of the eyes, and showed good agreement with gonioscopy for detecting quadrants with angle closure. The inter and intra observer variability for angle closure was moderate using EyeCam™. Significant angle widening was demonstrated using EyeCam™ documentation after LPI.
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6.8.2. Clinical examination methods: Photography: Anterior segment

P190 ACCURACY OF DETECTION OF GLAUCOMA BY APPLICATION OF FUNDUS PHOTOGRAPH ANALYSIS SOFTWARE

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Objective: Because of the high prevalence of glaucoma, fundus photographs are becoming increasingly useful as a screening tool. However, due to the variations in diagnosis between physicians who evaluate the photographs, developing a more quantitative rating method has become an issue. We previously devised a fundus photograph assessment method based on the Jikei-Disc Damage Likelihood Scale (J-DDLS) that focused on the disc margin. Here we report the development of analysis software that automatically computes the score on the J-DDLS.
Subjects and Methods: The analysis software was produced with Visual Basic, and its accuracy in detecting glaucoma was assessed by using fundus photographs of 303 eyes, including 41 eyes of healthy subjects, 95 eyes of patients suspected of having glaucoma, and 167 eyes of patients with glaucoma, and by stage classification based on the J-DDLS scores, which are composed of the vertical cup/disc (C/D) ratio, rim/disc (R/D) ratio, and disc-macula distance/disc diameter (DM/DD) ratio, by 1 attending ophthal-

mologist and 2 residents. Correlations with the mean deviations obtained with Humphrey perimetry were also assessed.
Results: When distances on the screen were measured with a ruler, the mean analysis time was approximately 120 sec/eye, but was significantly shorten, 40 sec/eye, when analysis software was used. The areas under the ROC curves for definitive diagnosis of glaucoma by 1 attending ophthalmologist and 2 residents were 0.725, 0.694, and 0.646, respectively, and detection power was greatest when J-DDLS Stage 2 was used as the cut-off value. There was also a significant correlation between the stage and the severity of glaucoma.
Conclusion: Use of the analysis software allows the quantitative evaluation of fundus photographs in a short times, and it is a useful screening tool for glaucoma.
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6.9. Clinical examination methods: Computerized image analysis

see also P072, P302

P191 CORRELATION OF RETINAL NERVE FIBER LAYER MEASURED BY GDX WITH VISUAL FIELD IN ANTERIOR ISCHEMIC OPTIC NEUROPATHY

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Purpose: To evaluate correlations between retinal nerve fiber layer (RNFL) thickness measured by scanning laser polarimetry (GDx VCC) and visual field in eyes with nonartertic anterior ischemic optic neuropathy (NAION) and determine the best receiver operating characteristic (ROC) curves for different GDx Parameter
Design: Case-control study, Farabi Eye Hospital, Tehran, Iran
Participants: Eighteen patients (12 male, 6 female) with diagnosis of unilateral NAION at least 3 months previously. The contralateral uninvolved eye was used as control. The mean ± SD age was 61 ± 9 years (range, 47-77 years).
Main outcome measure: GDx parameters, standard automated perimetry (SAP) sectoral and global indices
Methods: Subjects underwent SAP and retinal nerve fibre layer scans using GDx VCC. ROC curves were calculated. Pearson's correlation coefficients were used to evaluate the relationship between RNFL thickness parameters and MD(Mean deviation) and PSD (pattern standard deviation).
Results: All global and sectoral GDx parameters were significantly different between healthy and affected eyes. The only global SLP parameter that significantly correlated with MD in affected eyes was NFI (r = -0.713; P = .001). All sectoral SLP parameters except inferior average showed significant association with the corresponding VFs. Superior maximum, superior average, and normalized superior area had the greatest AROC (1.00, 0.95, 0.95).
Conclusion: NFI might be correlated with MD in eyes with AION. All sectoral SLP parameters except inferior average showed significant association with the corresponding VFs.
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P192 CORRELATION OF RNFL LOSS ON GDXVCC WITH FUNCTIONAL LOSS ON STANDARD AUTOMATED PERIMETRY (SAP) AND FREQUENCY DOUBLING PERIMETRY (FDP MATRIX) IN EARLY POAG

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Objective: To investigate the relationship between the deviation in peri papillary retinal nerve fiber layer retardation on scanning laser polarimetry (GDxVcc) with visual field defects on standard automated perimetry (SAP) and frequency doubling perimetry (FDP)
Design: Retrospective comparative case series.
Participants: Fifty-four eyes of 28 patients with early primary open-angle glaucoma (MD < -6dB, < 18 points depressed below 5% probability and < 10 points below 1% probability on SAP. No point in the central 5 degree with sensitivity less than 15dB).

Methods: All subjects underwent 24-2 SAP, 24-2 FDP and scanning laser polarimetry with variable corneal compensation (GDxVcc). Individual red pixels ($p < 0.5\%$) on the deviation map of GDxVcc were compared with individual points ($p < 5\%$ and $p < 1\%$) on 24-2 SAP and FDP. A correlation analysis was done between the three tests.
Main outcome measures: Red pixels on the deviation map of GDxVcc and the visual field defect points on SAP and FDP
Results: The mean age was 63 ± 9.4 years. The mean deviation (MD) values for SAP and FDP were -5.12 ± 1.2 dB and -5.31 ± 1.6 dB respectively. Significant correlation was found between the red GDx pixels ($p < 0.5\%$) in the inferior sector with the superior field defect points ($p < 5\%$ and $p < 1\%$) on the SAP ($r = 0.39$) ($p < 0.05$), the total red pixels on the GDx with the total field defect points on SAP and FDP ($r= 0.4$)($p < 0.01$) and the total red pixels on the GDx deviation with the mean deviation on SAP and FDP ($r = 0.34$ and 0.37 respectively)($p < 0.05$).
Conclusion: GDxVCC pixels indicating deviation from normal were significantly correlated to the depressed points on standard automated perimetry and frequency doubling matrix perimetry.
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6.9.1. Clinical examination methods: Computerized image analysis: Laser scanning

P193 COMPARISON OF OPTIC DISC MEASUREMENTS BY THE HEIDELBERG RETINA TOMOGRAPH I (CLASSIC) AND THE HEIDELBERG RETINA TOMOGRAPH II

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Purpose: To investigate the agreement between the optic disc measurements of the Heidelberg retina tomograph (HRT) I/Classic and the HRT II in a cross-sectional study, and to assess the effect of using an HRT I image as a baseline, compared to an HRT II image, in a pseudo-time' series.
Design: Retrospective cross-sectional study.
Participants: Forty-three ocular hypertension and 31 glaucoma subjects (mean age 68 ± 10 years; 44 male and 30 female).
Methods: HRT I and HRT II examinations in one eye were repeated 5 times in two visits within 6 weeks. All disc measurements were obtained via Heidelberg Eye Explorer software with a fixed 320 µm reference plane. Manual alignment of follow-up images to baseline was applied if needed.
Cross-sectional study: The rim area (RA) by HRT I and HRT II were compared, with the HRT I as the baseline for the HRT II images. Pseudo-time series study: two sets of time series' were generated with the baseline image either HRT I or HRT II, and 4 follow-up HRT II images at hypothetical (1 year) intervals. Paired T test and Bland-Altman plots were used to analyze the agreement of measurements. Linear regression was performed on the RA measurements for the pseudo time series.
Main outcome measures: Global and sector RA in HRT I and HRT II images; RA change/year.
Results: The mean global RAs were 1.15 ± 0.33 mm^2 for HRT I, and 1.03 ± 0.33 mm^2 for HRT II ($P < 0.001$, paired T test). The difference between RA by HRT I and HRT II (I minus II) were 0.11 ± 0.12 mm^2 (95% CI -0.11, 0.34). Using linear regression, the slopes in HRT I-baseline and HRT II-baseline longitudinal series were -0.02 ± 0.03 mm^2/year and -0.01 ± 0.02 mm^2/year, respectively. The trend was significant ($P < 0.05$) in 6 (all negative) and 5 (3 negative, 2 positive) series in the HRT I-baseline and HRT II-baseline groups, respectively.
Conclusions: There was moderate agreement in RA measurements between HRT I and HRT II. RA measured by HRT I was a litter larger than that by HRT II. Accordingly, there were more significant negative slopes in HRT I-baseline group in the pseudo-longitudinal set.
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P194 CORRELATION BETWEEN MEAN SENSITIVITY AND THE HEIDELBERG RETINA TOMOGRAPH PARAMETERS IN MYOPIC NORMAL TENSION GLAUCOMA

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Purpose: To evaluate correlation of mean sensitivity with the Heidelberg Retina Tomograph (HRT) parameters, age, refractive error and optic disc ovality in myopic normal-tension glaucoma patients.
Design: Cross-sectional study.
Participants: One hundred eighty one eyes from 181 normal

tension glaucoma patients with myopia. The mean age of patients was 52.1 years old (range, 24-85 years). Ninety-two eyes of 92 men and 89 eyes of 89 women were included in this study. The average of refractive error was -5.85 ± 3.22D (-10.0 - -0.5D).
Methods: All the patients were examined with Octopus Perimeter, program M2, and HRT. HRT and fundus photography were employed, and conducted to calculate optic disc ratio of horizontal to vertical diameter (X/Y). We divided the myopic patients into three groups; mild, moderate and severe group.
Main Outcome Measures: The relationship between the MS and HRT parameters, age, refractive error and X/Y was evaluated.
Results: The age, refractive error, C/D ratio, rim volume (RV), cup shape measure (CSM), mean RNFL thickness (RNFLT) and RNFL cross sectional area (RCSA) showed correlation with the MS within 10 degrees. In analysis of three myopic groups, RV showed correlation with MS in all groups. CSM showed stronger correlation with MS in moderate and severe groups.
Conclusions: The presence of significant correlations between MS and HRT parameters, such as RV, CSM, RNFLT and RCSA, suggests that these HRT parameters could be good indicators of the degree of normal-tension glaucoma with myopia.

6.9.1.1. Clinical examination methods: Computerized iamge analysis: Laser scanning: Confocal Scanning Laser Ophthalmoscopy

P195 COMPARISON OF OPTIC DISC TOPOGRAPHY BEFORE AND AFTER ANTI-GLAUCOMA TREATMENT IN JUVENILE GLAUCOMA

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Purpose: To compare the optic disc topography parameters of cases with juvenile glaucoma before and after anti-glaucoma treatment, by using Heidelberg Retinal Tomograph (HRT II).
Design: The medical records of the 21 consecutive cases with juvenile glaucoma, who had been examined between 2006 and 2008, were reviewed retrospectively.
Participants: Our study consists of 21 eyes of 21 juvenile glaucoma cases with the mean age of 13 ± 2.
Methods: The topographic optic disc parameters (cup volume, cup area, rim volume, rim area, mean cup to disc ratio and mean cup depth) and mean retinal nerve fibre layer thickness of 21 eyes of 21 children with juvenile glaucoma at baseline and at the sixth month of anti-glaucoma treatment, were compared with paired t-test.
Main outcome measure: The changes of optic disc topography parameters.
Results: No statistically significant differences were found between cup volume (p = 0.137), rim area (p = 0.07), rim volume (p = 0.102), and mean cup depth (p = 0.892) before and after treatment. But the mean cup area and cup to disc ratio at the sixth month of the treatment were statistically significantly smaller than the values at baseline (p = 0. 041, p = 0.002). Also the mean retinal nerve fibre layer at baseline was statistically significantly smaller than the value after treatment (p = 0.016).
Conclusion: This result suggests that glaucomatous changes of optic disc topography may be reversible after anti-glaucoma treatment in juvenile glaucoma cases.
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P196 EFFECT OF OPTIC DISC SIZE ON THE DIAGNOSTIC ABILITY OF THE HEIDELBERG RETINA TOMOGRAPH IN JAPANESE SUBJECTS

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Purpose: To evaluate the effect of the optic disc size on the ability to discriminate between normal eyes and those with glaucoma in Japanese subjects when using the Heidelberg retina tomograph (HRT) glaucoma probability score (GPS) and the Moorfields regression analysis (MRA).
Design: Cross-sectional study.
Participants: One hundred ten normal Japanese subjects and 136 Japanese glaucoma patients were studied. In the glaucoma eyes, the average mean deviation (standard deviation) of the Humphrey full-threshold 30-2 program was -6.39 (6.42) dB.
Methods: All participants underwent imaging of the optic disc with the HRT (software version 3.1.2.4). The samples were divided into three equal groups on the basis of disc size: small (disc area < 1.93 mm^2, group I), medium (disc area 1.93-2.34 mm^2, group II) and large (disc area > 2.34 mm^2, group III).
Main outcome measure: GPS and MRA diagnostic abilities in each group were evaluated by examining the sensitivity, specificity and area under the receiver operating characteristic curve (AUC), which were based on the overall classification results obtained when using a Japanese normative database.
Results: When borderline cases were counted as test negatives, the sensitivity and specificity for GPS in groups I, II and III were 44% and 97%, 68% and 93%, and 88% and 61%, respectively, while for MRA, the values were 62% and 100%, 58% and 95%, and 82% and 84%, respectively. In both methods, larger discs were associated with higher sensitivity (P = 0.023) and lower specificity (P ≤ 0.022). When borderline cases were counted as test positives, the sensitivity and specificity for GPS in groups I, II and III were 69% and 92%, 85% and 76%, and 96% and 42%, respectively, while for

MRA, they were 78% and 87%, 78% and 83%, and 90% and 65%, respectively. For GPS, but not MRA, larger discs were associated with higher sensitivity (P = 0.001) and lower specificity (P < 0.001). The AUCs for GPS in groups I, II and III were 0.81, 0.86 and 0.76, respectively, while for MRA, they were 0.86, 0.83 and 0.85, respectively. There were no significant differences found between the AUCs among the 3 groups when using either the GPS or the MRA method.
Conclusions: For both GPS and MRA, disc size is significantly associated with the sensitivity and specificity of glaucoma detection in Japanese subjects.
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P197 COMPARISON OF THE HEIDELBERG RETINA TOMOGRAPH GLAUCOMA PROBABILITY SCORE AND MOORFIELDS REGRESSION ANALYSIS FOR DETECTION OF GLAUCOMA IN JAPANESE SUBJECTS

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Purpose: To compare the ability of the Heidelberg Retina Tomograph (HRT) Glaucoma Probability Score (GPS) and Moorfields regression analysis (MRA) to discriminate between normal and glaucoma eyes in Japanese subjects.
Design: Cross-sectional study.
Participants: This study included 68 eyes of 68 normal Japanese subjects and 86 eyes of 86 Japanese patients with glaucoma. Each eye had a best corrected visual acuity of 20/25 or better, spherical refraction between -5 and +5 diopters, cylinder correction between -3 and +3 diopters, clear ocular media with no clinically significant cataract, normal open angle, no other diseases affecting visual fields, and no previous laser surgery or intraocular surgery. The average mean deviation (standard deviation) of the Humphrey full-threshold 30-2 program in glaucoma eyes was -6.4 (6.4) dB.
Methods: All participants underwent imaging of the optic disc with the HRT (software version 3.1.2.3).
Main outcome measure: The diagnostic abilities of GPS and MRA were evaluated using sensitivity, specificity, accuracy and area under the receiver operating characteristic curve (AUC) based on the overall classification results (within normal limits, borderline, or outside normal limits) obtained using a Japanese normative database.
Results: If borderline cases were counted as test negatives, the sensitivities, specificities and accuracies were 71%, 87% and 78% for GPS, and 69%, 96% and 81% for MRA, respectively. There was no significant difference in the accuracy between the two methods (P = 0.556). If borderline cases were counted as test positives, the sensitivities, specificities and accuracies were 83%, 78% and 81% for GPS, and 84%, 88% and 86% for MRA, respectively. There was no significant difference in the accuracy between the two methods (P = 0.170). The AUCs were 0.83 for GPS and 0.88 for MRA, with no significant difference observed between the two methods (P = 0.081).
Conclusions: The ability of GPS to discriminate between normal and glaucoma eyes was similar to that of MRA in Japanese subjects.
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P198 COMPARISON OF GLAUCOMA DIAGNOSTIC CAPABILITIES OF GDX-VCC, CIRRUS AND STRATUS OPTICAL COHERENCE TOMOGRAPHY

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Purpose: To compare the glaucoma diagnostic capabilities offered by Scanning Laser Polarimetry (GDx-VCC), time-domain (Stratus) and spectral-domain (Cirrus) optical coherence tomography (OCT).
Design: Cross sectional study.
Participants: Forty five glaucomatous and fifty four age-matched healthy subjects.
Methods: Participants were tested by GDx-VCC, Cirrus and Stratus OCT at same visit.
Main outcome measure: Areas under receiver operating characteristic curves (AUCs) of average, superior and inferior retinal nerve fiber layer (RNFL) thicknesses determined by the two OCTs and TSNIT, superior and inferior average and nerve fiber indicator (NFI) assessed by GDx-VCC were calculated and compared when the three imaging devices were employed to evaluate glaucomatous subjects. Positive and negative likelihood ratios (PLRs/NLRs) for glaucoma detection, using normative classifications, are also reported.
Results: Inferior RNFL thickness of two OCTs (Cirrus; 0.953, Stratus; 0,935) and NFI of GDx-VCC (0.933) showed the highest AUC values in each device. Cirrus OCT revealed significantly higher AUCs than Stratus OCT in average and superior quadrant RNFL thickness (0.946 vs 0.907, p = 0.021,

0.939 vs 0.865, p = 0.001), whereas no significant differences were found between Cirrus OCT and GDx-VCC in all analyzed parameters. Average RNFL thickness determined by Cirrus OCT showed the lowest NLR (0.38) among parameters with an infinite PLR.

Conclusions: In our series, all three imaging devices showed good glaucoma discrimination capability. Cirrus OCT demonstrated significantly higher AUCs than Stratus OCT. Both Cirrus OCT and GDx-VCC showed similar diagnostic capabilities for glaucoma detection. However, with all three instruments, abnormal and borderline results (compared with internal normative databases) were related to high PLRs, whereas normal results were associated with relatively high NLRs, reflecting small to insignificant effects on post-test disease probabilities.

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P199 CORRELATION BETWEEN THE PERIPAPILLARY ATROPHY AND THE OPTIC DISC CONFIGURATION IN NORMAL EYES - THE TAJIMI STUDY

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Purpose: Peripapillary atrophy (PPA) is known to be associated with glaucoma, and the size and the location of PPA are significant risk factors for optic disc damage and progression of visual field damage in glaucoma. The area of PPA zone in glaucoma has been reported to be correlated with disc parameters such as cup to disc ratio and rim area. However, no study has been conducted to determine the correlation between PPA area and optic nerve head configuration in normal eyes. The purpose of this study is to investigate the correlation between PPA area and optic disc morphology obtained by Heidelberg Retina Tomography (HRT) in normal healthy eyes in Japan. (The Tajimi Study)

Design: Cross-sectional study.

Participants: A total of 1729 right eyes of 1729 consecutive subjects confirmed as normal in the Tajimi study, with refractive power within ± 6.0 diopters, reliable quality of Heidelberg Retina Tomography (HRT) images and fundus photographs images (TRC-NW6SF, TOPCON) were enrolled.

Methods: The measurements of PPA area were evaluated by drawing a contour line to delineate zone ß on the image of 30 degree digital photographs of the optic nerve head taken by a nonmydriatic fundus camera. The parameters were corrected according to Littmann's method.

Main outcome measure: PPA area obtained by fundus camera and its correlation with HRT parameters, such as disc area, cup area, cup volume, cup to disc ratio, rim area, rim volume, mean cup depth, mean retinal fiber layer thickness, cup shape measure and height variation contour.

Results: Among 1729 eyes of the patients with normal eyes included in this study, 764 were men and 965 were women. The mean age of these patients was 55.6 ± 9.9 years, and the mean refraction was -0.49 ± 1.75 D. PPA was found in 542 eyes (31.3%) and the mean area of PPA was 0.32 ± 20.59 mm^2. The area of PPA was significantly positively correlated with older age, male sex, myopic refraction, and greater mean RNFL thickness and mean cup depth. (P = 0.001~0.01) However, no correlation was found between PPA area and disc area, cup area, cup volume, cup to disc ratio, rim area, rim volume, cup shape measure, and height variation contour in normal eyes.

Conclusions: Significant correlation was seen between the area of PPA zone ß and age, sex, refraction and some HRT parameters. However, cup and rim parameters of the optic disc, which are known to have an influence on the PPA area of glaucomatous eyes did not significantly correlate with PPA area in normal eyes.

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P200 OPTIC DISC MEASUREMENTS USING THE HEIDELBERG RETINA TOMOGRAPH IN SUPERIOR SEGMENTAL OPTIC HYPOPLASIA

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Purpose: To evaluate the optic disc characteristics using the Heidelberg Retina Tomograph (HRT) and the classification results of the HRT glaucoma probability score (GPS) and the Moorfields regression analysis (MRA) in eyes with superior segmental optic hypoplasia (SSOH).

Design: Cross-sectional study.

Participants: Sixteen eyes of 11 Japanese patients with SSOH were studied. Each eye had a best-corrected visual acuity ≥ 20/20, a normal intraocular pressure ≤ 21 mmHg, normal open angle, and a wedge-shaped visual field defect (oriented to the blind spot) with a corresponding retinal nerve fiber layer defect in the superior nasal region. There were 5 males and 6 females, with a mean age (standard deviation) of 35.1 (13.7). The average mean deviation of the Humphrey full-threshold 30-2 program was -4.51 (4.79) dB.

Methods: All participants underwent imaging of the optic disc with the HRT (software version 3.0).
Main outcome measure: Rim area and the overall classification results (within normal limits, borderline, or outside normal limits) of GPS and MRA.
Results: For GPS, when borderline cases were counted as test negatives, 8 eyes (50%) were classified as outside normal limits. When borderline cases were counted as test positives, 9 eyes (56.3%) were classified as outside normal limits. For MRA, when borderline cases were considered negative or positive, 11 eyes (68.8%) or 13 eyes (81.3%) were classified as outside normal limits, respectively. Rim area in the nasal superior sector was significantly smaller than that in the temporal superior or nasal inferior sector (P = 0.041).
Conclusions: In eyes with SSOH, there is significant thinning of the rim in the nasal superior sector. Optic disc measurements using the HRT may be useful in evaluating the optic disc characteristics in eyes with SSOH.
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P201 MORPHOMETRIC MARKERS OF OPTIC NEUROPATHY PROGRESSION IN NORMAL-TENSION GLAUCOMA PATIENTS

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Background: Normal-tension glaucoma (NTG) is a common form of open-angle glaucoma throughout the world, and yet there are many unanswered questions regarding its progression mechanisms. Among others pathognomonic signs, NTG diagnostic criteria include progressive loss of retinal ganglion cells, manifest clinically by loss of optic disc neuroretinal rim tissue, defects in the retinal nerve fibre layer (RNFL), and deficits on functional visual field testing. However, it was noticed that structural and functional changes in NTG could remain minimal during long time period.
Purpose: The aim of our study is to identify the localization of typical morphometric optic disc damages during NTG progression.
Methods: Thirty-seven patients with previously diagnosed NTG were evaluated retrospectively: mean age of patients who had early stage was 55,6 ± 10,3, moderate - 64,1 ± 11,3, advanced - 67,9 ± 12,1. The optic disc measurements were obtained with the Heidelberg Retina Topograph (Software 3.0.2).
Results: It was established, that in the initial stage of NTG rim area was firstly getting thinner in tmp/sup (0,042 ± 0,15 mm^2) and nsl/inf (0,034 ± 0,18 mm^2) sectors/parts ($p < 0,02$). Than progression took place in tmp/inf (0,09 ± 0,06 mm^2), and later, in advance stage, enlarged upon whole temporal rim hemisphere ($p < 0,0003$). Analyzing rim volume data, symmetric progressive damage growing was revealed in temporal and tmp/inf areas ($p < 0,0001$). Retinal nerve fibre parameters (height variation contour and mean RNFL thickness) were lowest in temporal and nsl/sup sectors ($p < 0,0003$).
Conclusion: Therefore, initial topographic optic nerve damages in patients with NTG were localized in tmp/inf, and than spread on temporal И tmp/sup sectors, where proportion of glial and neural elements was the most unfavorable.
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P202 OPTIC NERVE HEAD TOPOGRAPHY AND STRUCTURE-FUNCTION CORRELATION IN EYES WITH PRIMARY OPEN-ANGLE GLAUCOMA AND PSEUDOEXFOLIATION GLAUCOMA

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Objective: To compare the optic disc parameters as measured with the Heidelberg Retina Tomograph (HRT) in pri-

mary open-angle glaucoma (POAG) and pseudoexfoliation glaucoma (PEXG) and to study structure-function correlation within each type of glaucoma.
Design: Observational case series.
Participants: A total of 87 persons, 54 with POAG and 33 with PEXG, recruited from a university glaucoma service.
Methods: Each subject underwent visual acuity measurement, applanation tonometry, gonioscopy, slit lamp examination, dilated optic disc and retinal examination, automated perimetry and HRT optic disc evaluation. Subjects were classified as having glaucoma according to specific criteria that required the presence of both structural and functional damage. One eye per subject was included in the analysis. Chi-square test was used to compare proportions among different groups. T-test was used to compare the mean of continuous variables with normal distribution. Mann-Whitney U test was used to estimate the difference of continuous variables between the two groups when variables did not meet the criteria for T-test [visual field Advanced Glaucoma Intervention Study (AGIS) score]. Multivariate regression models were used for analysis of HRT parameters while adjusting for age, AGIS score and disc area. Pearson correlation coefficients were calculated between HRT parameters and AGIS score within each group, adjusting for age and disc area.
Main outcome measures: HRT parameters were compared between POAG and PXEG. Correlation between HRT parameters and AGIS score was estimated within each group.
Results: There was no statistically significant difference between POAG and PXEG groups with regards to gender (27males/27 females *vs* 19 males/14 females, p = 0.49) AGIS score (7.06 ± 5.3 *vs* 8.12 ± 5.45, p=0.201) and disc area (2.091 ± 0.408 *vs* 2.109 ± 0.397, p = 0.8) respectively, but age was significantly lower in patients with POAG (69.96 ± 7.1 *vs* 76.42 ± 7.11, p < 0.001). Seven HRT parameters were statistically significantly different between POAG and PEXG. Cup area (1.315 ± 0.053 *vs* 1.057 ± 0.069, p = 0.006), height variation contour (0.436 ± 0.023 *vs* 0.351 ± 0.031, p = 0.038) and cup/disc area ratio (0.619 ± 0.025 *vs* 0.495 ± 0.033, p = 0.005) were higher in POAG compared to PEXG, while rim area (0.781 ± 0.043 *vs* 1.039 ± 0.0620, p = 0.006), rim volume (0.160 ± 0.018 *vs* 0.243 ± 0.024), retinal nerve fiber layer (RNFL) cross section area (0.533 ± 0.064 *vs* 0.798 ± 0.084, p = 0.019) and mean RNFL thickness (0.105 ± 0.013 *vs* 0.158 ± 0.017, p = 0.020) were lower in POAG compared to PEXG. In POAG the AGIS score was positively correlated with cup/disc area ratio (p < 0.001), cup area (p < 0.001), cup shape measure (p = 0.008) and cup volume (p=0.046), while it was negatively correlated with rim area (p < 0.001, rim volume (p < 0.001), RNFL cross section area (p < 0.001) and mean RNFL thickness (p < 0.001). In PEXG there was no correlation between HRT parameters and AGIS score, except for rim volume (p = 0.021) which was negatively correlated with AGIS score.
Conclusion: POAG presented with larger cup and thinner rim compared to PEXG even after adjusting for visual field AGIS score, age and disc area. AGIS score was correlated with several HRT parameters in POAG, while only one HRT parameter was correlated with AGIS score in PEXG.
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P203 INFLUENCE OF SCAN QUALITY ON CONFOCAL SCANNING LASER OPHTHALMOSCOPY AUTOMATED SHAPE ANALYSIS WITHIN THE BRIDLINGTON EYE ASSESSMENT PROJECT

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Introduction: Commercially available Confocol Scanning Laser Ophthalmoscopes (CSLO) can be used to image the optic nerve head (ONH) in order to identify glaucomatous damage and to detect progressive structural changes. Image quality can be assessed by measuring the mean pixel height standard deviation (MPHSD) and images graded in to categories according to the device manufacturer; MPHSD < 20 excellent, 20-30 very good, 31-40 acceptable. Satisfactory images can often not be obtained in elderly patients. An automated shape analysis tool which produces a Glaucoma Probability Score (GPS) has recently been developed. Studies examining this tool, which does not require the manual placement of a disc contour line, have used different criteria for scan selection with image quality cut offs set between 30 and 50 µm.
Purpose: To determine the effect of scan quality on GPS in a normal elderly population.
Design: Population based cross sectional observational study.
Participants: One thousand ninety-six eyes of the first normal (defined with visual fields and intraocular pressures) 548 subjects (mean age 72 years, range 65-89 years) from The Bridlington Eye Assessment Project.
Methods: Patients underwent optic nerve imaging using a CSLO. Scan data was imported into a later version of the device for calculation of GPS.
Results: MPHSD ranged from 8-258 µm, with mean 35 µm (SD 28 µm). MPHSD and Cup-Disc ratio were significant covariates (p < 0.001) within a generalised linear model with the global GPS score as the dependent variable. MPHSD was significant even when scans with MPHSD > 50 µm were excluded (p < 0.001). MPHSD was not significant when scans with MPHSD > 30 um were excluded from the analysis (p = 0.14).
Conclusion: GPS should be interpreted with caution in scans acquired with MPHSD > 30 µm.
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P204 EVALUATION OF GLAUCOMA PROGRESSION ANALYSIS WITH HRT III: TOPOGRAPHIC CHANGE ANALYSIS VS. FLICKER TEST

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Purpose: Glaucoma progression analysis with HRT can alternatively be performed with topographic change analysis (TCA) or flicker test of the intensity and topography images. Aim of this study was to evaluate these two diagnostic tools.
Design: Prospective assessment of two methods for glaucoma progression.
Participants: Thirty HRT follow-up (FUP) cases of 29 patients (15 left and 15 right eyes) with POAG and with a mean number of FUP examinations of 3.8 ± 1.8 (range 2-7) and mean FUP-time of 27 ± 11 month (range 9-43).
Methods: All HRT FUP cases were evaluated by six German HRT specialists. They each individually assessed all cases in a masked fashion with TCA and flicker and decided if there was a) progression, b) rim loss, c) localized nerve fiber loss, and d) appearance or change of disc haemorrhages (DH). Finally, all cases were discussed and a consensus was reached for each technique and an overall consensus was established.
Main outcome measure: The results of the individual assessment were compared to the consensus for each technique and to the overall consensus.
Results: In 21 cases glaucoma progression was present according to the overall consensus. Flicker detected progression in all 21 cases and TCA in 14 of those. In the cases with no progression in the consensus, flicker detected progression in 1 and TCA in 2 cases. The agreement on progression was 86.1% for flicker individually versus flicker consensus, 51.1% for TCA individually versus TCA consensus, 82.8% for flicker individually versus overall consensus, 64.4% for TCA individually versus overall consensus. The agreement for the other parameter was: rim loss 83.9% / 79.4% / 81.7% / 62.8%, localized nerve fiber loss 76.1% / 84.4% / 76.1% / 71.1%, appearance or change of DH 72.2% / 93.9% / 72.2% / 67.2%, respectively. The agreement between the individual assessment and the overall consensus for progression (P = 0.017) and rim loss (P = 0.021) was statistically significant better for the flicker compared to the TCA.
Conclusions: The flicker test was able to detect progression more often compared to the TCA. There was good agreement between the individual assessment and the overall consensus for both techniques. The results suggest that for the evaluation of progression with the HRT the assessment should not only be based on the TCA alone. Therefore, the evaluation of glaucomatous progression by HRT should consist of the combination of TCA and flicker test.
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P205 EFFECT OF TWO DIFFERENT MACULAR BIREFRINGENCE IMAGING PROTOCOLS USED FOR CORNEAL COMPENSATION, ON RNFL THICKNESS PARAMETERS USING GDXVCC IN NORMALS AND EYES HAVING MACULAR LESIONS

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Objective: To study the effect of two different macular birefringence imaging protocols used for corneal compensation, on retinal nerve fiber layer (RNFL) thickness parameters using scanning laser polarimetry with variable corneal compensation (GdxVCC) in normals and eyes having macular lesions.
Design: Cross-sectional comparative study.
Participants: Fifty eyes of fifty consecutive patients with macular pathology (subretinal neovascular membrane, macular scar, diabetic macular edema, and macular hole) and fifty eyes of fifty consecutive normal subjects
Methods: Fifty eyes of 50 normal subjects (no disc or visual field abnormalities, IOP < 21 mmHg) and 50 eyes of 50 patients with macular pathology (subretinal neovascular membrane, macular scar, diabetic macular edema, and macular hole) were evaluated. Compensation for anterior segment birefringence was done using the standard protocol after imaging the macula (method I: small circle 10 X 10) and then repeated using the irregular pattern protocol (method II: large square 60X60). The various RNFL parameters evalu-

ated using the two different protocols included TSNIT average, Superior average, Inferior average, and Nerve Fiber Indicator (NFI).
Main outcome measure: TSNIT average, Superior average, Inferior average, and Nerve Fiber Indicator (NFI) on GdxVCC
Results: There was no significant difference between the RNFL parameters using both protocols in normal eyes. In patients with macular pathology, 18 out of 50 eyes (36%) had a significant overestimation of all RNFL thickness parameters with method I which normalized when repeated with method II (Table 1). Out of these 18 eyes, 16 had CNVM, one had DME and one eye had macular hole. Thirty two eyes (64%) did not show a significant change on GDx VCC parameters on either of the two scan protocols.
Conclusion: Imaging the RNFL using GDxVCC leads to significant overestimation of RNFL thickness in more than one third of eyes with a macular pathology. It is recommended that the irregular macula protocol be used for imaging in such cases. These findings highlight the need to change the imaging protocol in patients with macular lesions or those glaucoma patients who develop macular lesions during their course of follow up.
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6.9.1.2. Clinical examination methods: Computerized image analysis: Laser scanning: Confocal Scanning Laser Polarimetry

P206 COMPARISON OF SCANNING LASER POLARIMETRY WITH VARIABLE CORNEAL COMPENSATION AND ENHANCED CORNEAL COMPEMSATION FOR DETECTION OF GLAUCOMA IN JAPANESE SUBJECTS

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Purpose: To compare the ability of scanning laser polarimetry with variable corneal compensation (VCC) and enhanced corneal compensation (ECC) to discriminate between normal and glaucoma eyes in Japanese subjects.
Design: Cross-sectional study.
Participants: This study included 72 eyes of 72 normal Japanese subjects and 52 eyes of 52 Japanese patients with glaucoma. Each eye had a best corrected visual acuity of 20/25 or better, a spherical equivalent refractive error between -6 and +6 diopters, clear ocular media with no clinically significant cataract, normal open angle, and no previous laser surgery or intraocular surgery. The average mean deviation (standard deviation) of the Swedish Interactive Threshold Algorithm standard 24-2 program of the Humphrey Field Analyzer in glaucoma eyes was -5.2 (6.7) dB.
Methods: All participants underwent imaging using a scanning laser polarimeter (GDx) with VCC and ECC methods on the same day. Five GDx parameters were calculated for each method: TSNIT (temporal, superior, nasal, inferior, temporal) average, superior average, inferior average, TSNIT standard deviation, and nerve fiber indicator (NFI).
Main outcome measure: Between scanning laser polarimetry with VCC and ECC, the ability of the 5 GDx parameters to discriminate between normal and glaucoma eyes was compared using the area under the receiver operating characteristic curve (AUC).
Results: The AUCs in scanning laser polarimetry with VCC and ECC were 0.891 and 0.917 for TSNIT average, 0.885 and 0.882 for superior average, 0.849 and 0.884 for inferior average, 0.855 and 0.854 for TSNIT standard deviation, and 0.921 and 0.908 for NFI, respectively. For each GDx parameter, there was no significant difference in the AUC obtained from scanning laser polarimetry with VCC and ECC ($P > 0.05$).
Conclusions: The ability of GDx parameters to discriminate between normal and glaucoma eyes was similar in scanning laser polarimetry with VCC and ECC in Japanese subjects.
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P207 COMPARING THE DIAGNOSTIC ACCURACY OF HEIDELBERG RETINA TOMOGRAPH 3 CLASSIFICATIONS IN EYES WITH SMALL OPTIC NERVE HEAD

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Objective: A glaucomatous change is hardly detected in a

small and crowded optic nerve head (ONH). The purpose of this study is to evaluate the usefulness of the glaucoma probability score (GPS) which does not require manual outlining of the optic disc (OD) boundaries, and Moorfields Regression Classification (MRA), which requires manual outlining of the OD boundaries, for detecting normal and glaucomatous eyes using the Heidelberg Retinal Tomograph 3 (HRT 3).
Design: Retrospective cross-sectional study.
Participants: Among the caucasian cases that underwent confocal scanning laser ophthalmoscopic examination 45 eyes with the OD size smaller than 1.63 mm^2 according to stereometric parameters with HRT 3 were recruited in that study.
Methods: The eyes were divided into normal and glaucomatous groups depending on the results of standard automated perimetry and intraocular pressure. The glaucomatous group was further subdivided into subsets according to visual field loss as mild, moderate and advanced.
Main outcome measures: The diagnostic accuracies of the MRA and GPS related to mean deviation result of were analyzed by means of the Pearson correlation analysis.
Results: In small ONH, according to Pearson correlation analysis we found that the correlation between mean deviation (MD) results of visual field examination and the GPS was 0,314 which is significant at p = 0.05, however the correlation between the MD and MRA was not significant (0,199) according to Pearson correlation analysis at p = 0.05. Additionally, there was very strong correlation between the MRA global classification and the GPS global classification (Pearson correlation analysis was 0.629 at p = 0.05)
Conclusion: The GPS global classification showed correlation with visual field results in small sized ONH. The MRA global classification and the GPS global classification agreement was strong in small ONH examinations with HRT 3.
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P208 DIAGNOSTIC ACCURACY OF SCANNING LASER POLARIMETRY WITH AND WITHOUT ENHANCED CORNEAL COMPENSATION AND HIGH DEFINITION OPTICAL COHERENCE TOMOGRAPHY IN GLAUCOMA

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Purpose: To compare the discriminating ability of scanning laser polarimetry (SLP), using enhanced (ECC) and variable corneal compensation (VCC), and High Definition optical coherence tomography (HD-OCT) in the diagnosis of glaucoma.
Design: A cross-sectional study.
Participants: 103 normal (n = 56) and glaucomatous (n = 47) eyes of 52 patients
Methods: Complete examination, automated perimetry, SLP-ECC, SLP-VCC and HD-OCT. SLP parameters are recalculated in 90 degrees segments (quadrants) in the calculation circle to be compared.
Main outcome measures: Differences between normal and glaucoma eyes in main parameters of retinal nerve fiber layer thickness of the different techniques are observed (average thickness, superior, inferior, temporal and nasal quadrants) and AUROCs discriminating normal and glaucoma eyes are calculated and compared.
Results: Parameters of RNFL thickness measured with the three methods are significantly higher in normal than in glaucoma eyes (p < 0,0001) except in the temporal quadrant RNFL measured with SLP-VCC (p = 0,19) and with SLP-ECC (p = 0,55) where there is not found statistical significant difference. SLP-VCC parameter generating the greatest AUROC is the inferior quadrant RNFL thickness (0,87, SE = 0,03). SLP-ECC parameters generating the greatest AUROCs are the average (0,88, SE = 0,03) and the inferior RNFL thickness (0,88, SE=0,03). HD-OCT parameters generating the greatest AUROCs are the average (0,91, SE = 0,02) and the superior RNFL thickness (0,91, SE = 0,02). Comparison of ROC curves between SLP-VCC and SLP-ECC parameters shows only statistical significant difference in average thickness RNFL (p = 0,003). Comparison of ROC curves between SLP-ECC and HD-OCT parameters shows only statistical significant difference in temporal thickness RNFL (p = 0,001).
Conclusions: Even though SLP-ECC achieves some improvement in the AUROCs of different parameters measured with SLP-VCC, all of three techniques, SLP methods and HD-OCT, show high enough AUROCs values to be considered clinically accurate tools in the diagnosis of glaucoma.
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P209 DIAGNOSTIC ACCURACY OF SCANNING LASER POLARIMETRY SCREENING PROTOCOL IN IDENTIFYING GLAUCOMATOUS AND HEALTHY EYES

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Purpose: To evaluate the diagnostic accuracy of the Scanning Laser Polarimetry screening protocol in identifying healthy eyes and glaucomatous eyes and further to evaluate the diagnostic accuracy as a function of severity of glaucomatous damage.
Design: Cross-sectional study.
Participants: Healthy (n = 221) and glaucomatous (178) subjects were enrolled in 10 sites.
Methods: Subjects underwent polarimetry scan with the screening protocol and standard automated perimetry testing twice. The eyes were labeled glaucomatous or healthy on the basis of perimetry. The severity of glaucomatous damage was staged on basis of Mean Deviation of perimetry with early glaucoma having mean deviation less than -6 dB, moderate glaucoma greater than or equal to -6 dB but less than -12 dB and severe glaucoma greater than or equal to -12 dB. The screening protocol identifies an eye as being within normal limits, borderline or outside normal limits. For the purposes of the study all eyes identified as borderline or outside normal limits was grouped as 'disease' and all within normal limits as 'healthy'.
Main outcome measure: The sensitivity, specificity, accuracy, positive predictive value and negative predictive value in identifying disease or healthy eyes for the group as whole and at various stages of glaucoma was calculated.
Results: The sensitivity, specificity, accuracy and positive and negative predictive value overall was 82.6%, 93.7% 88.7% and 91.3% and 87.0% respectively. Dividing the group by severity of disease the sensitivity was 65.1%, 90.3% and 94.3% respectively for the early, moderate and severe glaucoma. The accuracy also varied with severity of damage was 87.3%, 92.9% and 93.8% for early moderate and severe glaucoma but to a lesser extent than sensitivity.
Conclusion: Screening tests gives us a method of identifying at risk individuals prior to a full exam being performed. In the present study, the sensitivity and accuracy of the scanning laser polarimetry screening protocol varies with level of severity of glaucoma with the values being higher in moderate and advanced disease when compared to early glaucoma. Further research is required in improving the diagnostic accuracy on early cases of glaucoma which are the most difficult to identify.
Disclosure/Commercial interests: P Gunvant Funding and research support Carl Zeiss Meditec, Inc., Dublin, CA R. Gurses-Ozden, K. Soules, Q. Zhou, Employee Carl Zeiss Meditec, Inc., Dublin, CA, Yi-Jing Duh - Statistical Consultant Carl Zeiss Meditec, Inc., Dublin, CA
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P209.1 CONFOCAL SCANNING LASER OPHTHALMOSCOPY IN AN OLDER POPULATION

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Purpose: To evaluate confocal scanning laser ophthalmoscopy as a tool for detecting open-angle glaucoma is an older Australian population.
Methods: The Heidelberg Retinal Tomograph II was used to take optic disc scans on participants in the Blue Mountains Eye Study 10-year follow-up (BMES III). The Moorfields regression analysis was applied to the scans using the default results of 'normal', 'borderline' and 'outside normal limits'. Open-angle glaucoma was diagnosed independently using optic disc photographs and 24-2 Humphrey visual field printouts.
Results: The mean age of the BMES III cohort was 73.7 years. HRT scans could be acquired in 1607 participants, 91.3% of those examined. Eighty-eight percent of scans had a topography standard deviation (SD) of 40 micrometers or less, with 52% having a SD of 20 micrometers or less. Increasing topography SD was associated with older age and the presence of open-angle glaucoma (OAG). OAG was detected in 105 participants – the overall glaucoma prevalence of 5.43% was identical to that in BMES I, after accounting for the older age of participants in BMES III. Of the 1607 participants who had HRT scans, the Moorfields regression analysis result was normal in both eyes of 1080 participants (67.2%). At least one eye was borderline in 252 participants (15.7%) and abnormal in 275 participants (17.1%). This third group included 184 left and 166 right eyes, and in 75 participants, both eyes were classified as abnormal. The Moorfields regression analysis had a sensitivity of 64.0% (confidence interval, [CI] 47.6-52.4), a specificity of 85.7% (CI 84.0-87.4), a positive predictive value of 21.5% (CI 19.5-23.5) and a negative predictive value of 97.5% (CI 96.7-98.3). The positive predictive value increased with age, from 11% for ages 60-69 years to 20% for 70-79 years and 27% for 80 years or older. If borderline results were also classified as abnormal, the sensitivity improved to 87% (CI 85.4-88.6%), but specificity dropped to 71% (CI 68.8-73.2). The positive predictive value fell to 15% (CI 13.3-16.8) while the negative predictive value improved to 98.9% (CI 98.4-99.4). Significant predictors of an abnormal Moorfields regression analysis were OAG (odds ratio, OR 8.3, CI 5.2-13.3), older age (OR 1.05 per year CI 1.03 - 1.07), topography SD (1.011 per micrometer CI 1.004 - 1.018) and larger optic disc size (OR 5.4 per mm mean vertical disc diameter, CI 2.3 - 12.5). Restricting analysis to scans with better topography standard deviation had little impact on the diagnostic accuracy of the Moorfields regression analysis. Analysis by disc size suggested that the Moorfields regression analysis would over-diagnose abnormality in large discs.
Conclusions: This study suggests that previous clinic-based

diagnostic test evaluation studies of HRT II may have overestimated test accuracy compared with our general population study. Although the specificity of the Moorfields Regression Analysis was inadequate for use as a glaucoma screening test, the HRT II performed relatively well in an unselected older population with acceptable quality scans in most eyes. Thus, development of a better detection algorithm may permit further evaluation of this instrument for glaucoma screening.

6.9.2. Clinical examination methods: Computerized image analysis: Optical coherence tomography

see also P258

P210 COMPARISON OF RETINAL NERVE FIBER LAYER DEFECT PATTERN BETWEEN PRIMARY OPEN-ANGLE AND ANGLE-CLOSURE GLAUCOMA BY OPTICAL COHERENCE TOMOGRAPHY

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Purpose: To compare the retinal nerve fiber layer (RNFL) defect pattern between primary open-angle glaucoma (POAG) and primary angle-closure glaucoma (PACG) measured by optic coherence tomography (OCT).
Design: Retrospective study.
Participants: One eye each from 38 POAG and 19 PACG subjects.
Methods: The RNFL thickness of 57 glaucoma subjects were exported and compared with the Thai normative database to have focal or diffuse RNFL loss.
Main outcome measure: Pattern of RNFL defect between POAG and PACG.
Results: The mean (± SD) age was 65.2 (±11.1) and 67.8 (± 11.4) years for POAG and PACG groups (p = 0.45). Average (± SD) mean deviation was -4.9 (± 2.8) and -5.6 (± 2.3) dB, respectively (p = 0.37). For the whole group, diffuse RNFL loss was found in POAG group and focal loss in PACG. However, after each eye was evaluated individually, 36.1% and 44.4% in POAG and PACG group was classified to have focal loss. The significant difference was not found between RNFL loss pattern in POAG and PACG groups (p = 0.73).
Conclusions: The RNFL defect pattern between POAG and PACG was similar. Chronically pattern of both diseases may be an explanation.
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P211 THE EVALUATION OF SCAN MISALIGNMENT ON RETINAL NERVE FIBER LAYER THICKNESS MEASUREMENTS BY OPTICAL COHERENCE TOMOGRAPHY IN NORMAL EYES

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Purpose: To evaluate the effect of improper Stratus optical coherence tomography circle scan placement by the operating physician around the optic nerve head during each RNFL testing.
Design: The effect of scan circle placement is evaluated via an observational clinical study.
Participants: In this study, thirty eyes of fifteen normal subjects underwent assessment of RNFL by optical coherence tomography utilizing the fast RNFL thickness protocol.
Methods: Four consecutive scans were obtained by the same operating physician with the circular scan accurately placed on the optic nerve head. Another four images each with displacing the scans superiorly, inferiorly, nasally and temporally were obtained as well.
Main outcome measure: Determination of the differences in average and sectorial RNFL thickness was established. The differences were statistically calculated and analyzed.
Results: When the average RNFL thickness of the correctly centered scans was compared with the average RNFL thickness of the displaced scans individually, no significant difference was found between the thickness of the centered scans and those of the superiorly, inferiorly and nasally displaced scans, a difference that was not statistically significant (p= 0.283).A significant difference was obtained between average thickness between temporally displaced and centered scans, a difference that was statistically significant (p < 0.0001). Significant differences in the sectorial RNFL thickness measurements were found between the centered and every displaced scan. These difference were statistically significant (p < 0.0001).
Conclusion: Average RNFL thickness measurements were similar with nasal, superior and inferior circle scan misplacement whereas the average thickness was increased with temporal scan displacement. Statistically significant differences in RNFL thickness in all sectors between centered and all displaced scans (p < 0.0001).
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P212 DIAGNOSTIC ABILITY OF SPECTRAL-DOMAIN OPTICAL COHERENCE TOMOGRAPHY TO DETECT RETINAL NERVE FIVER LAYER DEFECTS IN PATIENTS WITH PERIMETRIC GLAUCOMA

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Purpose: To assess the diagnostic ability of spectral-domain optical coherence tomography (OCT) for discriminating between healthy eyes and eyes with glaucomatous visual field loss.
Design: Cross-sectional study.
Participants: Sixty-two consecutive healthy subjects and 59 consecutive patients with open-angle glaucoma were included in the study. Only one eye per subject was randomly selected.
Methods: Participants were divided into two groups depending on the results of standard automated perimetry and intraocular pressure. Peripapillary retinal nerve fiber layer (RNFL) thickness was measured using the optic disc cube 200x200 scan protocol of the Zeiss Cirrus OCT (Carl Zeiss Meditec, Dublin, Ca). Left eye data were converted to a right eye format. The receiver operating characteristic (ROC) curves were plotted for OCT parameters between normal and glaucoma groups. Sensitivity-specificity pairs and the areas under the ROC curves (AUCs) were also calculated.
Results: Age did not differ significantly between the groups ($p = 0.31$). The average visual field mean deviation was -5.30 dB. Inferior quadrant thickness (0.934), 6 o'clock segment thickness (0.914), and average thickness (0.912) had the greatest AUCs. There were no significant differences between them. At a fixed specificity of 90%, sensitivities were 77.2% (cut-off point [COP]: ≤ 112 μ) for inferior quadrant thickness, 80.7% (COP: ≤ 122 μ) for 6 o'clock segment thickness, and 73.7% (COP: ≤ 85 μ) for average thickness.
Conclusions: Spectral-domain OCT can measure structural changes at the RNFL in glaucoma patients. The RNFL thickness at the superior and inferior clock-hour positions showed the best diagnostic ability.
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P213 FOURIER DOMAIN OPTICAL COHERENCE TOMOGRAPHY ARTIFACT IN RETINAL NERVE FIBER LAYER THICKNESS MEASUREMENT

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Purpose: To analyze optical coherence tomography (OCT) scan artifact in retinal nerve fiber layer (RNFL) thickness measurement using two scan protocols from Topcon 3D-OCT 1000 device. To determine if scans based on disc-size show more or less artifact than the standard Topcon RNFL protocol used for glaucoma evaluation.
Design: Cross-sectional study.
Participants: Glaucoma and glaucoma suspect patients from the New England Eye Center Glaucoma Service.
Methods: One eye of each patient was scanned with both 3-D optic-disc (3-D) and 3.4-circle scan protocols from Topcon 3D-OCT 1000 device. Only high-quality scans (> 50) were included in the analysis. All 128 scans from 3-D protocol and the 3.4-circle scan were reviewed, and misplacement of RNFL boundaries was manually corrected. Heidelberg Retinal Tomography was used to measure the disc-size. Three different radii size circle scans according to the disc-size (0.4, 0.7 and 1.0 mm bigger than the disc radius) were recorded from the 3-D protocol. Absolute difference in RNFL thickness before and after correction and the percentage of substantial error occurrence (difference greater than 10 μm) were analyzed between the two scan protocols, and among

sectors around the optic disc. Kruskal-Wallis and t-test were used to evaluate absolute difference in RNFL thickness, and Fisher's exact test was used to evaluate substantial error.
Main outcomes: Artifact percentage, and absolute difference in RNFL thickness.
Results: Twenty six glaucoma and 23 glaucoma suspect patients (mean age 63.5 years-old) were enrolled. Mean [standard deviation (SD)] image quality was 65.5 (7.5) on 3.4-circle scans, and 67.6 (7.2) on 3-D scans. Mean (SD) vertical disc-size was 1.69 (0.2) mm. Substantial error frequencies on 3.4-circle scans were 18.4%, 14.4%, 18.4%, and 6.1% on superior, nasal, inferior, and temporal sectors, respectively. On 3-D scan protocol, the 0.7-circle presented significantly fewer substantial artifacts (11.1%; 11.1%; 11.1%; 3.7%) than other circles, and the 1.0-circle presented the greatest substantial artifact percentages (88.9%, 88.9%, 85.2%, 81.5%; superior, nasal, inferior, temporal, respectively). On 3.4-circle scan protocol, the average (SD) absolute difference in RNFL thickness between pre- and post-correction was significantly smaller in the temporal sector [3.3 (6.0) µm ($p = 0.01$)] than in the superior [10.8(9.2)µm], nasal [8.3(11.7)µm] and inferior [10.3(10.9)m] sectors. The 3.4-circle scan presented a smaller difference in RNFL thickness compared to the 1.0-3-D circle in all sectors [21.1 µm ($p < 0.01$); 29.7 µm ($p < 0.01$); 20.4 µm ($p < 0.01$); 16.2 µm ($p < 0.01$)], and compared to the 0.4-3-D circle on superior and nasal sectors [10.8 µm ($p = 0.01$); 8.2 µm ($p = 0.04$), respectively], but was not different from the 0.7-3-D circle [4.7 µm ($p = 0.15$); 5.7 µm ($p = 0.66$); 5.3 µm ($p = 0.41$); 1.6 µm ($p = 0.18$); superior, nasal, inferior, temporal, respectively]. Eyes with peripapillary atrophy had a significantly greater difference in RNFL thickness on the temporal sector in the 0.7 3-D circle (mean: 2.8 µm) than eyes without peripapillary atrophy (mean: 0.3 µm) ($p = 0.04$). Eyes with glaucoma had a significantly greater difference in RNFL thickness than glaucoma suspects on the nasal sector on 3.4-circle scan (mean 8.6 *vs* 4.6 µm; $p = 0.03$), and on the superior sector of the 0.7-3-D circle (mean 6.7 *vs* 2.2 µm; $p = 0.04$). Optic disc size did not correlate with artifact occurrence.
Conclusions: Peripapillary RNFL thickness measurement on OCT result in varying amounts of artifact, depending on the size of the optic disc circle used on the 3D protocol. A circle 0.7 mm bigger than the disc radius resulted in less software artifact; however it was not statistically significant from the 3.4 circle scan. Peripapillary atrophy and glaucoma increase artifact occurrence in good quality image scans.

P214 EVALUATION OF THE EFFECT OF DIFFERENT INPUT PARAMETERS AND MACHINE LEARNING CLASSIFIERS IN GLAUCOMA DIAGNOSIS BY OPTICAL COHERENCE TOMOGRAPHY (OCT)

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Purpose: To compare the impact of two machine learning algorithms, an artificial neural network (ANN) and a support vector machine (SVM), and different input parameters on the glaucoma diagnostic ability of OCT.
Design: Retrospective analysis of prospectively collected clinical data.
Participants: Our material was based on OCT-derived Retinal Nerve Fiber Layer (RNFL) thickness measurements from 90 healthy individuals and 62 glaucoma patients, obtained with the Fast RNFL protocol.
Methods: Glaucoma diagnosis was based on the existence of reproducible visual field defects (with MD values equal to or better than -12dB), corresponding to glaucomatous optic nerve head cupping and/or abnormal RNFL findings. Twenty-one different OCT RNFL parameters were used as input to the ANN and SVM machine classifiers. The parameters included mean RNFL thickness values of the full scan circle, the four quadrants, and the 12 clock hour sectors. The thickest points of the superior (Smax) and inferior (Imax) quadrants and the difference between the maximum and minimum points in the RNFL scan (Max - Min) were also included. We also tested a novel parameter created from the non-linear reduction of the 256 A-scans of each OCT scan into a set of six measurements, by means of a dimensionality reduction algorithm. Significance testing was accomplished with a non-parametric method.
Main outcome measure: ANN and SVM performance, measured by the area under the receiver operating characteristic (ROC) curve, derived from 10-fold cross-validation, for each one of the 21 OCT RNFL parameters.
Results: The parameter based on the transformed A-scans provided the largest ROC areas (0.989 for the SVM and 0.982 for the ANN) and performed significantly better than the best of the conventional parameters, the mean RNFL thickness of the full scan circle ($p = 0.028$) with a ROC area of 0.943 for the ANN and 0.940 for the SVM. The poorest results were produced by the 9th clock hour sector (temporal) parameter. The small differences in ROC areas between the ANN and the SVM were not significant.
Conclusions: The choice of OCT input parameters has a considerably larger impact on the diagnostic accuracy than the choice between ANN and SVM classifiers. Both machine learning algorithms exhibited equally high classification accuracy in our current material. Optimized input is crucial in providing high classification accuracies to OCT based diagnostics.
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P215 CIRRUS HD-OCT NERVE FIBER LAYER INTEROCULAR ASYMMETRY IN ASYMMETRIC VISUAL FIELDS IN GLAUCOMA AND GLAUCOMA SUSPECTS

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Purpose: To compare Cirrus OCT nerve fiber layer interocular asymmetry with the difference in visual field mean deviations in glaucoma patients and glaucoma suspects.

Design: Retrospective study.
Participants: Twenty-four patients (16 open-angle glaucoma, 8 glaucoma suspects) from the New England Eye Center, Boston MA.
Testing: Cirrus OCT retinal nerve fiber layer (RNFL) scans and reliable 24-2 Humphrey Visual Fields (HVF) were analyzed from the 24 patients glaucoma clinic visit in 2008. Patients with unreliable visual fields were excluded.
Main outcome measure: The RNFL symmetry score, obtained from the glaucoma analysis software found on the Cirrus OCT system, is the correlation coefficient, converted to a percentage, derived by comparing 256 points between the OD and OS profile. The absolute value of the difference in HVF mean deviations (|(MD(OD)- MD(OS)|) was calculated, and this value was correlated with the RNFL symmetry score using the Pearson correlation coefficient.
Results: For all subjects, interocular mean deviation difference ranged from 0.18 to 5.36 MD, and their symmetry scores ranged from 13 to 95. There was poor correlation between the two values (r = -0.12, P = 0.56). For both open-angle glaucoma patients and glaucoma suspects, the correlation between interocular mean deviation difference and the symmetry scores were equally poor (glaucoma patients r = -0.09, P = 0.72, glaucoma suspects r = 0.11, P = 0.78).
Conclusion: The Cirrus OCT software includes a novel approach to assess glaucoma by providing an evaluation of RNFL interocular symmetry. Asymmetry may be a useful clinical sign of glaucoma as a high degree of RNFL symmetry has been shown in normal eyes. In both open-angle glaucoma patients and glaucoma suspects, there was poor correlation between the degree of asymmetry in their HVF and their Cirrus OCT RNFL scans. Further work must be done to evaluate the clinical utility of the RNFL interocular symmetry in assessing the onset and progression of glaucoma.
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P216 THE CORRELATION BETWEEN RETINAL NERVE FIBER LAYER THICKNESS PARAMETERS MEASURED BY OPTICAL COHERENCE TOMOGRAPHY AND VISUAL FIELD INDICES IN NORMAL-TENSION GLAUCOMA AND PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: To investigate the correlation between retinal nerve fiber layer(RNFL) thickness parameters measured by optical coherence tomography and visual field indices in early normal-tension glaucoma and early primary open-angle glaucoma and to determine the discriminating parameters best suited to distinguish healthy control eyes, preperimetric glaucomatous eyes and early glaucomatous eyes.
Design: Retrospective cross-sectional study.
Participants and controls: Forty patients with preperimetric glaucoma, 61 patients with early normal-tension glaucoma, 21 patients with early primary open-angle glaucoma and 34 controls without glaucoma.
Methods: Each subjects received a visual field test (Humphrey C30-2 visual field analyzer) and the fast RNFL thickness algorithm test by OCT(Stratus OCT 3000™).
Main outcome measure: Pearson's correlation coefficient between RNFL thickness and visual field indeices, and the sensitivity and specificity for the detection of early glaucoma determined by the area under the receiver operating characteristics curve (AUROC).
Results: The correlations between the parameters (the superior quadrant RNFL thickness and the average RNFL thickness) from the fast RNFL thickness algorithm and the pattern standard deviation (PSD) from the visual field test were statistically significant in early glaucoma ($p < 0.05$). The Pearson's correlation coefficient values in early primary open-angle glaucoma were higher than in normal-tension glaucoma. The AUROC value of the fast RNFL thickness algorithm parameters ranged from 0.56 to 0.66 in preperimetric glaucoma and from 0.75 to 0.83 in early glaucoma. The average thickness for early glaucoma (0.83, 95% CI 0.75-0.91) had the widest AUROC among all parameters.
Conclusion: The average RNFL thickness measured by OCT had a diagnostic ability in discriminating glaucoma and significant correlations with visual field indices.
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P217 THREE-DIMENSIONAL HIGH-SPEED OPTICAL COHERENCE TOMOGRAPHY FOR DIAGNOSIS OF HYPOTONY MACULOPATHY FOLLOWING GLAUCOMA FILTRATION SURGERY

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Purpose: Hypotony maculopathy, an important cause of visual loss following glaucoma filtration surgery, may be difficult to detect on fundus examination if the changes are subtle. This study describes the clinical findings of hypotony maculopathy using three dimensional (3D) topography maps reconstructed from spectral domain optical coherence tomography (SD-OCT) imaging, and compare SD-OCT with time domain OCT (TD-OCT) for hypotony maculopathy diagnosis.
Design: Observational non-comparative case series.

Participants: Six patients with hypotony maculopathy following trabeculectomy with mitomycin C.
Methods: Patients underwent complete ophthalmic examination including slit lamp biomicroscopy, dilated stereoscopic examination, gonioscopy, Goldmann applanation tonometry, and photography of the fundus and optic disc. Hypotony maculopathy was defined as intraocular pressure (IOP) ≤ 7 mmHg on two consecutive post-operative visits associated with chorio-retinal folds within the macular region. Patients underwent consecutive imaging with TD-OCT (Stratus OCT) and SD-OCT using three high-resolution instruments: Topcon 3D OCT (1000,Topcon, Tokyo, Japan); RTVue (Optovue, California, USA); and Cirrus HD-OCT (4000,Carl Zeiss Meditec, California, USA).
Main outcome measures: Comparison of 3D surface maps obtained using SD-OCT to linear scans obtained using TD-OCT.
Results: Mean patient age was 63.17 ± 8.84 years, mean spherical equivalent was -1.79 ± 1.91 diopters, and mean IOP was 4 ± 1.67 mmHg. In 5 of 6 (83.3%) cases, linear TD-OCT scans in the horizontal axis did not detect retinal or subretinal folds consistent with hypotony maculopathy. Two of 6 eyes (33.3%) had minimally detectable folds with TD-OCT imaging in the vertical axis. 4 eyes did not show folds in either axis on TD-OCT. 3D topographic maps using SD-OCT demonstrated advanced retinal and subretinal folds throughout the macular region in all 6 patients. All eyes (4 cases) with no topographically detectable folds using SD-OCT within the foveal avascular zone had visual acuity of 20/25 or better. Two eyes with obvious contour disruption within the foveal pit had visual acuity ranging from 20/30 to 20/70.
Conclusions: SD-OCT using 3D surface topography mapping provides greater sensitivity for hypotony maculopathy diagnosis and monitoring as compared with TD-OCT. Disruption of the foveal pit as detected using SD-OCT is associated with reduced visual acuity.
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P218 RELATIONSHIP BETWEEN SPECTRAL-DOMAIN OPTICAL COHERENCE TOMOGRAPHY AND STANDARD AUTOMATED PERIMETRY

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Purpose: To determine the relationship between the main indices of standard automated perimetry (SAP) and the peripapillary retinal nerve fiber layer (RNFL) thickness measured with spectral-domain optical coherence tomography (OCT).
Design: Cross-sectional study.
Participants: Fifty-five consecutive healthy subjects and 57 consecutive patients with open-angle glaucoma were included in the study. Only one eye per subject was randomly selected.
Methods: Participants were divided into two groups (healthy and glaucomatous subjects) depending on intraocular pressure and optic nerve head morphology evaluated in stereophotographs. SAPs were performed with a Humphrey perimeter and the 24-2 SITA standard algorithm. All of them underwent imaging with the Zeiss Cirrus OCT using the optic disc cube 200x200 scan protocol. Left eye data were converted to a right eye format.
Main outcome measures: The Kolmogorov Smirnov test was applied to check that the data were normally distributed. Pearson correlations were calculated between SAP indices (mean deviation, pattern standard deviation, and visual field index) and OCT parameters.
Results: The average visual field mean deviation was -5.75 dB in glaucoma patients. Mild to moderate correlations were observed between SAP indices and most OCT parameters. The strongest correlations were found between the RNFL thickness in the vertical axis (superior and inferior pole) and mean deviation and pattern standard deviation of SAP. In glaucoma patients, inferior quadrant thickness (0.474) and 6 o'clock segment thickness (0.466) had the strongest correlations with mean deviation of SAP. The healthy group showed milder correlations than the glaucomatous group.
Conclusions: RNFL thickness measured with spectral-domain OCT had moderate correlations with SAP indices in glaucoma patients. These results may help to understand the relationship between structural and functional changes in open-angle glaucoma.
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P219 AGREEMENT BETWEEN CIRRUS AND STATUS OCT AND RETINAL NERVE FIBER LAYER PHOTOGRAPHY IN EYES WITH LOCALIZED RETINAL NERVE FIBER LAYER DEFECT

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Purpose: To investigate the agreement between Cirrus and Stratus OCT and retinal nerve fiber layer (RNFL) photography in eyes with early RNFL defects visualized in RNFL photography.
Design: Observational case series.
Participants: Thirty six patients with at least one localized RNFL defect less than 20 degree width as shown by the red-free fundus photography.
Methods: Patients were scanned with the Cirrus and Stratus OCT. In the Cirrus OCT Deviation from normal map (deviation map), a defect was identified when the yellow or red color pixels constituted an image of a RNFL bundle defect (*i.e.*, radiating from the optic nerve head in an arcuate or wedge shape). In the clock hour diagrams of the Cirrus and Stratus OCT, a defect was identified when the measured thickness of the individual clock hour was abnormal at the 5% level. Clock hour locations of RNFL defects shown in the red-free photography and Cirrus OCT deviation map were determined using a clock face circle which was placed around the optic nerve head. The agreement between the OCTs and red-free photography was assessed as the number of identical clock hour sectors in terms of presence or absence of the RNFL defect by kappa statistics.
Main outcome measure: Kappa value as a measure of agreement between the Cirrus OCT deviation map and red-free photography, and agreement between circular diagrams of Cirrus and Stratus OCT and red-free photography.
Results: Cirrus OCT deviation map showed good overall agreement with red-free photography (k value = 0.66). When analyzed separately, the agreement was excellent in the non-nasal region (from 6 to 12 clock hour sector, k value = 0.75) but poor in the nasal region (from 1 to 5 clock hour sector, k value = -0.11). Of the total of 432 clock hour sectors (36 eyes x 12 clock hour sectors), Cirrus OCT deviation map determined 32 abnormal clock hour sectors where no corresponding defect was identified in the red-free photography. Conversely, 11 clock hour sectors where a localized defect was visible in the photography was determined as normal in the Cirrus OCT deviation map. The Cirrus and Stratus clock hour diagram showed moderate agreement with red-free photography (k value = 0.40 and 0.48, respectively).
Conclusions: Cirrus OCT Deviation from Normal map showed good overall agreement with red-free photography. However, the agreement was poor in the nasal regions. The Cirrus and Stratus clock hour diagram showed less degree of agreement with red-free photography than the Cirrus OCT deviation map.
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P220 SENSITIVITY AND SPECIFICITY OF STRATUS OCT FOR DETECTING DIFFUSE RETINAL NERVE FIBER LAYER ATROPHY IN PERIMETRIC GLAUCOMA

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Purpose: To determine the sensitivity and specificity of Stratus optical coherence tomography (OCT) with its internal normative database to detect diffuse retinal nerve fiber layer (RNFL) atrophy in glaucoma subjects with corresponding visual field defects.
Design: Cross-sectional study.
Participants: Seventy-five glaucoma patients with diffuse RNFL atrophy and 54 healthy control subjects.
Testing: Fast RNFL scans were performed in one eye of each patient using the Stratus OCT.
Main outcome measure: Sensitivity and specificity of various OCT RNFL thickness parameters for detecting diffuse RNFL atrophy.
Results: Using a criterion of abnormal at the < 5% level, the sensitivity of the Stratus OCT parameters ranged from 73.1% to 90.8%, and the specificity ranged from 85.2% to 100%. Using a criterion of abnormal at the < 1% level, the sensitivity of Stratus OCT ranged from 68.1% to 78.2%, and the specificity ranged from 98.1% to 100%. The maximal sensitivity was obtained with the TSNIT thickness graph that was abnormal at the < 5% level (sensitivity 90.8% and specificity 85.2%). The sensitivity of Stratus OCT was closely related to the degree of diffuse RNFL atrophy.
Conclusions: The Stratus OCT with its normative database can detect diffuse RNFL atrophy with high sensitivity and specificity. The most sensitive parameter for detecting diffuse RNFL atrophy was the TSNIT thickness graph abnormal at the < 5% level.
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P221 REPRODUCIBILITY OF PERIPAPILLARY RETINAL NERVE FIBER LAYER THICKNESS MEASUREMENTS IN GLAUCOMATOUS EYES USING SPECTRALIS OPTICAL COHERENCE TOMOGRAPHY

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Purpose: To determine the reproducibility of peripapillary retinal nerve fiber layer (RNFL) thickness measurements in glaucomatous eyes using a spectral domain optical coherence tomography (OCT) device (Spectralis OCT; Heidelberg Engineering, Heidelberg, Germany).
Design: Experimental study.
Participants: Twenty-two eyes of 13 open-angle glaucoma patients were included into this study.
Methods: Peripapillary RNFL thickness was measured using the standard scan protocol of Spectralis OCT three times at 5-minute intervals to determine intrasession variability. The same instrument was used by one operator for all scans.
Main outcome measure: Intraclass correlation coefficient (ICC), coefficient of variation (COV), and test-retest variability.
Results: For global RNFL thickness, ICC was 0.992 and COV was 1.24%. Test-retest variability defined at the 95% level for global RNFL thickness was 1.8 microns. For sextants RNFL thickness, ICCs ranged from 0.975 to 0.997 and COVs were below 2.0% except for nasal sextant. Test-retest variability defined at the 95% level for sextant RNFL thickness measurements ranged from 1.7 to 3.1 microns.
Conclusions: Spectralis OCT RNFL thickness measurements in glaucomatous eyes showed excellent reproducibility. This will make it possible to detect small changes in RNFL thickness with confidence at the follow-up of glaucoma.
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P222 ESTABLISHING COMPARABILITY BETWEEN TIME DOMAIN OPTICAL COHERENCE TOMOGRAPHY (TD-OCT) AND SPECTRAL DOMAIN OCT (SD-OCT) FOR RETINAL NERVE FIBER LAYER (RNFL) THICKNESS MEASUREMENT

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Purpose: TD-OCT has been commonly used in clinical practice, producing a large inventory of circular scan data for retinal nerve fiber layer (RNFL) assessment.1-5 We hypothesize that automated TD-OCT and SD-OCT circle placement matching can be achieved using OCT image data. The purpose of this study was to establish a mathematical method and to test its performance in terms of accuracy of the matched scanning circle location as well as the consistency of the RNFL thickness measurements.
Design: Cross-sectional.
Participants: Eleven eyes of 11 healthy subjects.
Methods: Nine circumpapillary TD-OCT Circle Scans (Stratus OCT, Carl Zeiss Meditec, Dublin, CA) each set with one center and eight displaced circles in known distance/directions, and one SD-OCT cube scan (Cirrus HD-OCT, Carl Zeiss Meditec, Dublin, CA; Optic Disc Cube 200x200x1024) were obtained. The location of the TD-OCT circle scan was automatically detected within the SD-OCT volume scan using a software program of our own design. Mixed effect models were used for the statistical analysis.
Main outcome measures: Distance of the detected scan location on the SD-OCT 3D volume from the actual TD-OCT scan and global and sectoral RNFL thickness measurements with or without scan location matching.
Results: The difference [95% confidence interval] in scan circle center location between TD- and SD-OCT was 2.34 [1.24-3.44] pixels (70.20 [37.20-103.20] μm on the retina). There were significant differences in RNFL thickness measurements when SD-OCT/TD-OCT scan locations were matched as compared to measurements where scan locations were not matched, except for the 7 o'clock sector.
Conclusions: Our novel method of scan location matching can bridge between circular scan (TD-OCT) and 3D scan (SD-OCT) data, providing follow-up comparability between TD- and SD-OCT RNFL thickness measurements.
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P223 RETINAL NERVE FIBER LAYER (RNFL) THICKNESS MEASUREMENT COMPARABILITY BETWEEN TIME DOMAIN OPTICAL COHERENCE TOMOGRAPHY (TD-OCT) AND SPATIALLY ISOTROPIC AND ANISOTROPIC SPECTRAL DOMAIN OCT (SD-OCT)

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Purpose: We have developed a novel method to identify TD-OCT (Stratus OCT; Carl Zeiss Meditec, Inc., Dublin, CA (CZMI)) scan locations within isotropic (evenly sized and spaced) 3D SD-OCT volumes. However, commercially available SD-OCT devices have spatially varying scan patterns, for example, isotropic or anisotropic. The purpose of this study was to compare the performance of our method on spatially isotropic and anisotropic SD-OCT volumes.
Design: Cross-sectional.
Participants: Twelve eyes of 12 healthy subjects.
Methods: Each subject had nine circumpapillary TD-OCT circle scans: one centered on the ONH and eight circles displaced in known distance/directions. In addition, each subject had 3D SD-OCT ONH cube with Cirrus HD-OCT (spatially isotropic, 200x200 samplings in 6x6 mm; CZMI), RTVue (spatially anisotropic, 513x101 samplings in 4x4 mm; Optovue, Fremont, CA), and Spectralis (spatially anisotropic, 512x193 samplings in 6x6 mm; Heidelberg Engineering, Heidelberg, Germany). The analogous circle location of the TD-OCT was automatically detected within the SD-OCT volume using software of our own design. Mixed effect models were used for the analysis.
Main outcome measures: Distance of the detected scan center location on the SD-OCT 3D volume from the actual TD-OCT scan center. A subset analysis was performed using only scans where the entire TD-OCT scanning circle was within 4x4 mm scanning window (41 scans).
Results: The systematic differences [95% confidence interval] in the center location of the scanned circle between TD-OCT and Cirrus, RTVue, and Spectralis were 87.28 [65.04-109.53] µm, 246.87 [207.00-286.74] µm, and 97.58 [71.85-123.31] µm, respectively. The systematic difference was not statistically significantly different between Cirrus (isotropic) and Spectralis (anisotropic), but RTVue (anisotropic) showed statistically significantly larger differences in comparison to both Cirrus and Spectralis. The subset analysis showed similar results.
Conclusions: Our backward comparability technique is robust enough to bridge between TD-OCT line scan and spatially isotropic and anisotropic SD-OCT volumes.
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P224 CCT MEASUREMENT AND DECISION MAKING IN GENERAL OPHTHALMOLOGY CLINIC

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Objective: To describe the distribution of CCT and study its correlation with glaucoma diagnosis, age, spherical equivalent, gender, history of ocular surgery, diabetes mellitus
Design: observational non-interventional cross-sectional study.
Participants and control: Fifty glaucomatous and 50 non glaucomatous eyes of 50 patients were included.
Intervention-observational non interventional study.
Main outcome measure: Participants received comprehensive ophthalmological evaluation including applanation tonometry (Goldmann applanation tonometer) and pachymetry (ultrasound pachymeter).
Results: Mean CCT in clinically normal, NTG, POAG, OHT eyes was 542, 509, 538, 534.5 µm respectively. Association of CCT and IOP was significant in NTG .No significant relation was found in POAG, ocular hypertensives, patients with DM, history of ocular surgery, gender. Low values of CCT was found in high myopes and older age group.
Conclusion: Our study has shown that there is a potential for patients with POAG who have thin corneas to be given a misdiagnosis and treated inappropriately for NTG. CCT measurement should be done in all glaucoma patients specially clinically suspicious cases. CCT helps attribute the risk and hence patient management decisions.
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6.9.2.1. Clinical examination methods: Computerized image analysis: Optical coherence tomography: Anterior

see also P063, P229, P343

P225 THE CHANGE OF ANTERIOR CHAMBER ANGLE MEASURED WITH ANTERIOR SEGMENT OCT AFTER LASER IRIDOTOMY OR PHACOEMULSIFICATION IN PATIENTS WITH NARROW ANGLE AND CATARACT

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Purpose: To compare the change of anterior chamber angle using anterior segment OCT (AS-OCT) before and after phacoemulsification or laser iridotomy (LI) in patients with narrow angle and coexisting cataract.
Design: Prospective, comparative, interventional, clinical trial.
Participants: Fifty-six eyes from 56 patients with narrow peripheral anterior chamber angle (van Herick grade I or II) and cataract were studied.
Methods: Recruited patients were classified into group 1 (LI alone) or group 2 (phacoemulsification). The anterior chamber angle was imaged with AS-OCT before and on 2 weeks after phacoemulsification or LI.
Main outcome measure: The angle-opening distance (AOD500, AOD750), the trabecular-iris space area (TISA500, TISA750), the angle recession area (ARA500, ARA750), scleral spur angle at the nasal and temporal angles were measured with AS-OCT.
Results: Forty-one eyes were classified into group 1, and 15 eyes were classified into group 2. Fifty-one eyes (91.1%) were primary angle-closure suspect, 5 eyes (8.9%) had primary angle closure/primary angle-closure glaucoma. There was statistically significant increase in AOD 500, AOD 750, TISA 500, TISA 750, ARA 500, ARA 750, scleral spur angle after LI or phacoemulsification in two groups ($p < 0.001$). These parameters including scleral spur angle were more increased nearly threefold in group 2 than in group 1 ($p < 0.001$). There was statistically significant correlation between the measurements before and after LI in group 1 ($p < 0.001$), but no significant correlation before and after phacoemulsification in group 2.
Conclusions: The anterior chamber angle was significantly widened after LI or phacoemulsification by parameters of AS-OCT. Although LI alone or phacoemulsification was effective in widening of anterior chamber angle, phacoemulsification was more effective procedure for patients with narrow angle and coexisting cataract.
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P226 THE EFFECT OF BRIMONIDINE AND TIMOLOL FIXED COMBINATION ON ANTERIOR SEGMENT CONFIGURATION

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Purpose: To evaluate the effect of brimonidine and timolol fixed combination on anterior segment configuration in normal subjects comparing with 2% pilocarpine.
Design: Case-control study.
Participants: Thirty normal subjects without ocular disease were enrolled in this study.
Methods: Before instillation of eyedrops, pupil size (ORB II scan, Bausch & Lomb, Rochester, NY), anterior chamber depth (IOL master, Carl Zeiss Meditec, Dublin, CA) and angle parameters (Visante OCT, Carl Zeiss, USA) including Angle opening distance (AOD), Trabecular-iris space area (TISA), Angle recess area (ARA), Trabecular-iris angle (TIA), angle to angle distance were measured. One hour after instillation of fixed combination of brimonidine and timolol in the right eye and pilocarpine in the left eye, anterior segment parameters were evaluated.
Results: Pupil diameters were significantly decreased after instillation in both groups, and the amount of decrease was significantly higher in the pilocarpine group. Anterior chamber depth showed no significant changes in the fixed combination group, whereas the pilocarpine group showed significant decrease with significant different amount of changes between after pilocarpine instillation. Angle parameters including AOD500, AOD750, TISA500, TISA750, ARA500, ARA750 and TIA showed significant increase after instillation in both groups and relatively greater increase in the fixed combination group, although changes after instillation were not significantly different between two groups.
Conclusions: Brimonidine and timolol fixed combination widened anterior chamber angle after instillation in normal individuals.
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P227 MORPHOLOGICAL ANALYSIS OF AGE-RELATED IRIDOCORNEAL ANGLE CHANGES IN NORMAL AND GLAUCOMATOUS CASES USING ANTERIOR SEGMENT OCT

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Purpose: To analyze the age-related morphological changes of the iridocorneal angle in normal and glaucomatous cases using anterior segment optical coherence tomography (AS-OCT).
Design: A cross-sectional observational study.
Participants and controls: Eighty five eyes of 85 glaucoma cases (54 females and 31 males, mean age: 61.2 ± 13.2 years) and 84 eyes of 84 age-matched normal controls (60 females and 24 males, 63.1 ± 12.1 years) were enrolled in this study.
Methods: Iridocorneal angle structures were measured by the enhanced high resolution mode, and anterior chamber depth (ACD) by the enhanced anterior segment mode using AS-OCT (Visante OCT, software ver. 2.0.1.88; Carl Zeiss Meditec AG, Jena, Germany). Axial length and refractive error were measured by an IOL Master (Carl Zeiss Meditec AG, Jena, Germany) and auto refracto-keratometer (RKT-7700; Nidek, Gamagori, Japan), respectively. Angle opening distance at 500 and 750 micrometer apart from scleral spur (AOD 500, and 750 respectively) and angle recess area at 500 and 750 micrometer (ARA 500, and 750 respectively), were calculated in the nasal and temporal lesion on each right eye. When the right eye was not able to be evaluated, the left eye was then utilized. Cases that produced inadequate quality of images, difficulty in detecting the scleral spur, or with previous surgical intervention which affects the angle structure such as cataract surgery or laser iridotomy were excluded. A new index which represents the peripheral angle structure was proposed; *i.e.*, peripheral angle frame index (PAFI), defined as (ARA750 - ARA500) / ARA 500.
Main outcome measures: Iridocorneal angle structures, axial length and refractive error between normal and glaucoma cases, nasal and temporal lesion were compared.
Results: The glaucoma cases, which included 20 primary open-angle glaucoma (POAG) cases, 38 normal tension glaucoma (NTG), 11 primary angle closure/glaucoma (PAC/G), 3 ocular hypertension (OHT), 13 secondary glaucoma and other types of glaucoma cases, showed significantly different angle structure between the nasal and temporal lesion, while normal controls showed no differences. There were significant differences in refractive error ($p < 0.0001$), axial length ($p = 0.0001$), ACD ($p = 0.0153$), and temporal and nasal angle structure ($p = 0.004 - 0.019$) between the glaucoma and normal cases. Both ACD and ARA decreased linearly in an age-dependent manner in the normal group. However, there are large amount of variations in the glaucoma group, partly resulting from the variations of refractive errors. The new index, PAFI, stayed in relatively constant values throughout the entire age distribution both in normal and glaucoma groups, while outlier values were taken in the cases with plateau iris configuration or iris root thickening.
Conclusions: AC-OCT was useful for not only quantitatively evaluating the age-related changes of peripheral angle structure, but also detecting the abnormality of the iridocorneal structure.
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P228 ANTERIOR SEGMENT IMAGING IN GLAUCOMA USING SPECTRAL AND TIME DOMAIN OPTICAL COHERENCE TOMOGRAPHY

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Objective: Anterior segment imaging is rapidly evolving and the application of optical coherence tomography (OCT) is a significant breakthrough in Ophthalmology especially in Glaucoma. This study aims to present and illustrate differences in the images obtained from spectral domain OCT (SD-OCT) and time domain anterior segment OCT (TD-ASOCT)
Design: Retrospective comparative case series.
Methods: Four eyes of Asian patients were imaged using two new systems, SD-OCT (CirrusTM HD-OCT Carl Zeiss Meditec Inc., Dublin, CA, USA) and TD-ASOCT (VisanteTM OCT, Carl Zeiss Meditec Inc., Dublin, CA, USA). A special lens adaptor for anterior segment was attached to SD-OCT machine with the objective of capturing images of the anterior eye. Consecutive scans were taken using TD-ASOCT followed by SD-OCT. One subject had open anterior chamber angle. The second had angle closure characteristics. The third patient underwent prior glaucoma filtering procedure and trabeculectomy bleb was imaged after surgery. The fourth had glaucoma drainage device implanted. Scanning centered on the sclera-conjunctival tissue cover of the tube portion of the glaucoma implant.
Results: Spectral domain OCT revealed cross sectional layers of the scanned segment in greater detail due to higher axial resolution (5 µm) but with limited depth of tissue penetration at 2 mm. Time domain ASOCT, on the other hand allowed deeper tissue penetration at 6mm but axial resolution was between 10-20 µm. In the anterior chamber angle scans from SDOCT, the Schlemm's canal outline was visible along with the trabecular meshwork in a triangular configuration but structure imaged was restricted to a depth of 2 mm and width of 7.2 mm. Time domain ASOCT provided a full image of the anterior chamber (AC), showing depth, iris profile, angle wall-iris & iris-anterior lens interfaces although ultrastructural definition was reduced. In trabeculectomy bleb, SDOCT imaging showed bleb wall thickening and discrete hyporeflective spaces while bleb cavity, scleral flap, scleral surface and ostium were seen and better appreciated using time domain ASOCT. In the scans over the tube of glaucoma drainage implant, tissue layers above the tube were well delineated in SDOCT but not in time domain ASOCT. The entire path of the tube and its position in the anterior chamber were visualized in a single scan frame only with the time domain ASOCT.
Conclusion: Spectral domain and time domain optical coher-

ence tomography applied in the anterior segment for glaucoma imaging were both useful tools. Each system provided information helpful in glaucoma diagnosis and surgical treatment assessment.

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P229 ASSESSMENT OF NARROW ANGLES BY GONIOSCOPY, VAN HERICK TECHNIQUE AND ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY (AS-OCT)

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Purpose: To evaluate narrow angles using gonioscopy, Van Herick technique and anterior segment optical coherence tomography (AS-OCT).
Design: Cross-sectional study.
Participants: Ninety three eyes of 93 primary angle closure (PAC) and primary angle closure suspect (PACS) subjects.
Methods: PAC and PACS subjects diagnosed by gonioscopy underwent Van Herick technique evaluation and AS-OCT imaging. Angle closure was defined by each two method when peripheral anterior chamber depth (ACD) was less than one fourth of the corneal thickness (Van Herick technique) and when the contact between peripheral iris and angle wall anterior to scleral spur was confirmed by AS-OCT imaging. Angles in nasal and temporal quadrants were incorporated for analysis.
Main outcome measure: Agreements of these three techniques were estimated. Areas under receiver operating characteristic curves (AUCs) of angerior chamber angle parameters (AOD500, 750, ARA 500, 750, TISA 500, 750, ACD) for detection of angle closure determined by AS-OCT among eyes with PAC or PACS were also evaluated.
Results: The agreement between gonioscopy and Van Herick technique was excellent (kappa = 0.795 (temporal), 0.822 (nasal)). However, AS-OCT revealed a poor agreement with both Van Herick technique and gonioscopy (gonioscopy vs AS-OCT; kappa = 0.111 (temporal), 0.110 (nasal), Van Herick vs AS-OCT (kappa = 0.164 (temporal), 0.154 (nasal)). Among the AUCs of AS-OCT parameters for detection of angle closure, TISA500 showed the highest values (temporal: 0.943, nasal 0.921) and ACD showed the lowest values (temporal: 0.704, nasal 0.629).
Conclusions: Assessment of narrow angles by gonioscopy and Van Herick technique showed good agreement, while both measurements revealed poor agreement with AS-OCT. TISA500 showed the highest diagnostic capabilities for detection of angle closure among various AS-OCT parameters.

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P230 DISTRIBUTION OF ANTERIOR CHAMBER BIOMETRY MEASURED BY ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY IN ADULT CHINESE

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Purpose: To describe the distribution of anterior chamber biometric characteristics in adult Chinese using anterior segment optical coherence tomography (ASOCT).
Design: Cross-sectional study.
Participants: Random clustering sampling was used to identify adults aged 35 years and over in Huang Hua Street Block, Guangzhou. A total of 840 adults aged 35 years and older were randomly selected from this cohort for ASOCT examination.
Methods: ASOCT was used to collect one horizontal scan and the images were analyzed using custom software.
Main outcome measures: Angle opening distance at the location 500 microns anterior to scleral spur (AOD500), iris thickness at 750 microns from the scleral spur (IT750), iris curvature (IC), anterior chamber depth (ACD), anterior chamber width (ACW, scleral spur to scleral spur distance).
Results: The AOD500, IT750, IC, ACD and ACW were 0.339 ± 0.198 mm, 0.454 ± 0.072 mm, 0.211 ± 0.147 mm, 2.737 ± 0.372 mm and 11.58 ± 0.41 mm, respectively. In multiple regression model, older adults tended to have narrower angles, shallower anterior chambers and more convex irides. The associations of ACD and ACW with age were linear but this was not the case for the AOD and iris curvature. Iris thickness did not change with age. Females had narrower angles, shallower anterior chambers, and thinner and more convex irides.
Conclusions: This study, for the first time, systematically documents the distribution of anterior chamber parameters in adult Chinese. Narrow angles are more commonly seen in older and female adults.

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P231 COMPARISON OF ANTERIOR CHAMBER DEPTH MEASUREMENTS USING ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY AND MODIFIED SMITH METHOD

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Purpose: To compare anterior chamber depth measurement by two non contact methods using the modified Smith clinical method and Visante anterior segment optical coherence tomography (AS-OCT).
Methods: Prospective, observational pilot study of 34 new patients attending the glaucoma clinic in a tertiary referral centre. Both eyes of each patient were included in the study. One trained investigator measured the anterior chamber depth of all the patients using the modified Redmond Smith (RS) clinical method. A separate trained investigator measured the anterior chamber depth using the AS-OCT.
Result: Sixty-eight eyes were examined of which there were 21 male and 13 female patients. Mean (Standard Deviation {SD}) age was 62.9 years (12.09). Mean (SD) anterior chamber depth was 3.06 (0.735) using the RS method, and 3.007 (0.513) with AS-OCT. Mean difference of anterior chamber depth measurement by AS-OCT *vs* RS method was -0.05735 (SD 0.511). 95% confidence interval of the mean difference was -0.182 to 0.063. The difference of measurement of the anterior depth by the two methods was not statistically significant (p = 0.337).
Conclusion: Modified Smith method of measurement of the anterior chamber depth was comparable with the measurement done by the AS-OCT. This simple clinical method can be applied in clinic setting by ophthalmologist, nurses and optometrist to assess the anterior chamber depth and can be used as a safe guide to screen shallow anterior chambers.
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P232 PROSPECTIVE COMPARISON OF ULTRASOUND BIOMICROSCOPY AND ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY FOR EVALUATION OF ANTERIOR CHAMBER DIMENSIONS IN EUROPEAN EYES WITH PRIMARY ANGLE CLOSURE

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Purpose: To compare the accuracy in measurement of the anterior chamber angle by anterior segment optical coherence tomography (AS-OCT) and ultrasound biomicroscopy (UBM) in European patients with suspected primary angle closure (PACS), primary angle closure (PAC) or primary angle closure glaucoma (PACG)
Design: Cross-sectional study.
Methods: Fifty-five eyes of 33 consecutive patients presenting with PACS, PAC, or PACG were examined with AS-OCT, followed by UBM. The trabecular-iris angle (TIA) was measured in all four quadrants. The angle-opening distance (AOD) was measured at 500 µm from the scleral spur. The Bland-Altman method was used for assessing agreement between the two methods.
Results: The mean (± SD) superior TIA was 19.3 ± 15.8° in AS-OCT and 15.7 ± 15.0° in UBM (p = 0.50) and inferior TIA was 17.9 ± 12.9° (AS-OCT) and 16.7 ± 14.1° (UBM) (p = 0.717). The superior AOD500 was 0.17 ± 0.16 mm in UBM and 0.21 ± 0.16 mm in AS-OCT (p = 0.06) Bland-Altman analysis showed a mean SD of ± 9.4° for superior and inferior TIA and a mean SD of ± 0.10 mm for the superior and inferior AOD500.
Conclusions: This comparative study demonstrates that AS-OCT measurements are significantly correlated with UBM measurements but show poor agreement with each other. We do not believe that the AS-OCT can replace UBM for the quantitative assessment of the anterior chamber angle.
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P233 STUDY OF VARIOUS ANGLE PARAMETERS AS MEASURED ON ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY BEFORE AND AFTER LASER PERIPHERAL IRIDOTOMY (LPI) IN CASES OF PRIMARY ANGLE-CLOSURE GLAUCOMA (PACG)

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Objective: To evaluate changes in angle parameters in cases with angle closure on Visante following LPI.
Design: Observational case series.
Participants: Twenty-two eyes of 11 patients (8 with subacute and 3 resolved acute PACG) were recruited.
Materials and Methods: All patients underwent detailed ophthalmological evaluation including anterior segment OCT and gonioscopy. After obtaining the informed consent all patients underwent LPI for Subacute PACG (16 eyes), resolved acute PACG (3 eyes) and their fellow eyes (3 eyes). Enhanced anterior segment single images were taken before and 1 week after the LPI on Visante™. Images were measured using custom software to determine angle opening distance (AOD) at 500 µm and 750 µm, trabecular-iris space area (TISA) at 500 µm and 750m from scleral spur and Scleral spur angle at 180°, 0°, 270° and 90°.
Main outcome measures: Quantify the change in angle parameters following LPI.
Results: Mean age in study was 53.09 ± 10.66 (range 39 to 71); there were 5 males and 6 females. All parameters showed marked increase in all meridians following LPI in all cases. The results can be found in the Table (n = 22) in the poster.
Conclusion: Anterior segment OCT (VisanteTM) is a non contact method to reliably document opening of angle structures following LPI in cases of PACG.
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P234 ANTERIOR CHAMBER ANGLE CHANGES AFTER APPLICATION OF SELECTIVE ALPHA-1 RECEPTOR AGONIST EYE DROPS

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Purpose: To investigate anterior chamber angle changes after application of selective alpha-1 receptor agonist eye drops in normal subjects.
Design: Cross-sectional study.
Participants: Twelve normal volunteers without ophthalmic symptoms whose spherical equivalent was +0.5 - -7.0 diopters, and whose angle was determined to be Shaffer grade IV by a Goldmann-type one-mirror gonioscope.
Methods: Anterior segment optical coherence tomography (SS-1000: TOMEY corporation) was used for anterior chamber angle imaging. Each eye was imaged under room light (light intensity = 250 lux), and then imaged in the dark after allowing the eyes to adjust to darkness for 30 seconds. The same procedure was performed 20, 40, 60, and 120 minutes after phenylephrine hydrochloride eye drops were administered.
Main outcome measure: The pupil diameter, angle opening distance (AOD) 500, T-I angle (TIA), and trabecular iris space area (TISA) 500 of the temporal, nasal, superior, and inferior angles.
Results: Twelve randomly selected eyes in 12 persons (6 male and 6 female, mean age ± standard deviation was 35.4 ± 6.0) were analyzed by a single observer. After eye drop application, the vertical/ horizontal ratio of pupil diameter became more than 1.02 in 9 of 12 eyes (75.0%). The anterior chamber angle showed gradual narrowing in 10 of 12 eyes (83.3%). Under the light condition, sixty minutes after phenylephrine hydrochloride was applied, the AOD, TIA, and TISA were significantly smaller than before the application of eye drops (AOD: temporal $p = 0.0032$, nasal $p = 0.0183$, superior $p = 0.0342$, inferior $p = 0.0005$, TIA: nasal $p = 0.0099$, inferior $p = 0.0022$, TISA: temporal $p = 0.0085$, nasal: $p = 0.0155$, superior $p < 0.0001$, inferior $p < 0.0001$)(paired t-test).
Conclusions: After administering a selective alpha-1 receptor agonist, the vertical pupil diameter became larger than the horizontal diameter, and the anterior chamber angle showed narrowing. Anterior segment OCT could precisely detect small changes in the anterior chamber angle caused by phenylephrine hydrochloride eye drops.
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P235 ANTERIOR CHAMBER ANGLE BIOMETRY APPLYING WITH ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY

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Purpose: To measure the angle between the iris surface and inner corneoscleral wall in the sitting position in normal eyes.
Design: Cross-sectional study.
Participants: Twenty three normal volunteers with no apparent ocular disorders but with spherical equivalents of +0.5 to -7.5 diopters, axial length of > 23 mm and a Shaffer grade IV angle measured using a Goldmann-type one-mirror gonioscope.
Methods: Angle imaging was performed with an anterior segment optical coherence tomograph (SL-OCT: Heidelberg Engineering). Each eye was imaged horizontally and vertically under room light (light intensity = 250 lux), and then assessment was repeated in the same manner after the eyes were allowed to adjust to darkness for 30 seconds. Angle parameters were measured in one eye selected at random by another independent masked observer. Parameters were compared using paired t-tests with the Bonferroni correction.
Main outcome measures: The anterior chamber angle (ACA), the angle opening distance (AOD) 500, and the trabecular iris space area (TISA) 500 of the temporal, nasal, superior, and inferior angles.
Results: Twenty three eyes in 23 persons comprised of 9 males and 14 females aged 32.0 ± 5.1 were analyzed for this study. Superior angle parameters were smaller than temporal parameters in both the dark and light conditions (AOD500: $p = 0.0030$, $p = 0.0006$, TISA500: $p = 0.0019$, $p = 0.0012$, ACA: $p = 0.0036$, $p < 0.0001$ in the dark and light conditions respectively). In the light condition, the ACA of the superior angle was significantly smaller than the ACAs of the other angles (temporal: $p < 0.0001$, nasal: $p = 0.0186$, inferior: $p < 0.0001$).
Conclusions: The anterior segment optical coherence tomograph is believed to provide more precise information for the analysis of the anterior chamber angle as compared to the conventional gonioscopic approach. In addition, while the conventional gonioscope can only be used in light conditions, the anterior segment optical coherence tomograph can be used in both dark and light conditions.
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P236 ANALYSIS OF LIGHT-DARK CHANGES IN IRIS THICKNESS AND ANTERIOR CHAMBER ANGLE WIDTH IN EYES WITH OCCLUDABLE ANGLES

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Purpose: To investigate light-dark changes in iris thickness and anterior chamber angle width in eyes with occludable angles.
Design: Cross-sectional study.
Participants: Fifty-nine eyes of 34 Japanese patients with primary angle closure suspects, primary angle closure, or primary angle-closure glaucoma.
Methods: The iris thickness (ID), angle opening distance 500 (AOD500), and trabecular-iris space area 500 (TISA500) were determined by anterior segment optical coherence tomography (AS-OCT) in each quadrant (superior, inferior, temporal, and nasal) under light and dark conditions. The angle closure was confirmed with AS-OCT and classified into two patterns: type B, in which the closure starts from the bottom of the angle, and type S, in which the closure starts in the vicinity of Schwalbe's line.
Main outcome measure: The ID, AOD500, TISA500, and the prevalence and the pattern of angle closure.
Results: The ID, AOD500, and TISA500 measured in the light were 0.295 ± 0.046 mm, 0.132 ± 0.044 mm, and 0.057 ± 0.020 mm, respectively. The ID, AOD500, and TISA500 measured in the dark were 0.359 ± 0.048 mm, 0.087 ± 0.047 mm, and 0.039 ± 0.020 mm, respectively. The ID in the dark was significantly greater than that in the light, and the AOD500 and TISA500 in the dark were significantly smaller than those in the light. Significant negative correlations were found between the ID difference (ID (light) – ID (dark)) and the AOD500 difference (AOD500 (light) - AOD500 (dark)) ($r = -0.494$, $p < 0.001$), and between the ID difference and TISA500 difference (TISA500 (light) - TISA500 (dark)) ($r = -0.300$, $p < 0.05$). The prevalence of angle closure was greater inferiorly and superiorly than temporally and nasally. The type B closure was more frequently detected than the type S under both light and dark conditions.
Conclusion: A significant negative correlation was found between the difference of the iris thickness and that of the angle width measured under light and dark conditions. The present results suggested that the topology of the iris root was related to the mechanism of the primary angle closure.
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P237 ANTERIOR CHAMBER ANGLE CHANGES IN PRIMARY ACUTE ANGLE-CLOSURE GLAUCOMA AFTER LASER EVALUATED BY IMAGES FROM STRATUS OCT3

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Objectives: Images of acute primary angle-closure glaucoma were acquired by OCT3 before and after laser treatment to evaluate the angle configuration and result of laser management.
Design: Retrospective study.
Participants: Twenty-one eyes of 21 cases of first attack of acute angle-closure glaucoma within 72 hours were included. The average attack intraocular pressure was 59.46 ± 16.79 mmHg.
Main outcome measure: Iridoplasty was performed within 2-24 hours while iridectomy was finished in one week after that. Images of anterior chamber angle were obtained by OCT3 to evaluate the angle configuration on attack and after laser treatment.
Results: Anterior chamber angle widened from 10.38 ± 4.27 degree on attack to 28.16 ± 9.77 degree after laser ($P < 0.01$). OCT3 could clearly show angle changes at real time. IOP reduced to 38.24 ± 9.67 mmHg after initial medications. Apparent IOP reducing happened after iridoplasty as well as iridotomy to 22.38 ± 4.55 mmHg ($P < 0.01$).
Conclusions: Compared with traditional angle examination, OCT3 was an economic, convenient and accurate method to evaluate angle configuration glaucoma. Images could be acquired clearly at different period of acute angle-closure glaucoma.
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P238 ASSESSMENT OF ANTERIOR CHAMBER CHANGES AFTER LASER PERIPHERAL IRIDOTOMY USING ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY

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Purpose: To compare the anatomical changes that occur in the anterior chamber after laser peripheral iridotomy (LPI) using anterior segment optical coherence tomography (AS-OCT).
Design: Prospective case series.
Participants: Consecutive patients from a tertiary care glaucoma practice.
Methods: Using AS-OCT, we imaged 74 patients with closed or occludable angles as determined clinically, before and after LPI. We obtained low resolution scans of the horizontal and vertical meridians, as well as high resolution scans of all four quadrants.
Main outcome measures: Data measures included anterior chamber depth (ACD), lens rise to anterior chamber ratio (LR: AC), iris convexity (IC), angle opening distance at 500 microns (AOD500), trabecular iris angle (TIA), and iris thickness at 1000 microns (IT1000).
Results: Preoperatively, the mean IC was 307 µm, which decreased to 150um after LPI ($p < 0.0001$). Mean AOD500 and TIA increased from 84 µm and 9.1° preoperatively to 139µm and 15.0° postoperatively, respectively ($p < 0.0001$, $p < 0.0001$). We found that the patients could be divided into two groups, those whose angles improved significantly and those whose did not, defined as a change in TIA of less than or equal to 4°. There were 37 patients who improved and 37 who did not. Preoperatively, there was not a significant difference between the groups in ACD ($p = 0.96$), AOD500 ($p = 0.59$), TIA ($p = 0.31$), or IT1000 ($p = 0.49$). There was a significant difference in IC ($p < 0.05$) and LR: AC ($p < 0.0001$). In the group whose angles did not change significantly, the only significant change postoperatvely was in IC (290µm to 167µm, $p < 0.0001$). In the group who had a significant change in TIA, there was also a significant change in ACD (2.21 mm to 2.25 mm, $p < 0.05$), IC (324 µm to 132 µm, $p < 0.0001$), AOD500

(79 µm to 189 µm, p < 0.0001), and TIA (7.8° to 19.3°, p < 0.0001). Between the two groups postoperatively, there was a significant difference in IC (p < 0.05), AOD500 (p < 0.0001), and TIA (p < 0.001).

Conclusions: AS-OCT was helpful in determining objective measurements before and after LPI. In the group of patients where TIA increased significantly, so did AOD500 and there was a significant decrease in IC. In patients that did not have a significant increase in TIA, there was also a lack of significant change in AOD500. They did show a significant change in IC. This may demonstrate that their narrow angles are likely due to a combination of pupillary block and plateau iris syndrome. Once the pupillary block is resolved via LPI, the angle remains narrow due to the plateau iris mechanism.

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P239 ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY AS A METHOD TO DETECT OCCLUDABLE ANGLES AND CORRELATION WITH GONIOSCOPY

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Purpose: To correlate the objective measurements acquired using anterior segment optical coherence tomography to clinical gonioscopy and determine the ability to detect occludable angles.

Design: Prospective case series.

Participants: Consecutive patients from a tertiary care glaucoma practice.

Methods: Patients were evaluated by gonioscopy performed by one glaucoma specialist. Patients were subsequently imaged using AS-OCT. We obtained low resolution scans of the horizontal and vertical meridians, as well as high resolution scans of all four quadrants.

Main outcome measures: Data measures included angle opening distance at 500 microns (AOD500), and trabecular iris angle (TIA).

Results: Sixty-eight angles of 68 patients were included in the study. Clinical gonioscopy found 18 patients to have a Shaffer grade 4 angle, 15 patients with a grade 3 angle, 15 patients with a grade 2 angle, 11 patients with a grade 1 angle, and 9 patients with a grade 0 angle. Mean TIA and AOD500 were 42 ± 11 (25-59) and 485 ± 193 (240-880) in patients with a grade 4 angle, 27 ± 9 (14-46) and 283 ± 123 (121-552) in grade 3 angles, 14 ± 4 (8-22) and 126 ± 45 (74-257) in grade 2 angles, 9 ± 8 (0-20) and 98 ± 95 (0-248) in grade 1 angles, and 7 ± 7 (0-19) and 70 ± 80 (0-211) in grade 0 angles. Using a TIA of less than 22 degrees, AS-OCT has the ability to detect occludable angles with a sensitivity of 100% and a specificity of 88%. When using an AOD of 214 µm, AS-OCT detects occludable angles with a sensitivity of 94% and a specificity of 89%.

Conclusions: AS-OCT was helpful in determining objective measurements of angle grade. AS-OCT was also useful in detecting occludable angles.

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P240 QUANTITATIVE ASSESSMENT OF CHANGES IN TRABECULECTOMY BLEB MORPHOLOGY USING ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY

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Objective: To quantify changes in bleb morphology after trabeculectomy surgery using anterior segment optical coherence tomography (ASOCT).

Design: Prospective longitudinal case series.

Participants: Seventy subjects with glaucoma who underwent trabeculectomy with mitomycin-C.

Methods: Subjects were assessed 1 day, 1 week, and 1, 3 and 6 months after trabeculectomy. At each visit, a standardized cross-sectional ASOCT (ASOCT prototype, Carl Zeiss Meditec, Inc., USA) image of the bleb was obtained. A second masked observer measured standardized bleb height (hB), cavity height (hC), wall cross sectional area (AW), cavity cross sectional area (AC), and bleb cross sectional area (AB) using custom software. Success in terms of intraocular pressure (IOP) was defined as 6-month IOP ≤ 18 mmHg and ≥ 20% drop from preoperative IOP, without medications. Qualified successes was defined as 6-month IOP ≤ 18 mmHg and < 20% IOP drop from preoperative IOP without medications. Failure was defined as IOP > 18 mmHg with or without medications. Relative IOP reduction was defined as (IOP at 6 months - preoperative IOP) / preoperative IOP.

Main outcome measures: Quantitative changes in hB, hC, AW, AC, and AB over 6 months.

Results: Seventy-three eyes were included with a mean follow-up of 6.7 ± 1.5 months (range, 4.5-11.3 months). At month 6, there were 44 (60.3%) successes, 26 (35.6%) qualified successes and 3 (4.1%) failures. In successful cases, there was an increase in mean hB from week 1 to month 3 (1.16 ± 0.36 mm to 1.36 ± 0.45 mm, p = 0.001) and from week 1 to month 6 (1.16 ± 0.36 mm to 1.45 ± 0.51 mm,

p = 0.0006). Relative IOP reduction from before trabeculectomy to month 6 correlated with the change in hB from day 1 to month 1 (r^2 = 0.213, p = 0.01), as well as with mean hB at month 3 (r = 0.149, p = 0.01) and month 6 (r^2 = 0.225, p = 0.002). Intra-observer reproducibility of bleb measurements was high, with interclass correlation coefficient > 0.95 for all parameters studied.

Conclusions: Changes in bleb morphology after trabeculectomy can be objectively quantified using ASOCT. Early changes in bleb height are correlated with IOP outcome. Bleb morphology quantitation with ASOCT may be useful in the management of patients after trabeculectomy.

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P241 USING BIOMETRIC PARAMETERS IN SCREENING FOR 'ANGLES-AT-RISK' ON ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY

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Objective: Angle closure and angle-closure glaucoma are prevalent in Asia. Anterior segment optical coherence tomography (AS-OCT) appears to be a promising imaging technology in screening patients for narrow angles. However, the screening for such 'angles-at-risk' in a high-volume patient cohort is time-consuming and requires ophthalmologist-evaluation of AS-OCT images. We aim to assess if AS-OCT can be adapted for clinician-independent screening of 'angles-at-risk' by determining agreement of biometric parameters measured on AS-OCT with clinician-assessment of 'angles-at-risk'.

Design: Cross-sectional, hospital-based study.

Participants: One hundred seventy-eight eyes from 178 consecutive patients with a spectrum of angle configurations and clinical diagnoses: open angles, narrow angles, primary angle closure and primary open-angle glaucoma.

Methods: AS-OCT examination, ophthalmologist-evaluation of AS-OCT images.

Main outcome measures: Biometric parameters measured in the temporal quadrant of the right eye on AS-OCT: Anterior chamber depth (ACD), scleral spur-to-scleral spur distance (SSD), lens vault distance (LV), area of recessed angle at 500 µm and 750 µm (ARA500, ARA750) and angle opening distance (AOD500, AOD750). The temporal quadrant of the left eye image was used if visualization of the scleral spur or angle structures did not allow assessment of angle grade. Angle configurations were determined as closed, very narrow, narrow and open based on a consensus decision by three ophthalmologists masked to the biometric measurements. We regarded angles with closed, very narrow or narrow configurations as 'angles-at-risk'.

Results: ACD, LV, ARA500, AOD500, ARA750, AOD750 showed significant correlation (p < 0.001) with angle configuration, but not SSD (p = 0.651). The best parameter in detecting 'angles-at-risk' was AOD750 (area under curve, AUC 0.978), then ARA750 (0.964), AOD500 (0.959), ARA500 (0.909), ACD (0.834) and LV (0.810). AOD750 had optimal sensitivity of 100% and specificity of 89.1 % at a threshold of < 0.232 mm in predicting 'angles-at-risk'.

Conclusions: The biometric parameter AOD750 correlated well with ophthalmologist-assessment of 'angles-at-risk' on AS-OCT imaging. This important finding suggests that in Singapore, the AS-OCT may be adapted for use at the tertiary healthcare level as a clinician-independent device to identify patients with 'angles-at-risk' for further evaluation of angle closure and glaucoma.

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P242 ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY MEASUREMENT OF ANTERIOR CHAMBER DEPTH AND ANGLE CHANGES AFTER PHACOEMULSIFICATION IN PRIMARY ANGLE-CLOSURE GLAUCOMA

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Purpose: To measure changes in anterior chamber parameters with an anterior segment OCT after facoemulsification and intraocular lens (IOL) implantation in primary angle-closure glaucoma (PACG). We also studied changes in the intraocular pressure (IOP) after facoemulsification.

Design and Participants: Twenty eyes (20 patients) had uneventful phacoemulsification and IOL implantation through a clear corneal incision. Anterior segment OCT was performed preoperatively and 1 month postoperatively. Intraocular pressure was measured at the same time preoperatively and 1 month postoperatively.

Methods and Main outcome measure: evaluation of the

lens referenced anterior chamber depth (ACD) and nasal and temporal angle width after phacoemulsification with an anterior segment OCT (AS-OCT). Meassurement of IOP with Goldmann applanation tonometer (GAT).
Results: We documented and quantified an increase in anterior segment chamber depth and also in the nasal and temporal angle width after the facoemulsification. On the other hand, IOP measurements were lower after the surgery compared with the previous ones.
Conclusions: Deepening of the anterior chamber and widening of the nasal and temporal angles after cataract extraction was shown on AS-OCT in patients with primary angle-closure glaucoma. Goldmann applanation tonometer measurements were lower after the surgery in the same patients.
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P243 EVALUATION OF ANTERIOR CHAMBER ANGLE WITH VISANTE AS-OCT IN VARIOUS TYPES OF GLAUCOMA

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Purpose: To evaluate the anterior chamber angle (ACA) using Visante AS-OCT in four groups of patients (a control group-healthy volunteers-, patients with primary open-angle glaucoma (POAG), patients with ocular hypertension and patients with pseudoexfoliation (PEX) glaucoma).To investigate possible correlation between central corneal thickness(CCT) and anterior chamber angle.
Material and method: Observational prospective study. Twenty-six patients were recruited for each group. Two measurements were obtained in every eye of each participant the same day and the mean values were evaluated. The measurements included calculation of the anterior chamber angle nasally and temporally as well as recording of CCT in each eye of the participants.
Results: The ACA in the control group was 30.98° (SD 8.47), in POAG patients 26.61° (SD 7.0), in patients with ocular hypertension 25.87° (SD 6.83) and in PEX glaucoma patients 23.97° (SD 5.6). The results of the one-way independent ANOVA analysis for the measurements between groups were $F(3,99) = 4.53$, $p < 0.005$ και $r^2 = 49.9$. The post-hoc analysis showed that there was a statistical significant difference between control group and PEX glaucoma group. The correlation of ACA with CCT using the Pearson's correlation test was $r = +0.19$, $p = 0.2$.
Conclusions: The ACA was wider in normal volunteers, becoming narrower in order in POAG patients, in ocular hypertension patients and in PEX glaucoma patients, with statistical significant difference between groups. The correlation of ACA with CCT was feeble positive, meaning that an increase in the ACA may be followed by an increase in CCT or the opposite.
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P244 COMPARITIVE EVALUATION OF TIME DOMAIN AND SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY IN RETINAL NERVE FIBER LAYER THICKNESS MEASUREMENTS

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Purpose: To evaluate retinal nerve fiber layer (RNFL) measurements between two optical coherence tomography (OCT) systems: the Stratus OCT, a time domain system, and the Cirrus HD-OCT, a spectral domain system (both by Carl Zeiss Meditec, Inc., Dublin, CA) and compare their precision in the diagnosis of glaucoma.
Design: Observational cross-sectional study.
Participants: Fifty-two eyes of 52 subjects (20 eyes with primary open-angle glaucoma and 32 eyes of healthy controls).
Main outcome measures: Each clock hour, quadrant, and average RNFL thickness was determined on each of the two instruments.
Methods: One eye of each patient was imaged on the same day with each instrument by two experienced operators. The order of the machines was randomized. RNFL thicknesses measured by the two instruments were compared. Reliabilty was assessed by the Intraclass correlation coefficient (ICC) and the Bland Altman plot for the limits of agreement for the overall mean RNFL thickness and for each quadrant.
Results: A randomly selected eye of each of the 52 participants was analyzed. The mean temporal, superior, nasal and inferior RNFL thickness (in microns) were found to be 65.42 ± 18.98, 114.85 ± 26.67, 75.83 ± 28.61 and 116.35 ± 29.43

when measured by the Stratus OCT. In glaucoma patients these values were 55.06 ± 18.22, 97.86 ± 29.37, 63.44 ± 24.89, and 102.94 ± 38.20; and in controls these values were 70.59 ± 17.40, 123.61 ± 20.65, 82.03 ± 28.67 and 123.06 ± 21.63 respectively. The mean temporal, superior , nasal and inferior RNFL thickness (in microns) were 62.00 ± 13.08, 112.00 ± 25.13, 68.56 ± 16.66 and 114.23 ± 25.82 respectively, when measured with the Cirrus OCT. In glaucoma patients these values were 57.88 ± 12.99, 98.56 ± 26.88, 64.63 ± 12.52 and 105.50 ± 29.49; while in the control group these were 64.06 ± 12.82, 118.72 ± 21.63, 70.53 ± 18.33, and 118.59 ± 23.05 respectively. Intraclass correlation coefficient alpha (ICC alpha) for the temporal, superior, nasal and inferior quadrant RNFL thickness measurements were 0.81, 0.85, 0.66 and 0.93 respectively. Bland-Altman plots showed the limits of agreement (95%CI) for average RNFL to be 4.59 ± 20.10 in the control group. In patients of glaucoma, Bland-Altman plots showed the limits of agreement (95%CI) for average RNFL to be 1.56 ± 21.50.

Conclusions: There is considerable variability in the RNFL thickness measurements made by the Cirrus and Stratus OCT that exceeds the limits of resolution afforded by the instruments. RNFL measurements obtained from the two OCT systems may not be used interchangeably.

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P245 COMPARISON OF UVEAL EFFUSION IN PRIMARY ANGLE CLOSURE EYES DIAGNOSED BY ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY (AS-OCT) AND ULTRASOUND BIOMICROSCOPE (UBM)

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Purpose: To evaluate the imaging ability for sub-clinical uveal effusion in primary angle-closure eyes by anterior segment OCT (AS-OCT) and to compare it with ultrasound biomicroscope (UBM).

Design: Observational case series.

Participants: We evaluated 23 eyes of 12 patients with acute or chronic primary angle closure (PAC), PAC suspect (PACS), or with glaucoma (PACG).

Methods: Demonstrating uveal effusion on AS-OCT or UBM were summarized. The images were evaluated and graded by masked observers. Uveal effusion was diagnosed when the suprachoroidal space was visualized as a separation between the sclera and pars plana of the ciliary body. Uveal effusion was graded as 0 (none), 1 (slit), 2 (band), and 3 (severe) as previously reported.

Main outcome measures: Presence of uveal effusion and PAC, PACS, PACG.

Results: In 4 eyes of 4 patients with acute PAC, 3 eyes had grade 2 and 1 eye had grade 1 uveal effusion. All 4 eyes had effusion circumferentially and were identified by both UBM and AS-OCT. Grade 1 uveal effusion was diagnosed by AS-OCT in 19 chronic PAC eyes, and 14 eyes out of these 19 eyes showed effusion on UBM; none of the effusions were seen on UBM alone. Using AS-OCT, effusion was evident in 4 quadrants (3 eyes), 3 quadrants (7 eyes), 2 quadrants (5 eyes), and 1 quadrant (4 eyes). UBM showed effusion in 3 quadrants (5 eyes), 2 quadrants (2 eyes) and 1quadrant (7 eyes). Using UBM none of the eyes demonstrated effusion in all 4 quadrants and effusion was not found in 5 eyes ($P = 0.015$, chi-square test, William's correction).

Conclusion: AS-OCT seems to have greater ability compared to UBM to demonstrate sub-clinical uveal effusion, such as that present in eyes with chronic PAC.

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6.9.2.2. Clinical examination methods: Computerized image analysis: Optical coherence tomography: Posterior

see also P081, P110, P198, P216, P289

P246 GANGLION CELL COMPLEX LAYER MEASUREMENTS IN MACULAR REGION WITH FOURIER DOMAIN OPTICAL COHERENCE TOMOGRAPHY IN NORMATIVE AND GLAUCOMATOUS EYES

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Purpose: Unlike the Stratus time-domain optical coherence tomography which allows only total macular thickness measurements, a Fourier domain optical coherence tomography device (FD-OCT) can provide automatic measurements of ganglion cell complex (GCC) thickness in macular area. And it has come to know that glaucoma primarily affects the thickness of GCC in the macula area. The objectives of this study were: 1) to measure GCC layer and total retinal nerve fiber layer (RNFL) thickness in macular area in normal and glau-

coma patients with hemifield defects confirmed by standard automated perimetry (SAP); 2) to analyze difference in the GCC thickness between superior and inferior hemisphere in normal and glaucomatous eyes; and (3) to analyze differences between normal and glaucoma eyes.
Participants and Methods: Thirty-six eyes of 36 patients with hemifield SAP glaucomatous loss by SAP and 20 normative eyes of 20 age-matched controls underwent FD-OCT imaging (RTVue-100: Optovue, Fremont, CA) by the MM7 test program to obtain GCC thickness measurements in macular area automatically. MM7, concomitant test of RTVue-100: Optovue, Fremont, CA, automatically measurement GCC thickness in macular area.
Results: In normative normal eyes, there were no not significant differences in the GCC thickness (GCCT) and the total total retinal thickness between the superior and inferior hemispheres (superior, 95.79 ± 9.3 µm 266.00 µm ± 14.8 µm; inferior, 96.64 ± 9.3 µm 264.23 µm ± 9.3 µm, P > 0.1). In glaucomatous eyes, the GCCT and the total retinal thickness in the worse hemisphere were significantly thinner (76.6 ± 8.2 µm, 252.58 ± 14.6 µm) than those in the better hemisphere (89.98 ± 10.3 µm, 269.30 ± 10.3 µm) (p < 0.01, p < 0.01). The GCCT in the better hemisphere of glaucomatous eyes was significantly thinner than that GCC of normative eyes normal (P = 0.01). On the other hand, no such a difference was observed in the NFLT in the better hemisphere between glaucomatous and normative eyes (P = 0.323). Total retinal thickness in the better hemisphere of glaucomatous eyes was not significantly thinner than that in normal (P = 0.323).
Conclusion: In glaucomatous eyes with hemifield defects, GCCT in an apparent normal hemisphere was significantly thinner than that in normative eyes. This suggested that GCCT measurements in macular area by the FD-OCT have an ability to detect glaucomatous damages in preperimetric stage.

P247 RETINAL NERVE FIBER LAYER (RNFL) THICKNESS MEASUREMENT BY HIGH-DEFINITION SPECTRAL-DOMAIN (CIRRUS) COMPARED TO TIME-DOMAIN (STRATUS) OPTICAL COHERENCE TOMOGRAPHY (OCT)

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Objective: OCT is a useful adjunct in the management of glaucoma. However, the older time-domain technology has in it inherent flaws of measurement artifacts arising out of eye movements, and lack of registration of the scan circle. The recently introduced spectral-domain OCT may overcome these shortfalls due to its greatly enhanced speed of acquisition and improved resolution. This study was conducted to compare retinal nerve fiber (RNFL) measurements by spectral-domain compared to time-domain optical coherence tomography.
Design: Prospective cross-sectional observational study.
Participants: Normal subjects, glaucoma suspects and glaucoma patients.One hundred twenty-three eyes of 123 subjects were included comprising 68 normal, 32 glaucoma suspect and 23 glaucomatous eyes.
Methods: The study was approved from the Institute Ethics Committee, and adhered to the principles enshrined in the Declaration of Helsinki. Informed consent was obtained from all recruited individuals. Using time-domain OCT, the peripapillary RNFL was scanned using the Fast RNFL Thickness (3.4) scanning protocol, which uses a 3.46 mm aiming circle. Using the Cirrus OCT, the Optic Disk Cube 200x200 scan protocol was used, which generates a cube of data through a 6 mm square grid by acquiring a series of 200 horizontal scan lines each composed of 200 A-scans. Average and Quadrantic measurements from both machines were correlated using Spearman's rho correlation coefficient. Differences in RNFL thickness measurements were analyzed by Mann-Whitney U test. Bland-Altman plots were constructed to study agreement between the measurements using both machines. Area under receiver operating curves was analyzed to determine the best parameter to diagnose glaucoma. P < 0.05 was considered to be statistically significant.
Main outcome measures: Average and quadrantic peripapillary RNFL thickness measurements by both machines.
Results: Average RNFL thickness were significantly thinner on the Cirrus® (mean difference 11.23 microns) compared to the Stratus in normal subjects, but thicker on the Cirrus® in glaucoma patients (mean difference 2.89 microns). There was good correlation between the measurements in all three groups. In normals, the average, superior, nasal, inferior and temporal correlations were r = 0.668; 0.601; 0.508; 0.620 and 0.661; p < 0.001 respectively. In glaucomatous eyes, the corresponding values were r = 0.560; p = 0.005; r = 0.423; p = 0.04; r = 0.117; p = 0.596; r = 0.742; p < 0.001; r = 0.669; p < 0.001 respectively. Ninety-five percent limits of agreement of average RNFL thickness measured on the Cirrus and Stratus OCT were -30.2 to 13.8 microns. AROCs for diagnosing glaucoma were comparable, with highest values for superior RNFL thickness by Cirrus® (0.925) and average RNFL thickness by Stratus® (0.987).
Conclusions: RNFL measurements on the Cirrus® and Stratus® OCT correlate well, but do not have clinically acceptable agreement between their measurements. The instruments cannot be used interchangeably at the present time.
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P248 CORRECTED CALCULATION OF PERIPAPILLARY RETINAL NERVE FIBER LAYER THICKNESS BY OPTIC NERVE HEAD TILTING

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Objective: To understand better influences of the tilting of optic nerve head (ONH) on peripapillary retinal nerve fiber layer (RNFL) thickness measurement by spectral domain optical coherence tomography (OCT).
Design: Cross-sectional observational comparative case series.
Participants: One hundred twenty-eight eyes of 64 healthy Korean subjects aged from 20 to 69 years.
Methods: Peripapillary RNFL thicknesses were measured by an Optic Disc Cube 200 x 200 scan of the spectral domain Cirrus OCT. For each subject, the horizontal and vertical angles of ONH were calculated on the basis of cross-sectional OCT images of ONH. According to the ONH angles, the corrected clock-hour RNFL thicknesses were provided and compared with the original values.
Main outcome measures: Horizontal and vertical angles of ONH, original and corrected peripapillary RNFL thickness.
Results: For the entire study population, the mean values of horizontal and vertical angles of ONH were 12.62 degrees (SD, 5.17) and 4.17 degrees (SD, 3.30), respectively. In 125 eyes (97.66%), the horizontal ONH plane was tilted temporally; in 89 eyes (69.53%), the vertical ONH plane was tilted inferiorly. The corrected clock-hour RNFL thicknesses by ONH tilting were significantly different with the original values ($p = 0.009$); mean difference of these two RNFL differences were 11.53% (SD, 11.58).
Conclusions: Even though the current ocular imaging devices assume that ONH is never tilted, it seemed to be not true. It implies that the ONH tilting should be considered whether a certain RNFL thickness measurement is normal or not. And the corrected RNFL thicknesses by ONH tilting might be more suitable than the original RNFL thicknesses.
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P249 CORRELATION BETWEEN CENTRAL CORNEAL THICKNESS AND PERIPAPILLARY RETINAL NERVE FIBER LAYER THICKNESS IN NORMAL TENSION GLAUCOMA PATIENTS

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Objective: To investigate correlation between central corneal thickness (CCT) and peripapillary retinal nerve fiber layer (RNFL) thickness in the eyes of patients with normal-tension glaucoma (NTG).
Design: Case control study.
Participants and controls: Fifty-one eyes of 36 patients with NTG were subject to the study and 51 eyes of 30 people without the disease were used as control group.
Methods: Intraocular pressure, CCT and peripapillary RNFL thickness measured in each eye by Goldmann applanation tonometry, ultrasonic pachymetry, and optical coherence tomography, respectively.
Main outcome measure: The correlations between the CCT and the peripapillary RNFL were measured.
Results: CCT did not show any significant difference between the eyes of NTG patients (543.19 ± 37.24 μm) and those of control group (552.86 ± 32.71 μm, $p = 0.167$). There was no significant correlation between the CCT and the peripapillary RNFL thickness in the control group ($R = -0.26$, $p = 0.07$). In contrast, patients with NTG showed significant positive correlation between the CCT and the mean peripapillary RNFL thickness ($R = 0.68$, $p < 0.01$) and also between the CCT and the peripapillary RNFL thickness of each quadrant ($p < 0.05$).
Conclusion: Patients with thinner CCT are more prone to show thinner peripapillary RNFL thickness at the initial examination in NTG.
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ness in healthy subjects. Am J Ophthalmol 2008; 146: 561-566.

P250 CORRELATION OF NOVEL OBJECTIVE SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY OPTIC NERVE HEAD PARAMETERS WITH DISC PHOTOGRAPHY AND VISUAL FIELD PARAMETERS

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Purpose: To investigate if good correlation exists between a novel objective Spectral Domain Optical Coherence Tomography (SDOCT) optic nerve head (ONH) parameter (*i.e.*, minimum distance band) and more subjective clinical parameters (*i.e.*, disc photography assessments and visual field parameters).
Design: Prospective case series.
Participants: There were eleven patient volunteers. Included were two normal eyes, two ocular hypertension eyes, two glaucoma suspect eyes, and ten glaucomatous eyes with various stages of glaucoma.
Methods: A clinical SDOCT system was used for high-speed (29 fps) and high-axial resolution (4.7 µm) cross-sectional optic nerve head imaging. The SDOCT neuroretinal rim minimum distance band (MDB) was defined as the circular band with the smallest area delimited by the retinal pigment epithelium (RPE) end and the ONH surface. The mean thickness and area of the MDB were compared with Humphrey visual field (Carl Zeiss Meditec, Dublin, CA) mean deviation (MD) and pattern standard deviation (PSD) and disc photography vertical cup-to-disc ratio assessments (as determined by 5 masked glaucoma specialists).
Main outcome measures: SDOCT MDB mean thickness and area were correlated with clinical parameters (i.e. cup-to-disc ratio, Humphrey visual field mean deviation and pattern standard deviation).
Results: SDOCT MDB determinations demonstrated glaucomatous structural changes that correlated well with visual field test results and disc photography cup-to-disc ratio assessments. Excellent correlations were found between MDB mean thickness and all clinical parameters [*i.e.*, MD (R = 0.631, P = 0.009); PSD (R = -0.866, P = 0.0004); and cup-to-disc ratio assessments (R = -0.883, P = 0.0003)] as well as between MDB area and all clinical parameters [*i.e.*, MD (R = 0.633, P = 0.009); PSD (R = -0.734, P = 0.001); and cup-to-disc ratio assessments (R = 0.559, P = 0.024)].
Conclusions: The objective SDOCT MDB mean thickness and area calculations correlated very well with the more subjective clinical parameters derived from visual field testing and disc photography and may potentially be used for a more thorough evaluation of glaucoma patients.
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P251 PERIPAPILLARY RETINAL NERVE FIBER LAYER THICKNESS MEASUREMENT BY SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY, SCANNING LASER POLARIMETRY AND CONFOCAL SCANNING LASER OPHTHALMOSCOPY IN NORMAL SUBJECTS

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Purpose: To compare average peripapillary retinal nerve fiber layer thickness (avg RNFLT) determined by spectral domain optical coherence tomography (SD-OCT, 3D-OCT1000), scanning laser polarimetry (GDx with variable corneal compensation [VCC] and enhanced corneal compensation [ECC]) and confocal scanning laser ophthalmoscopy (Heidelberg Retina Tomography II).
Design: Cross-sectional study.
Participants: One hundred sixty-four eyes of 164 ophthalmologically normal subjects.
Methods: Avg RNFLT was determined with SD-OCT, GDx VCC/ECC, and HRT II, and was correlated with each other. The peripapillary area was divided into 6 sectors for regional analysis.
Main outcome measures: Correlation coefficients between avg RNFLT and sectoral RNFLT determined by SD-OCT and the other fundus imaging devices.
Results: Subjects' age averaged 51.1 ± 16.2 (range: 21~77) years old and spherical equivalent error (SE) -0.63 ± 1.64 (-5.75~2.88) diopters (D). In 135 eyes of 135 subjects with reliable SD-OCT and GDx results, avg RNFLT by SD-OCT at a 3.4 mm diameter significantly correlated with the TSNIT average of GDx VCC (Rs = 0.48, P < 0.0001) Avg RNFLT of each sector significantly correlated between the two devices (Rs = 0.35~0.54, P < 0.0001), although the ratio of measurement values (TSNIT average [GDx VCC]/ avg RNFLT [SD-OCT]) varied significantly among the sectors (0.40~0.69, P < 0.0001). The results were similar regarding correlation between SD-OCT and GDx ECC. When the subjects were divided into half by an SE of -0.5D, there was no significant difference in correlation in avg RNFLT by SD-OCT and GDx VCC/ECC between the two groups. However, avg RNFLT by SD-OCT did not significantly correlate with those by GDx in the temporal superior and inferior sectors in myopic eyes (SE ≦-0.5D), whereas significant correlation was seen in all sectors in non-myopic eyes. In 164 eyes of 164 subjects with reliable SD-OCT and HRT II results, avg RNFLT by SD-OCT did not significantly correlate with the mean RNFLT by HRT II (Rs = 0.16, P = 0.08).
Conclusions: RNFLT measurements by SD-OCT and GDx VCC/ECC significantly correlated with each other in normal subjects. However, the degree of correlation was not high enough and RNFLT values were not interchangeable. No

significant correlation was seen between RNFLT measured by SD-OCT and HRT II.

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P252 THE CORRELATIONS OF RETINAL NERVE FIBER LAYER THICKNESS BETWEEN TIME DOMAIN AND SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY

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Purpose: To compare the peripapillary retinal nerve fiber layer (RNFL) thickness of patients with different glaucoma diseases obtained from time domain optical coherence tomography (TD-OCT; Stratus, Carl Zeiss Meditec, Inc., Dublin, CA) and spectral domain optical coherence tomography (SD-OCT; Spectralis, Heidelberg Engineering, Heidelberg, Germany).

Design: Retrospective comparative study.

Participants: Ninety-four glaucoma suspect patients, 45 normal-tension glaucoma (NTG) patients, 32 primary open-angle glaucoma (POAG) patients, 10 primary angle-closure glaucoma (PACG) patients, and 30 healthy normal subjects as controls were included.

Methods: In one randomly selected eye in each subject, patients were scanned in a single session, by a single operator, on both OCT systems.

Main outcome measures: Average (AvgT), superior quadrant (Savg), and inferior quadrant (Iavg) RNFL thicknesses.

Results: Peripapillary RNFL thicknesses of total patients measured by TD-OCT were significantly greater than those measured by SD-OCT: AvgT, Savg, Iavg were 99.05 μm, 117.63 μm, 123.19 μm in TD-OCT and 96.03 μm, 113.66 μm, 120.14 μm in SD-OCT ($p = <0.001, 0.001, 0.005$). Mean differences of the two systems were 3.02 ± 9.37 μm in AvgT, 3.97 ± 13.83 μm in Savg, and 3.05 ± 12.84 μm in Iavg. Normal and glaucoma suspect groups showed a statistical difference only in Iavg. However, NTG and POAG groups demonstrated statistical significances in all measurements. Correlation coefficients of AvgT, SavgT, IavgT were 0.880, 0.804, 0.792 in normal group ($p < 0.01$), 0.744, 0.734, 0.796 in glaucoma-suspect group ($p < 0.01$), 0.836, 0.923, 0.847 in NTG group ($p < 0.01$), 0.895, 0.965, 0.900 in POAG group ($p < 0.01$), 0.967, 0.965, 0.900 in PACG group ($p < 0.01$).

Conclusions: Absolute measures of peripapillary RNFL thickness differed between TD-OCT and SD-OCT. Especially, NTG and POAG groups showed more significant differences. However, both OCT systems were highly correlated, and higher correlations were seen in NTG, POAG, PACG groups than in normal, glaucoma suspect groups.

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P253 COMPARISON OF NERVE FIBER LAYER THICKNESS MEASUREMENTS BETWEEN STRATUS, CIRRUS, AND RTVUE IN PATIENTS WITH GLAUCOMA

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Objective: To compare retinal nerve fiber layer (RNFL) measurements obtained from two spectral domain optical coherence tomography (SD OCT) instruments (Cirrus OCT; Carl Zeiss Meditec, Dublin, CA and RTVue FD OCT system; Optovue, Inc., Fremont, CA) and a time domain OCT (TD OCT) instrument (Stratus OCT; Carl Zeiss Meditec) and compare their agreement, correlation and diagnostic precision.

Design: Cross-sectional observational study.

Participants: Two hundred-elevenconsecutive subjects in an outpatient tertiary glaucoma center. One hundred-seven open-angle glaucoma patients grouped according to severity of visual field (VF) defect as by the Hodapp-Anderson criteria and 46 healthy eyes as controls.

Methods: Peripapillary average and quadrant RNFL thickness measurements were obtained for comparison and analysis from all participants with all 3 OCTs in random order on the same day by one operator.

Main outcome measures: Bland and Altman plots, Intraclass correlation coefficient (ICC), Regression analysis, Area under receiver operating characteristic curve (AUC).
Results: Eighteen, 3, and 4 eyes by Stratus (72%), Cirrus (12%), and RTVue OCT (16%), respectively were excluded due to poor image acquisition. RNFL thicknesses were generally thicker with the RTVue, followed by the Stratus then the Cirrus for all diagnostic groups. There was significant inter-instrument reliability and agreement among all instruments ($p < 0.0001$). ICC showed comparable correlation for all 3 instruments that was more pronounced for average and inferior RNFL measurements (ICC; Range: 0.684~0.930). Eighteen, 3, and 4 eyes by Stratus (72%), Cirrus (12%), and RTVue OCT (16%), respectively were excluded due to poor image acquisition. There was significant inter-instrument reliability and agreement among all instruments ($p<0.0001$). ICC showed comparable correlation for all 3 instruments that was more pronounced for average and inferior RNFL measurements (ICC; Range: 0.684~0.930). There were no significant differences in the diagnostic ability of all 3 instruments, but the RTVue and the Cirrus had the highest AUC for average RNFL (0.825 and 0.813), while the Stratus had the highest AUC in the inferior quadrant (0.818). There were no significant differences in the diagnostic ability of all 3 instruments, but the RTVue and the Cirrus had the highest AUC for average RNFL (0.825 and 0.813), while the Stratus had the highest AUC in the inferior quadrant (0.818).
Conclusions: Comparison of RNFL thickness measurements obtained with the best quality images provided by the 3 OCT instruments are well correlated and compatible. The diagnostic precision of each instrument was not significantly different. However, good quality image acquisition seems to be easier with the SD OCT instruments. Also, direct comparison of measurements may be misleading as there are significant differences among the 3 OCTs studied. Therefore comparisons among instruments should be exercised with caution.
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P254 AGREEMENT BETWEEN SLIT LAMP EXAMINATION AND OPTICAL COHERENCE TOMOGRAPHY IN ESTIMATING CUP DISC RATIOS IN GLAUCOMA PATIENTS
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Purpose: To compare cup-disc ratio (CDR) measurements by OCT with those estimated by two experienced glaucoma specialists using slit lamp for evaluation of optic nerve head in glaucoma patients.
Design: Retrospective observational comparative study.
Participants: One hundred-two eyes of 54 glaucoma patients.
Methods: Optic nerve head of 102 eyes of 54 glaucoma patients were examined using slit lamp with a +90 D lens by 2 experienced glaucoma specialists. Horizontal CDR [HCDR] and vertical CDR [VCDR] were compared with OCT readings.
Main outcome measure: Cup-disc ratio.
Results: The mean HCDR [0.761 ± 0.15] obtained by OCT was significantly higher than mean HCDR estimated by both the specialists by slit lamp [0.590 ± 0.15 and 0.595 ± 0.15, p value < 0.001]. The mean VCDR [0.698 ± 0.14] obtained by OCT was also significantly higher than mean VCDR estimated by two specialists by slit lamp [0.532 ± 0.13, 0.526 ± 0.14, $p < 0.001$]. The CDR difference between two specialists was not statistically significant.
Conclusion: The measurements obtained from OCT differ significantly from those obtained by using slit lamp .This difference needs to be considered.
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P255 ASYMMETRY OF THE BIORETINOMETRY PARAMETERS OF THE TWIN EYES IN NORMAL STATE AND IN PRIMARY GLAUCOMA
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Introduction: Primary glaucoma is the both sides disease, which has asymmetry character in the twin eyes. The range of the asymmetry of the glaucoma optical neuropathy in the twin eyes may be important in the early glaucoma diagnostic.
Purpose: To study the asymmetry of bioretinometry the parameters in normal state and in primary glaucoma.
Participants and controls: Forty healthy persons and 64 patients with the primary glaucoma were examined. The patients with glaucoma were divided into two groups. The first group - 49 patients (98 eyes) with different stages of

glaucoma in both eyes. The second group - 15 patients (30 eyes) with developed glaucoma in one eye and without perimetry symphtoms in the other (better) eye. The control group - 40 healthy persons (80 eyes) with undiscovered eye pathology of the same age.
Methods: The optic nerve head analysis and retina results were made by means of optical coherent tomography Stratus OCT 3000 (Germany).
Results: The asymmetry of the optic nerve head (ONH) diameters in all groups did not exceed of 0,1 mm (asymmetry 6%), which makes the basis for the asymmetry evaluation of all the other OCT parameters of ONH. In the control group the minimum asymmetry was discovered in the parameter characterising saggital area of the neuroretinal rim (horizontally integrated rim width (area)) - 4%. The maximum asymmetry was discovered in the parameters, characterising the cup shape measure (47%). The asymmetry of the middle thickness RNFL parameters (average thickness) of the twin eyes in normal state makes 3%, for Imax, Iavg - for the inferior sector of the nerve fiber level - 6%, for superior sector - (Savg, Smax) - 9%. In the group of patients with primary glaucoma of different stages, the significant growth of the asymmetry of all bioretinometry parameters of the twin eyes was discovered. In the second group the repeated growth of the same parameters was discovered.
Conclusions: It was determined, that the development of the primary open-angle glaucoma is accompanied by the significant growth of the asymmetry of the bioretinometry parameters in the twin eyes. The maximum range of the asymmetry of the bioretinometry parameters of twin eyes under the primary glaucoma was determined in such parameters, which have the least asymmetry in normal state.

P256 REPRODUCIBILITY OF RETINAL NERVE FIBER LAYER THICKNESS MEASUREMENT USING SPECTRAL-DOMAIN OCT IN NORMAL EYES

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Purpose: To compare the reproducibility of retinal nerve fiber thickness (RNFLT) measurement around the optic nerve heads between a spectral-domain optical coherence tomography (SD-OCT) and a time-domain OCT (TD-OCT).
Design: A prospective study.
Participants: Thirty ophthalmologically normal eyes of 30 subjects.
Methods: In all subjects, after confirming ophthalmological normality by comprehensive ophthalmic examinations including visual field testing with the Humphrey Field Analyzer 24-2 SITA standard (Carl Zeiss Meditec, CA), RNFLT measurements with a SD-OCT (3D-OCT1000, Topcon, Japan) and a TD-OCT (Stratus OCT, Carl Zeiss Meditec) were performed three times in the same day (short-term reproducibility) and repeated in another day (inter-visit reproducibility). Scanning protocols of the SD-OCT were the circular scan and the 3-dimensional raster(3-D scan) scan around the optic disc and that of the TD-OCT was the Fast-RNFL scan.
Results: Coefficients of variation (CVs) for the short-term reproducibility were good for the both instruments (≤2.2%) without significant difference between the instruments in the 360-degree average and sectorized average of RNFLT ($P > 0.1$). CVs for the long-term reproducibility were not significantly different for the 360-degree average of RNFLT between the two instruments ($P > 0.1$). In sectorized analysis, CVs for the long-term reproducibility by the SD-OCT were significantly smaller in the superior and inferior quadrants with the circular scan and in the superior and nasal quadrants with the 3-D scan than those with the TD-OCT, respectively ($P \leqq 0.03$).
Conclusion: Inter-visit reproducibility of RNFLT measurement with the SD-OCT were better than that with the TD-OCT at least in some quadrants in which the changes in RNFLT by glaucoma was often clinically important.
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P257 A SUPER PIXEL ANALYSIS FOR GLAUCOMA DISCRIMINATION BY SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY (SD-OCT)

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Purpose: To evaluate the glaucoma discriminating ability of a super pixel (SP) analysis of the macular region using SD-OCT.
Design: Cross-sectional.
Participants: Eighty-eight eyes of 54 healthy volunteers; 26 eyes of 26 glaucoma subjects.
Methods: The macular region of all subjects was scanned using SD-OCT (Cirrus HD-OCT; Carl Zeiss Meditec, Dublin, CA; Macular Cube 200x200 scan). Total retinal (TR) and inner retinal complex (IRC; retinal nerve fiber (RNFL), ganglion cell, and inner plexiform layers) were automatically measured using custom software. 54 eyes (one eye from each healthy volunteer) were used to establish normative data for TR and IRC thicknesses, and the remaining 34

healthy eyes were used to assess glaucoma discriminating performance (test group). SPs were defined as the mean of 4x4 adjacent sampling points and used for RNFL thickness analysis. Our software automatically calculated the number of abnormal SP (< mean - 2*standard deviation; Num) and the number of abnormal SPs in the largest abnormal SP cluster (cluster should have at least 5 adjacent abnormal SPs; Max). The conventional circumpapillary RNFL (cpRNFL) thickness was measured on each eye with Cirrus HD-OCT, Optic Disc 200x200 scan.

Main outcome measures: Area under receiver operating characteristics curve (AUC) and specificity for cpRNFL, TR Num, TR Max, IRC Num, IRC Max.

Results: Glaucoma subjects were older (64.3 ± 11.5 *vs* 43.1 ± 15.3 years, $p < 0.001$, Wilcoxon) with a worse visual field mean deviation (-7.3 ± 7.6 *vs* -0.5 ± 1.4 dB, $p < 0.001$) than the healthy test group. AUC and specificity at a sensitivity of ~0.96 were as follows: cpRNFL AUC 0.97 (specificity 0.81), TR Num AUC 0.94 (specificity 0.84), TR Max AUC 0.94 (specificity 0.81), IRC Num AUC 0.99 (specificity 0.93), IRC Max AUC 0.99 (specificity 0.93). No statistically significant difference in AUC was seen among measured parameters (Jackknife method).

Conclusions: A super pixel analysis of the macular region performs at least as well at discrimination glaucoma from healthy eyes as conventional cpRNFL thickness measurements.

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P258 CORRELATION BETWEEN STRATUS OPTICAL COHERENCE TOMOGRAPHY AND SCANNING LASER POLARIMETRY MEASUREMENTS IN GLAUCOMA, OCULAR HYPERTENSIVE AND GLAUCOMA-SUSPECT EYES

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Objective: To study the relationship between Stratus optical coherence tomography (OCT) and scanning laser polarimetry with variable corneal compensation (SLP-VCC) in measuring peripapillary retinal nerve fiber layer (RNFL) thickness in eyes with early glaucoma (EG), ocular hypertension (OH), and glaucoma suspect (GS) in a Taiwan Chinese population.

Design: Prospective cross-sectional study.

Participants: One eye each of 120 patients (50 with EG, 32 with OH and 38 with GS) was included in the study.

Methods: Retinal nerve fiber layer (RNFL) thickness was measured by both technologies. Humphrey Field Analyzer visual field testing was performed in each patient.

Main outcome measure: The three parameters of the Stratus OCT (average, superior quadrant and inferior quadrant thickness) and GDx VCC (TSNIT average, superior average and inferior average thickness) were correlated using the Pearson's correlation coefficient (r) in three groups.

Results: In EG group, the following parameters were found to be significantly correlated ($P < 0.005$). GDx VCC-TSNIT-average/ Stratus average thickness ($r = 0.467$), GDx VCC-superior average/ Stratus OCT-superior quadrant ($r = 0.614$), and GDx VCC-inferior average / Stratus OCT-inferior quadrant ($r = 0.558$). In the OH group, there was no significant correlation in the three parameters. In GS group, there was significant correlation only in GDx VCC-inferior average/ Stratus OCT-inferior quadrant ($r = 0.361$).

Conclusions: The RNFL thickness measured by Stratus OCT and GDx VCC was well correlated in early glaucomatous eyes. However, the correlation of the measurement between the two imaging machines was poor either in ocular hypertension or glaucoma suspect eyes. When managing the case with ocular hypertension or glaucoma suspect eye, we should be more cautious in interpreting the imaging data.

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P259 EFFECT OF AGGRESSIVE LOWERING OF INTRA OCULAR PRESSURE ON RETINAL NERVE FIBER LAYER THICKNESS USING HIGH DEFINITION OCULAR COHERENCE TOMOGRAPHY

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Objective: To assess peripapillary RNLF thickness in glaucoma patients after aggressive reduction of IOP by using HD OCT.

Design: Prospective selective case allocation observational trial.

Participants: Nine eyes of 5 patients having POAG underwent medical or surgical intervention to reduce IOP by minimum of 50% from base line (damaging IOP).

Methods: Newly diagnosed POAG patients with very high initial IOP underwent RNFL measurement with HD OCT (Cirrus Software version 3.0 Carl Zeiss, Dublin CA), before initiation of therapy and after reduction of minimum 50% IOP by medical or surgical therapy, peripapillary RNFL thickness compared on following basis: 1. Mean RNFL thickness across TSNIT curve; 2. Mean RNFL thickness in 4 quadrants TSNI; 3. Mean RNFL thickness at each clock position; 4. RNFL thickness across TSNIT curve at 254 locations.
Results: Mean IOP before initiation of therapy was 40.66 ± 6.78 mmHg at 3 months was 14.88 ± 1.76 mmHg. Minimum reduction of more than 50% in each eye from baseline. One eye of one patient underwent trabeculectomy and and eight eyes of four patients received medical therapy. Mean RNFL thickness before treatment was 71.44 ± 14.43 µm. Mean RNFL thickness at 3 months after treatment was 70.11 ± 15.01 µm. Mean RNFL thickness at four quadrants pre and post treatment were respectively: Temporal 61.11 ± 14.56 / 66.33 ± 9.85, Superior 81.44 ± 78.50 / 74.77 ± 15.31, Nasal 70.00 ± 12.12 / 71.66 ± 12.63, Inferior 76.88 ± 21.42 / 78.55 ± 21.34. RNFL thickness at each clock hour were compared and also across the TSNIT curve at 254 locations were observed for any deviation of more than five microns at three consecutive locations, none showed that.
Conclusion: Aggressive lowering of IOP by medical or surgical means is not associated with change in RNFL thickness as measured by HD OCT.
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P260 RETINAL NERVE FIBER LAYER THICKNESS MEASURED BY OPTICAL COHERENCE TOMOGRAPHY IN THE FELLOW EYES OF UNILATERAL RETINAL VEIN OCCLUSION

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Purpose: To investigate whether the retinal nerve fiber layer thickness is decreased in the fellow eyes with normal intraocular pressure in subjects with unilateral retinal vein occlusion (RVO).
Design: Prospective cross-sectional study.
Participants and controls: Fifty six patients with unilateral RVO and 56 age-matched normal control subjects were enrolled.
Methods: Goldman applanation tonometry, Stratus OCT and standard automated perimetry (SAP, Humphrey Field Analyzer II 750; Swedish Interactive Threshold Algorithm (SITA) standard).
Main outcome measure: Global average, quadrant and clock hour RNFL thicknesses as measured by Stratus OCT and SAP result.
Results: The mean IOP of RVO fellow eyes was 14.93 ± 2.64 (range 9-20 mmHg). The global average (100.22 ± 13.61 *vs* 106.12 ± 8.99, p = 0.008), inferior quadrant (127.18 ± 18.93 *vs* 134.75 ± 14.04, p = 0.018) and temporal quadrant thicknesses (73.70 ± 14.32 *vs* 79.11 ± 10.10, p = 0.023) were significantly thinner in RVO fellow eyes compared to normal control eyes. In the clock hour analysis, thicknesses were significantly thinner in the 7 (134.57 ± 22.53 *vs* 143.86 ± 16.99, p = 0.015), 10 (83.18 ± 20.34 *vs* 95.41 ± 14.78 p < 0.001) and 11 (125.95 ± 28.80 *vs* 143.45 ± 18.13, p < 0.001) o'clock sectors in RVO fellow eyes than in normal controls. The glaucomatous visual field defects corresponding to the OCT finding were found in 11 of 56 (19.6%) RVO fellow eyes.
Conclusions: In RVO fellow eyes, the RNFL thickness was decreased, in particular in the inferotemporal and superotemporal sectors compared to normal control eyes. These data suggest that RVO and glaucoma may have systemic risk factors as a common pathogenic mechanism.
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P261 THE EFFECT OF SPHERICAL EQUIVALENT ON THE RETINAL NERVE FIBER LAYER THICKNESS PROFILE IN HEALTHY EYES

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Purpose: To determine the effect of spherical equivalent (SE) on the retinal nerve fiber layer thickness (RNFL) profile in healthy eyes.
Design: Cross-sectional observational study.
Participants: One hundred twenty seven eyes of 67 Korean normal subjects.
Methods: Tilt ratio of the optic disc was calculated from color disc photographs. Peripapillary Fast RNFL scans performed by Stratus OCT were taken. From the raw data of scanned

images, angular location of superior maximal RNFL thickness point from a reference line, which was drawn horizontally through the center of the scan circle, was calculated. With same method, that of inferior maximal RNFL thickness point was calculated.
Main outcome measure: Linear regression analysis of the effect of SE on angular location of superior and inferior maximal RNFL thickness points.
Results: The mean SE was -4.75 diopter (standard deviation, 3.31) and the mean tilt ratio was 0.88 (standard deviation, 0.07). Closer angular location toward the fovea of both superior ($r = 0.49$, $P < 0.01$) and inferior maximal RNFL thickness point ($r = 0.54$, $P < 0.01$) was associated with lower SE. However, lower tilt ratio was not significantly associated with lower SE ($r = 0.10$, $P = 0.29$).
Conclusion: Maximal superior and inferior RNFL thickness points were located closer to the fovea in eyes with lower SE. This variable may need to be taken into account when constructing internal normative database of Stratus OCT and evaluating patients for diagnosis of glaucoma based on this device.
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P262 VISUAL FUNCTION AND RETINAL NERVE FIBER LAYER THICKNESS: THE TIPPING POINT

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Purpose: It has been suggested that glaucomatous structural damage precedes the appearance of functional abnormality. The purpose of this study was to determine the retinal nerve fiber layer (RNFL) thickness at which visual field (VF) damage accelerates.
Design: Cross-sectional.
Participants: Both eyes in 10 healthy and 29 glaucoma subjects.
Methods: VF exams and spectral-domain optical coherence tomography (SD-OCT; Cirrus HD-OCT, Carl Zeiss Meditec, Dublin, CA) optic disc 200x200 cube scans were obtained from all subjects. A 'broken stick' analysis model was fitted to VF mean deviation (MD) and average and quadrant RNFL thicknesses data while ignoring clustering to provide an initial estimate of the tipping point. The change point is a knot between the two straight-line segments for higher MD and lower MD. The method of maximum likelihood was used to estimate the mixed effect model parameters including the knot location.
Main outcome measures: RNFL thickness.
Results: At higher MD, the rate of functional loss was shallower (0.076 dB/µm RNFL thickness lost [95% confidence interval -0.013-0.165]) than the rate of loss in lower MD (0.568 dB/µm [0.453-0.683]). The inflection point for VF loss was 72.34 µm, 23% below the healthy population mean of 92.60 µm, which was an RNFL thickness equal to a loss of approximately 50% of the OCT dynamic range. Inferior, superior, nasal, and temporal RNFL tipping point thicknesses were 88.36, 67.75, 53.96, and 57.10 µm respectively.
Conclusions: Substantial structural loss occurs prior to the appearance of functional VF loss. At mean RNFL thicknesses above 72m, RNFL assessment is more sensitive to disease progression.
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P263 MEASUREMENT OF RETINAL NERVE FIBER LAYER THICKNESS USING 3D FOURIER-DOMAIN OCT IN EYES WITH DIFFERENT STAGE OF GLAUCOMA

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Purpose: To measure retinal nerve fibre layer (RNFL) thickness with Topcon 3d-OCT 1000 in normal subjects and glaucoma patients and to evaluate the relationship between visual field (VF) parameters and RNFL thickness.
Design: Cross-sectional study
Participants: Hundred fifty eight subjects - 41 normal, 25 with preperimetric glaucoma (PPG) and 92 with different stages of primary open-angle glaucoma (POAG) were enrolled in this study.
Methods: Standard automated perimetry was performed in all eyes. High-density 6x6 mm 3d-scans of the optic disc were taken. RNFL thickness was measured for 6 areas of the 3,4 mm circle and for 8 areas corresponding to the ETDRS grid, both centered on the optic disc. RNFL thickness values were calculated for inner ring 1 surrounding the optic disc border (consisting of areas 2-5) and the outer ring (ring 2, consisting of areas 6-9) of the ETDRS grid. The strength of association between mean sensitivity (MS), mean defect (MD) of visual fields and RNFL thickness were evaluated with regression analysis and Pearson correlation coefficients.
Main outcome measures: VF parameters: mean sensitivity (MS) and mean defect (MD). OCT measurements of RNFL thickness.

Results: In the normal group mean RNFL for 3,4 mm circle was 555 µm (60 µm) and 363 µm (56 µm) for ring 1, for the POAG group the values were 347 µm (125 µm) for 3,4 mm circle and 166 µm (85 µm) for ring 1, and for the PPG group the values were 473 µm (79 µm) and 250 µm (51 µm), respectively. The differences in RNFL thickness between normal eyes, PPG eyes and POAG eyes were highly significant ($p \leqq 0{,}001$) for areas 2 and 4 of the ring 1, ring 1 and mean RNFL for the 3,4 mm circle. The correlation of RNFL and the VF parameters in normal and PPG eyes was not significant. In POAG eyes, RNFL and both MS (r = 0,602) and MD (r = -0,593) correlated significantly. The best parameters for differentiating normal from PPG eyes eyes were ring 1 (area under receiver operator characteristic curves (AUC) = 0,949) and area 4 values (AUC = 0,905).
Conclusions: 3d-OCT showed significantly decreased mean RNFL thickness of the ring 1 by 26% in PPG eyes and by 50% in eyes with early perimetric glaucoma compared to the control group. These results support the usefulness of this technology. However, in the future normative database is needed, adjusted for variables that have an effect on RNFL.
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P264 MAPPING OF MACULAR SUBSTRUCTURES WITH SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY IN NORMAL AND GLAUCOMATOUS EYES, 2ND REPORT

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Purpose: To evaluate damage in normal and glaucomatous eyes, we measured the ganglion cell complex layer thickness of macular regions using spectral domain optical coherence tomography (SD-OCT).
Design: Observational cross-sectional retrospective study.
Participants: One hundred forty-six eyes of ninety-four participants in Hiroshima University Hospital, divided into four groups: normal (N), early glaucoma (EG), moderate glaucoma (MG) and severe glaucoma (SG) with 45, 14, 10 and 69 eyes (Stages are decided using Anderson's classification), respectively.
Methods: RTVue-100 (Optovue, Inc., Fremont, CA, USA) was used to map the macula over an area of 7-mm square. Macular OCT images were prepared for automatic segmentation using the GCC program. We measured the thickness of the macular ganglion cell complex layer (mGCCL) as a nerve fiber layer, ganglion cell layer with its inner plexiform layer, and that of the macular total retina (mTR) as the mGCCL with its outer retinal layer (mORL) (The mORL thickness was determined as the mTR thickness minus the mGCCL thickness). The results in G eyes were compared with those in N eyes. We also evaluated the co-efficiency of each thickness of the mGCCL, mORL and mTR and each mean deviation (MD) employing the Humphrey® Field Analyzer (HFA) using the SITA-standard™ program.
Main outcome measures: Area-weighted average thicknesses of retinal sublayers in the macula.
Results: The mGCCL was significantly thinner in other groups {EG (87.39 ± 6.41 µm), MG (79.11 ± 3.58 µm), SG (77.98 ± 13.65 µm)} than the N (91.36 ± 8.34 µm) eyes ($p < 0.0001$). Also the total retina was significantly thinner in other groups {EG (255.34 ± 10.95 µm), MG (240.55 ± 13.81 µm), SG (245.93 ± 19.47 µm)} than in N (260.05 ± 12.26 µm) eyes ($p < 0.0001$). However, the difference in mORL thickness between each glaucoma groups {EG (167.95 ± 7.47 µm), MG (161.44 ± 7.04 µm), SG (167.96 ± 10.39 µm)} and N (168.69 ± 7.95 µm) eyes was not significant ($p = 0.1609$). The co-efficiency of the mGCCL thickness and MD was significant ($r^2 = 0.323$, $p < 0.0001$), also, that of the mTR thickness and MD was significant ($r^2 = 0.201$, $p < 0.0001$). However, that of the mORL thickness and MD was non-significant ($r^2 = 0.005$, $p = 0.426$)
Conclusions: Glaucoma leads to the thinning of the mGCCL and mTR at several stages. The MD (representing visual field loss), mGCCL and mTR thickness showed significant co-efficiency, but the mORL did not. Measurement of the mGCCL using RTVue-100 was suggested to facilitate effective glaucoma detection and evaluation at various stages.

P265 REPRODUCIBILITY OF RETINAL NERVE FIBER LAYER THICKNESS MEASUREMENTS WITH THE REPEAT-SCAN PROTOCOL USING THE CIRRUS OCT IN NORMAL AND GLAUCOMATOUS EYES

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Purpose: To evaluate the test retest variability of Cirrus optical coherence tomography (Carl Zeiss Meditec, Inc., Dublin, CA) in measurement of retinal nerve fibre layer thickness.
Design: Observational cross-sectional study.
Participants: Ninety-two eyes of 92 subjects (30 eyes with primary open-angle glaucoma, 62 eyes of healthy controls).
Main outcome measures: Intrasession test-retest variability of each clock hour, quadrant, and average RNFL thickness was determined.
Methods: Peripapillary RNFL thickness was measured using the repeat scan protocol of Cirrus optical coherence tomography (OCT) three times on the same day performed by a single operator over a 30-minute period with a brief rest between sessions to determine intrasession variability. Reliability was assessed by the Intraclass correlation coefficient alpha (ICC) and the Bland Altman plot for the limits of agreement for the overall mean RNFL thickness and for each quadrant.
Results: The average age of the subjects was 43.09 ± 16.28 years. The mean average RNFL thickness (in microns) in glaucoma patients for each of the repeats was 76.52 ± 13.72, 77.11 ± 12.65, and 76.78 ± 13.21 respectively. The mean

average RNFL thickness in the control group was 91.40 ± 9.29, 91.15 ± 9.75, 91.18 ± 10.48 respectively. The Intraclass correlation coefficient alpha for mean RNFL thickness was 0.99, while that for the temporal, superior, nasal and inferior quadrants was 0.97, 0.92, 0.91 and 0.97 respectively. As per the bland Altman plots the limits of agreement (95% CI) for the average RNFL thickness for sessions one and two, one and three, and two and three were, 0.26 ± 26.30,and 0.20 ± 26.66, and 2.00 ± 25.74 respectively in the control group. In patients of glaucoma limits of agreement (95% CI) for the average RNFL thickness for sessions one and two, one and three, and two and three were 0.59 ± 18.9, 0.26 ± 12.92 and 0.33 ± 13.24 respectively.

Conclusions: The Cirrus OCT shows excellent intrasession repeatability in both normal and glaucomatous eyes using the repeat scan protocol.

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P266 REPEATABILITY AND INFLUENCE OF PUPIL DILATION ON RNFL MEASUREMENT WITH THE OPTOVUE OCT IN DIFFERENT SEVERITY OF GLAUCOMA

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Objective: To evaluate repeatability (CoV) and influence of pupil dilation on RNFLT measurements with the Optovue OCT (RTVue) in different glaucoma severity.

Design: Evaluation of a diagnostic technique.

Participants: One eye of 14 healthy subjects (MD<2dB), 11 glaucoma patients with MD 6-12dB and 12 glaucoma patients with MD > 15dB.

Testing: RTVue NHM4 scan (software version 3.5) was obtained 5 times before and after pupil dilation. Undilated RNFLT repeatability was compared to that calculated from 5 GDx-VCC and 5 ECC measurements obtained on the same eyes.

Main outcome measure: CoV, ICC.

Results: Pupil diameter changed from 2.5 ± 1.0 mm to 6.1 ± 1.7 mm (paired t-test, $p < 0.001$). Most RNFLT values did not change in mydriasis, and mean difference remained ≤ 1.47 µm. CoV was < 7% for all parameters and did not change due to pupil dilation. Repeatability with RTVue OCT was similar to that with GDx-VCC and ECC, but for RNFLT avg it was consistently better than that found with GDx (VCC or ECC or both). A significant trend for decreasing repeatability in increasing disease severity (Jonckheere-Terpstra test, $p < 0.007$) was seen for all parameters.

Conclusions: Repeatability of RNFLT measurements with the RTVue OCT is favorable in all severity stages of glaucoma, not influenced by mydriasis, similar to and for average RNFLT lower than that with GDx-VCC and ECC. RTVue OCT repeatability shows small but significant decrease with increasing disease severity.

P267 VARIABILITY OF THE OPTICAL COHERENCE TOMOGRAPHY MEASUREMENT OF THE PERIPAPILLARY RETINAL NERVE FIBER LAYER ACCORDING TO OPTIC DISC MARGIN DISTANCE

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Purpose: To verify the variability of peripapillary retinal nerve fiber layer (RNFL) thickness in glaucomatous and glaucoma suspect patients on Fourier domain optical coherence tomography (OCT) according to the optic disc margin distance.

Methods: Prospective cross sectional study in which 3D optic disc OCT scans (3D1000 Topcon OCT) were performed twice in one eye of 27 glaucoma or glaucoma suspect patients. After the measurement of the optic disc size with Heidelberg Retinal Tomography III, three different circle scans centered on optic disc with radius 0.4; 0.7; 1.0 mm larger than the optic disc radius were recorded from the 3D OCT scan. RNFL thickness was computed for six subfields. All scans were manually corrected for software breaks of the 2 boundaries of the RNFL. Inter-scan reproducibility of each circle was assessed with intraclass correlation coefficients (ICCs).

Results: Twelve eyes from glaucoma suspects and 15 eyes from glaucoma patients (11 POAG; 4 secondary glaucoma) were scanned. The mean [standard deviation (SD)] vertical and horizontal optic disc size were respectively 1.7 (0.2) mm, and 1.5 (0.2) mm. The average (SD) RNFL thickness progressively decreased with the increasing distance to the optic disc border (0.4; 0.7; 1.0 mm) on both first [103.6 (20.8); 94.5 (16.1); 80 (13.9) µm] and second scans [102.9 (22.7); 93.9 (17.4); 79.9 (15.8) µm] ($p < 0.0001$). ICCs (95% confidence interval) showed good reproducibility on every sub-field in all the three size circles. Superior temporal sub-field was the most reliable on both 0.4 and 0.7 mm size circles [0.96 (0.92-0.98)] but was the less reliable [0.74 (0.52-0.87)] in the 1.0 mm size circle. The less reliable subfield in the 0.4 and 0.7 mm size circle was inferior nasal [0.66 (0.38-0.83)] and superior nasal [0.79 (0.59-0.90)], respectively. The ICC of the average RNFL thickness in the 0.7 mm size circle [0.96 (0.92-0.98)] was similar to the 1.0 mm size circle [0.96 (0.91-0.98)], and both were greater than the 0.4 mm [0.90 (0.89-0.98)].

Conclusion: The peripapillary RNFL thickness varies according to the optic disc distance, progressively thinning with the increase of the distance from the optic disc margin. Reproducibility between two scans is good for all the three circles size and there is no significant difference among them.

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P268 COMPARISON OF CIRRUS SPECTRAL DOMAIN OCT AND STRATUS OCT ON THE ABILITY TO DETECT LOCALIZED RETINAL NERVE FIBER LAYER DEFECTS IN PREPERIMETRIC GLAUCOMA

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[1]Seoul National University Hospital, SEOUL, South-Korea, Stratus OCT for detecting preperimetric RNFL defects. Among the various Cirrus OCT parameters, the Deviation from Normal map had the highest sensitivity.

Purpose: To evaluate and compare the diagnostic abilities of the Cirrus and Stratus optical coherence tomography (OCT) to detect localized retinal nerve fiber layer (RNFL) defects in patients with normal standard automated perimetry.
Design: Cross-sectional study.
Participants: Fifty-five eyes of 55 subjects with preperimetric localized RNFL defects based on red-free fundus photography and 55 healthy control eyes of 55 age- and sex-matched subjects were enrolled from the Glaucoma Clinic of Seoul National University Hospital.
Methods: All individuals underwent the Cirrus OCT and Stratus OCT within a 1-month period. Areas under the receiver operating characteristic curves (AUROCs) were calculated and compared for parameters reported as continuous variables. The sensitivity and specificity of various OCT parameters for detecting preperimetric localized RNFL defects were calculated.
Main outcome measures: Sensitivity, specificity, and AUROCs for various Cirrus and Stratus OCT parameters.
Results: There was no statistically significant difference between the AUROCs for the best parameters from the Cirrus OCT (inferior thickness, AUROC = 0.728) and Stratus OCT (7 o'clock sector, AUROC = 0.760) (P = 0.477). The sensitivity of the various Cirrus OCT parameters, with the criterion of abnormal at the 5% level, ranged from 21.0% to 87.1%, and that of the Stratus OCT parameters ranged from 4.8% to 30.7%. The highest Cirrus OCT sensitivity was obtained with the Deviation from Normal map (sensitivity 87.1% and specificity 61.8%), and the highest Stratus OCT sensitivity was obtained with the TSNIT thickness graph (sensitivity 30.7% and specificity 85.5%).
Conclusions: Cirrus OCT was more sensitive, but less specific than Stratus OCT for detecting preperimetric RNFL defects. Among the various Cirrus OCT parameters, the Deviation from Normal map had the highest sensitivity.
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P269 ASSESSMENT OF MACULAR ANATOMICAL AND FUNCTIONAL CHANGES IN GLAUCOMA PATIENTS

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Purpose: To detect the correlation between micro-structural changes in the Ganglion Cell Complex (GCC) thickness and macular functional damage detected in glaucoma patients
Design: A prospective study on patients with primary open-angle glaucoma (POAG)
Participants: Seventy five eyes of thirty three glaucoma patients were included in the study. The patients were divided into groups according to the generalized glaucoma functional damage detected.
Methods: Evaluation of micro-structural changes of the Ganglion Cell Complex (GCC) at the macular area using spectral domain optical coherence tomography (OCT) was performed. Deviation map together with the average, superior and inferior GCC thicknesses obtained from the thickness map were used. Humphrey Automated Perimetry (HAP) using 10-2 Threshold strategy for detection of functional damage at the macular area was also performed to all eyes.
Main Outcome Measures: Significant correlation between anatomical and functional changees in glaucomatous maculae with significant deviation from normal values was detected in eyes with severe affection.
Results: An average thickness of the GCC in eyes showing no visual field defect was ± 102.1µ. In eyes with early glaucomatous functional damage the average GCC thickness was ± 96.5µ, while eyes showing advanced field defects had an average GCC thickness of ± 65.2µ. These changes indicated a significant reduction of the GCC thickness (deviations exceeding the lower 95th percentile), compared to age-matched normative database, in patients with advanced glaucomatous functional damage. A statistically significant correlation between the GCC thickness and the existing macular field defects was detected in the inter-group analysis.

Conclusion: The combination of evaluating the macular area both anatomically (using spectral domain OCT) and functionally (using the HAP, 10-2 strategy) has an important role in defining the impact of GCC thickness on the integrity of the visual field in glaucoma patients.

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P269.1 SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY MEASUREMENTS OF LAMINAR AND PRELAMINAR TISSUE MOVEMENT AFTER INTRAOCULAR PRESSURE ELEVATION

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Purpose: To determine the effects of acute intraocular pressure (IOP) elevation on laminar and prelaminar tissue position.

Methods: Eleven healthy subjects (mean 36.2; range 13-52 years) had their right optic nerve heads scanned with spectral domain optical coherence tomography (SD-OCT, Spectralis, Heidelberg Engineering) with 24 radial scans in high-resolution mode. Each radial scan consisted of 50 A-scans per location. Baseline IOP was measured with a Tonopen and then measured again with an ophthalmodynamometer with a fixed force perpendicular to globe through the inferior lid. SD-OCT imaging was repeated with the ophthalmodynamometer in place. The software allows image acquisition in the same locations in sequential scans, hence the baseline and post-IOP elevation images were precisely registered. A line joining Bruch's membrane/retinal pigment epithelium opening was used as reference for baseline and post-IOP elevation for each radial scan. The vertical distance from the reference line to the anterior laminar surface and prelaminar tissue surface at 9 equidistant points was measured for IOP conditions.

Results: The mean baseline IOP was 13.8 (range; 9-19) mmHg. Mean IOP elevation was 12.7 (range; 9-17) mmHg, with the elevated IOP ranging 19-36 mmHg. The overall mean shift in laminar position for the subjects was 0.06 (range; -5.29 to 3.99) microns indicating negligible net movement of the laminar surface with IOP elevation. On the other hand, the prelaminar tissue surface was displaced backwards by a mean of 22.54 (range, 14.67-25.63) microns. There was no relationship between the amount of prelaminar tissue displacement and magnitude of IOP elevation ($r = -0.19$, $P = 0.68$) or absolute IOP during elevation ($r = 0.05$, $P = 0.92$).

Conclusions: In normal subjects, the lamina appears to be non-compliant to acute IOP changes. Our results suggest that disc surface changes caused by acute IOP elevation are the result of compression of prelaminar tissue as opposed to a backwards displacement of the lamina.

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P269.2 NEURAL AND NON-NEURAL COMPOSITION OF THE RETINAL NERVE FIBER LAYER IN EXPERIMENTAL GLAUCOMA

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Purpose: Optical coherence tomography (OCT) is commonly used to obtain thickness measurements of the circumpapillary retinal nerve fiber layer (RNFL) in glaucoma, but the measurement does not give information regarding the composition of this region. Furthermore, it has been observed with histology that there is an increase in the glial content with glaucomatous damage which may confound the interpretation of the OCT measurements. The purpose of the present study was to quantify the neural and non-neural components of the retinal nerve fiber layer in both glaucomatous and control eyes.

Design: Case-control observational study.

Participants: Four macaque monkeys with experimental glaucoma induced in one eye. The fellow eyes served as controls.

Methods: Fixed retinal tissue from eight eyes was exposed to phalloidin-Alexa 488, DAPI, glutamine synthetase and anti-GFAP antibody to visualize actin in axons, nuclei, Mueller cells, and astrocytes respectively. Segments of the RNFL corresponding to similar regions previously measured with OCT were examined using the Zeiss LSM510 Confocal Microscope (Zeiss Meditec, Dublin CA). The proportion of each stain in the RNFL was determined using a customized MATLAB program in order to evaluate the tissue compositon of the RNFL.

Main outcome: Evaluation of cell bodies contained within the RNFL revealed a small decrease in the content of DAPI staining elements between the normal and glaucomatous

retina. The degree of actin staining showed a significant decrease in the glaucomatous eyes versus the controls. GFAP and glutamine synthetase staining elements were elevated in the glaucomatous eyes.
Conclusions: Eyes with experimental glaucoma show a significant decrease in the proportion of actin staining elements indicating a loss of ganglion cell axons, and an increase in the proportion of GFAP and Mueller cell staining elements indicating an increase in glial tissue in the RNFL with glaucoma.
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P269.3 DEVELOPMENT OF A NORMATIVE DATABASE FOR GANGLION CELL COMPLEX ASSESSMENT WITH THE RTVUE OCT

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Purpose: To determine the range of normal thickness of the ganglion cell complex in the macula region measured with the RTVue, a Fourier Domain OCT, and to evaluate the relationship with age and possible ethnic differences.
Methods: A total of 861 eyes were collected at 15 clinical sites worldwide with the average age 50.7 years old (range 19-82 years). Eligible participants were over 18 years old, free from known ocular pathology, had IOP below 22 mmHg, and had a normal visual field test based on the Humphrey 24-2 SITA Standard perimetry. The appearance of the optic disc was not used as an exclusion criterion because it could introduce bias in the database.
Results: The table lists the mean GCC thickness and standard deviation by ethnicity. Significant ethnic differences were found ($p < .001$) even when age effects are taken into account.
Discussion: The GCC in the macula may be an important area of interest for detecting early glaucoma. Significant ethnic differences were found in the GCC thickness. Thus it may be important for an instrument to use an ethnic-specific database which automatically adjusts the normative range and cut-offs to account for both age and GCC effects.

6.9.5. Clinical examination methods: Computerized image analysis: Other

P270 STRUCTURAL AND FUNCTIONAL PARAMETERS OF THE EYES OF GLAUCOMA PATIENTS AND THEIR RELATIVES

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Background: Primary open-angle glaucoma has been previously associated with a positive family history of glaucoma. The purpose of this study was to describe the value and the results of screening of glaucoma patients and their first-degree relatives.
Methods: Twenty families (sixty-six subjects) were included in this study: 20 probands (glaucoma patients) with mean age of 66 years, 14 siblings with mean age of 62 years and 32 their children with mean age of 41 years. Each participant underwent a detailed examination, including visual acuity, intraocular pressure measurement, gonioscopy, ophthalmoscopy. The HRT with software 3, the Humphrey 24-2 white-on-white (W/W) and blue-on-yellow (B/Y) visual fields scores were utilized.
Results: The relations between the topographic parameters, retinal nerve fibre parameters, and visual field indices were analyzed in glaucoma patients group. The mean retinal nerve fiber layer (RNFL) thickness showed well correlation with both pattern-standart deviation (PSD) ($r = -0.58$, $p < 0.01$) and mean deviation (MD) ($r = 0.55$, $p < 0.01$) of W/W perimetry. There was also found statistically significant correlation with optic nerve head (ONH) parameters such as rim area and rim volume, and MD and PSD values of W/W visual field. The MD and PSD values of B/Y perimetry were not so well correlated with respective mean RNFL thickness ($r = 0.40$, $r = -0.30$, respectively, $p < 0.01$), as W/W perimetry data. B-Y perimetry MD and PSD of glaucoma patients are not so well correlated with ONH parameters measured with the HRT, as it has been reported previously. Among first-degree relatives of glaucoma patients there were one affected child and one affected sibling. Two glaucoma suspect children were also firstly revealed. They had moderate changes in ONH parameters in one or two sectors, and decrease of MD and PSD of B/Y perimetry. Inrtaocular pressure and W/W perimetry indices were in normal limits.
Conclusion: Therefore, both structural and functional aspects should be evaluated in order to obtain full information of the glaucomatous damage and to reveal any significant changes in first-degree relatives of patients with glaucoma, who has a strongly increased risk of this disease.
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6.11. Clinical examination methods: Blood-flow measurements

see also P037, P114

P271 RETROBULBAR FLOW VELOCITIES IN OPEN-ANGLE GLAUCOMA AND THEIR ASSOCIATION WITH MEAN ARTERIAL BLOOD PRESSURE

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Purpose: A number of previous studies have shown that blood velocities in retrobulbar arteries are reduced in primary open-angle glaucoma patients (POAG), indicative for reduced blood flow to the eye. Some small scale studies also indicate that reduced flow velocities as assessed with color Doppler imaging (CDI) are a risk factor for the progression of the disease. Large scale prospective studies on this topic are, however, still missing. In the present studies we investigated the relation between blood flow velocities in retrobulbar vessels and mean arterial blood pressure in patients with POAG and healthy control subjects.
Design: Cross-sectional study.
Participants: A total of 252 POAG patients and 198 healthy age-matched control subjects were included.
Main outcome measures: Retrobulbar flow velocities were measured using CDI. Mean flow velocities (MFV) in the ophthalmic artery (OA), posterior ciliary arteries (PCAs) and the central retinal artery (CRA) were taken as the main outcome variables. Mean arterial blood pressure was measured non-invasively using automated oscillometry and intraocular pressure was measured using applanation tonometry.
Results: Intraocular pressure was higher in glaucoma patients than in healthy controls ($p < 0.01$). Mean arterial blood pressure was not different between groups. All flow velocities were significantly reduced in POAG patients as compared to healthy control subjects ($p < 0.01$ each). The correlation between MFV and mean arterial blood pressure was higher in POAG than in healthy control subjects for all measured vessels.
Conclusions: As in previous studies blood velocities in retrobulbar vessels were reduced in POAG as compared to healthy control subjects. In addition, an abnormal correlation between blood velocities and mean arterial blood pressure was found in POAG. This indicates vascular dysregulation and supports the concept that reduced ocular blood flow in glaucoma is not solely a consequence of the disease.
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P272 THE RELATIONSHIP BETWEEN PROGRESSION OF VISUAL FIELD DEFECTS AND RETROBULBAR CIRCULATION IN PATIENTS WITH NORMAL-TENSION GLAUCOMA

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Purpose: To investigate whether the change of retrobulbar circulatory dynamics are associated with progression of visual field defects in eyes with normal-tension glaucoma (NTG).
Design: Prospective study.
Participants: Thirty-four NTG patients (age: 60 ± 9 years, gender: M/F = 17/17) underwent with diurnal tension curve (DTC) and Color Doppler imaging.
Methods: Both eyes of all patients were followed up more than 10 years with topical antiglaucoma medication. The visual field was examined using program 30-2 of the Humphrey field analyzer in every twice a year. Progression of visual field was defined as more than 2 adjacent points or at least one of the innermost 4 points showed more than 10-dB deterioration relatives to the average baseline values according to the Collaborative Normal-Tension Glaucoma Study. Right eye of each patient was enrolled into the study. The follow-up data of visual field change were analyzed using a Kaplan-Meier life-table analysis.
Results: Eighteen eyes of 18 patients showed the progression of visual field, 16 eyes of 16 patients revealed visual field stability during followed-up period. The mean value of resistance index (RI) in the central retinal artery (CRA) was 0.75. The visual field stability was 61 ± 14% for eyes with RI in the CRA less than 0.75, and 24 ± 11% for those with RI in the CRA more than 0.75. There was a statistically significant difference in the probability of visual field stability between eyes with higher RI in the CRA than those with lower RI in the CRA (Log Rank test; $p = 0.03$). Eyes with progressive visual field showed significantly lower intraocular pressure (IOP) of DTC than those with visual field stability (Paired t-test, $p = 0.012$), but there was no difference in IOP during followed-up period between the two groups.
Conclusion: Eyes with progressive visual field defects in NTG have increased RI of CRA and lower IOP, suggesting that not elevated IOP but circulatory factors may play a key role in the deterioration of visual field defects.
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P273 RELATIONSHIPS OF HEMODYNAMIC, STRUCTURAL AND FUNCTIONAL FINDINGS IN NORMAL TENSION GLAUCOMA PATIENTS

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Purpose: To investigate the relation between retrobulbar hemodynamics parameters measured by color Doppler imaging (CDI), optical coherence tomography (OCT) analysis of the optic nerve head (ONH) and retinal nerve fibre layer (RNFL), central corneal thickness (CCT) and standard automated perymetry (SAP) measures in patients with normal tension glaucoma (NTG) and control subjects.
Design: A prospective, open-label study.
Participants and controls: Twenty-seven patients with nontreated NTG (F/M 23/4 mean age 60,6 SD 9,3) and 27 control subjects (F/M 23/4 mean age 56,7 SD 8,5).
Methods and Main outcome measure: Peak systolic (PSV) and end-diastolic velocities (EDV) and Pourcelot's resistive index (RI) of the ophthalmic artery (OA), the central retinal artery (CRA) and the temporal and nasal short posterior ciliary arteries (TPCA, NPCA), Stratus OCT ONH parameters (disc area DA, cup area CA, rim area RA, cup/disc area ratio CDR, cup/disc horizontal ratio CDHR, cup/disc vertical ratio, CDVR), OCT RNFL findings (average thickness AT, superior average thickness Savg, inferior average thickness Iavg), CCT and Humphrey visual field parameters (mean defect MD and pattern standard deviation PSD) were correlated in both groups. All measured parameters were also compared between glaucoma and control subjects. Statistical analysis was performed using t-test and the Fisher's test.
Results: The PSV CRA, EDV CRA and EDV TPCA were significantly reduced and RI CRA significantly increased in NTG. CCT and all OCT ONH and RNFL outcomes differ significantly between groups. In NTG patients a significant positive correlation were found between EDV CRA, EDV TPCA, EDV NPCA and RNFLSavg thickness (EDV CRA: r = 0,41, EDV TPCA: r = 0,43 and EDV NPCA: r = 0,39), PSV TPCA and RNFLSavg (r = 0,41), EDV CRA and RNFL AT (r = 0,39). A significant negative correlation was found with PSV NPCA and ONH CDR (r = - 0,41) and with PSV NPCA and ONH CDVR (r = - 0,41). A significant correlation between CCT and PSV AO was positive in NTG patients (r = 0,40) whereas in healthy subjects the correlation was negative with CCT and both AO velocities (PSV AO: r = -0,53; EDV AO: r= =0,41). In healthy subjects ONH RA was significantly positively correlated with both RNFL Savg and RNFL Iavg thickness (r = 0,40 and r = 0,49, respectively).
Conclusions: Patients with NTG had reduced blood flow velocities in CRA and TPCA and higher resistivity index in CRA. Some hemodynamic parameters in NTG were positively correlated with OCT RNFL thickness, CCT and negatively with OCT ONH cup/disc ratio. In healthy subjects OCT RNFL thickness was positively correlated with OCT ONH rim area whereas CCT was negatively correlated with AO velocities.
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P274 THE EFFECT OF AGE ON CONTACT LENS DYNAMOMETRY

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Purpose: To examine the effect of age on diastolic and systolic blood pressure in the ophthalmic artery and the vein pulsation pressure measured by a new contact lens dynamometer.
Design: Prospective cross-sectional study.
Participants: One randomly chosen eye of 106 healthy subjects (F: M = 58: 48) was examined. A nearly uniform age distribution was achieved by recruiting subjects in 7 age groups with at least 12 in each decade: 10-19 y, 20-29 y, 30-39 y, 40-49 y, 50-59 y, 60-69 y, and older or equal 70 y.
Methods: The diastolic and systolic blood pressure in the ophthalmic artery and the vein pulsation pressure was measured by a new contact lens dynamometer (CLD) (Meditron, Voelklingen, Germany). Arterial blood pressure at the upper arm was measured by the cuff method according to Riva Rocci (RR).
Main outcome measures: Systolic and diastolic ophthalmic artery pressure, systolic and diastolic pressure in the subclavian artery (RR), pulsation pressure of the central retinal vein (VPP).
Results: Blood pressures in the ophthalmic artery (CLD pressures) and in the subclavian artery (RR pressures) increased with increasing age. This increase was stronger for the systolic ophthalmic artery pressures (R^2 = 0.55; P < 0.001; 0.93 mmHg/year) than for the systolic subclavian artery pressures (R^2 = 0.28; P < 0.001; 0.45 mmHg/year). The increase with age in diastolic pressure did not differ widely in both arteries (CLD: R^2 = 0.32; P < 0.001; 0.37 mmHg/year, RR: R^2 = 0.26; P < 0.001; 0.29 mmHg/year). The CLD pressures closely correlated with the RR pressures (systolic: R^2 = 0.54; P < 0.001; diastolic: R^2 = 0.49; p < 0.001). The VPP was not statistically significant related to age (R^2= 0.0001 and P = 0.824).
Conclusions: We showed for the first time that the systolic pressure in the ophthalmic artery and the systemic blood pressure converge with increasing age. This phenomenon may be explained by increasing stiffness of the walls in the

carotid arteries and the ophthalmic artery. Clinical CLD measurements in circulation diagnostics need to be compared to measurements of the same age to avoid misinterpretation.

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6.12. Clinical examination methods: Ultrasonography and ultrasound biomicroscopy

P275 COMPARATIVE STUDY OF CENTRAL CORNEAL THICKNESS MEASUREMENT BY NON CONTACT SPECULAR MICROSCOPE AND ULTRASOUND PACHYMETER IN NORMAL SUBJECTS

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Purpose: To compare central corneal thickness measurements by non contact specular microscope and ultrasound pachymeter of corneas in normal subjects.

Design: Prospective randomized comparative study.

Participants: Ninety-six eyes of 49 normal subjects were randomized and central corneal thickness was measured.

Method: Central corneal thickness was measured in 96 eyes of 49 normal subjects using Non Contact Specular Microscope, TOPCON SP2000P and Ultrasound Pachymeter P2000 (MICRO MEDICAL DEVICES,USA. All readings were taken between 11.00 am and 2.00 pm (3hrs after awakening) and by single investigator.

Main outcome measure: Central corneal thickness.

Results: Ninety-six eyes of 49 normal subjects were included in the study with age ranging from 45 to 64 yrs and male to female ratio of 1.5. CCT measured by ultrasound pachymeter ranged from 491-575.6 µm with a mean of 527.5 ± 24.8 µm. Central corneal thickness as measured by specular microscope ranged from 450-542 µm with a mean of 490.5 ± 26.4 µm. The mean value of central corneal thickness obtained by non contact specular microscope was significantly less (37 µm) than the one by Ultrasound Pachymery ($p < 0.001$).The two modalities show excellent linear correlation.

Conclusion: Both ultrasound pachymeter and non contact specular microscope can be used to measure central corneal thickness. Non contact specular microscope gives smaller corneal thickness than ultrasound pachymeter which should be kept in mind while interpreting corneal thickness.Though these two devices show excellent correlation, they are not interchangeable

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P276 UBM IMAGING OF THE FILTERING BLEB AFTER X-200 IMPLANTATION

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Purpose: To visualize and characterize on ultrasound biomicroscopy (UBM) the filtering bleb after X-200 Ex-PRESS™ implantation in a modified minimally penetrating deep sclerectomy.

Design: Prospective, unmasked, monocentric, non-randomized clinical study.

Participants: Twenty patients with uncontrolled primary open-angle glaucoma.

Methods: The patients underwent a modified deep sclerectomy with X-200 implantation in the scleral bed. After performing a standard deep sclerectomy, the tube was inserted 2 mm behind Schlemm's canal into the anterior chamber. The tube was covered with the superficial scleral flap to prevent from eroding the conjunctiva. Comprehensive slit lamp examinations including Goldmann applanation intraocular pressure (IOP) measurements, best corrected visual acuity (BCVA) assessments and fundus observation were performed before surgery and every week for 1 month then every month for a 9 months follow-up. Outcome data were mean IOP, BCVA, number of medications and complication rates. UBM imaging was performed 6 months after surgery and subconjunctival, intrascleral and subchoroidal spaces were analyzed using digital imaging software.

Main outcome measure: IOP, BCVA, number of medication, filtering bleb size.

Results: The preoperative IOP was 22.4 ± 6.9 mmHg, the BCVA was 0.46 ± 0.33, and the number of medication was 2.8 ± 1.1 (mean ± SD). At the end of the follow-up (7.7 ± 1.4 months) the IOP was lowered to 11.4 ± 3.2 mmHg, the BCVA was 0.46 ± 0.31, and the number of medication was reduced to 0.6 ± 0.9. On UBM imaging the subconjunctival bleb was barely visible. The mean intrascleral bleb volume measured was 0.72 ± 0.69 mm^3. The subchoroidal space was visible for 11 (55%) patients only. One case of malignant glaucoma was reported. The complete success rate was 65%. No tube was removed or went blocked. Needling of the bleb was required in 6 (30%) cases to prevent durable fibrosis of the filtering bleb.

Conclusions: The subconjunctival filtering bleb after deep sclerectomy using X-200 is rather shallow and the main bleb visible is located into the intrascleral space. The new technique of minimally penetrating deep sclerectomy reduces the subconjunctival bleb thickness without compromising on the IOP control.

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P277 GONIOSCOPY OR ULTRASOUND BIOMICROSCOPY IN THE DETECTION OF ANGLE CLOSURE IN PATIENTS WITH SHALLOW ANTERIOR CHAMBER

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Objective: To find the extent of agreement between gonioscopy and ultrasound biomicroscopy (UBM) as related to occludable and closed angles in patients with shallow anterior chamber.
Design: Observational comparative study of two different examination methods.
Participants: Persons with normal intraocular pressure and peripheral anterior chamber depth less than of corneal thickness based on slit lamp examination.
Methods: Gonioscopy was performed with a Goldman goniolens in a dark room first using a 1-mm beam that did not fall upon the pupil followed by full beam light and indentation. An occludable angle was defined as an eye where no more than 90 degrees of the filtering trabecular meshwork was visible in dim illumination. Angle closure was defined as the presence of any peripheral anterior synechia. UBM was first undertaken in a darkened room with all lights off then repeated with normal room lighting. The central anterior chamber depth (ACD) of each eye and the number of quadrants with iris-trabecular apposition under the two conditions were recorded. Occludable angle was defined if there was any apposition of the iris and trabecular meshwork only with lights off but not on. Angle closure was defined when there was any apposition of iris-trabecular meshwork with lights both off and on.
Main outcome measure: For occludable angle the outcome measure was observation of Non Apposition versus Apposition of iris-trabecular meshwork. For angle closure the outcome measure was the presence or absence of synechia.
Results: Fifty-three eyes of 27 patients (one patient was with only one eye) were examined. Out of the 53 eyes examined 24 were occludable and 17 were closed using the gonioscopic method. And 20 were occludable and 20 were closed using the UBM method. Kappa analysis showed that agreement between these two methods was good. (Kappa = 0.44, $p < 0.001$). The ACD was measued as 2.22 mm on average in all patients enrolled.
Conclusions: Both gonioscopy and UBM are indispensable methods for detecting occludable and closed angle. However, none of them could replace the other.
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P278 ULTRASOUND BIOMICROSCOPY IN THE INFANTS WITH CONGENITAL CORNEAL OPACITY AND ITS CORRELATIONS WITH CLINICAL DIAGNOSIS AND INTRAOCULAR PRESSURE

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Purpose: To clarify the appearance of ultrasound biomicroscopy (UBM) in the infants with congenital corneal opacity and its correlations with clinical diagnosis and intraocular pressure (IOP).
Design: Retrospective, consecutive, non-comparative, case series.
Participants: This study involved 19 eyes of 10 consecutive infants (8 females and 2 males) with congenital corneal opacity who were recruited at the Kyoto Prefectural University of Medicine between September 2001 and January 2009. The mean age of the subjects at the time of first visit was 8.0 ± 13.8 months (1 to 47 months).
Methods: All subjects were examined by an ophthalmologist (Y.I.) using UBM (UD-6010, Tomey Corp, Nagoya, Japan), and compared with the clinical diagnosis based on the IOP and slit lamp findings. The IOP of each subject was measured using an ICare® tonometer (iCare Finland Oy, Helsinki, Finland) or tactile measurement. A diagnosis of glaucoma was made in any subjects with IOP more than 20 mmHg or with the obvious enlargement of the eyeballs in their clinical course.
Main outcome measure: UBM appearances and clinical course.
Results: Of the disease types found in the 19 examined eyes, 7 subjects (13 eyes) involved Peter's anomaly (PA) and 3 subjects (6 eyes) involved sclerocornea (SC). The mean observation periods for PA and SC subjects were 18.9 ± 27.1 and 46.7 ± 37.7 months, respectively. Several abnormal appearances with slit lamp examination were observed such as congenital corneal opacity (n = 19), iridocorneal dysgenesis (n = 13), and shallow anterior chamber (n = 9). The main UBM clinical appearances include as follows; defects of the Descemet's membrane (13 and 6 eyes in PA and SC, respectively), abnormal membrane ringing out from the iris (12 and 6 eyes), partial iridocorneal obstruction (10 and 5 eyes), aniridia (3 and 0 eyes), shallow anterior chamber (5 and 1 eyes), and lens dysgenesis (1 and 0 eyes). Among the PA subjects, 3 subjects (4 eyes) showed high IOP using the ICare® tonometer, 2 subjects (3 eyes) were diagnosed as high IOP by only a tactile measurement, and 5 subjects (6 eyes) were within normal IOP range. All 3 SC subjects (6 eyes) showed normal IOP, while 6 PA subjects (7 eyes;

53.8%) were diagnosed as glaucoma. There are no morphological differences in the UBM appearances between the eyes with normal IOP and glaucoma with congenital corneal opacity.
Conclusions: High incidence of UBM abnormality was clarified similar between PA and SC. However, the PA infants had higher incidence of glaucoma than the SC infants, and UBM has a limited capability to predict those glaucomatous changes in the infants with congenital corneal opacity.
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P279 CORRELATION OF HIGH RESOLUTION ULTRASOUND OF SCHLEMM'S CANAL WITH CLINICAL OUTCOME POST TRABECULOTOMY BY FOUR DIFFERENT TECHNIQUES
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Objective: Trabeculotomy has evolved over the past two decades mainly due to advances in canal surgery. The purpose of the study is to compare the postoperative ultrasonic appearance of Schlemm's canal after four different trabeculotomy procedures and correlate with the clinical outcome.
Design: Image the canal for several clock hours after trabeculotomy by high frequency ultrasound techniques. The patients that exhibit the best clinical correlates from the four procedure groups will be presented.
Participants: Patients who could be imaged after trabeculotomy surgery.
Main outcome measure: The angle following 4 different methods of trabeculotomy including trabecular ablation with microcautery, standard metal trabeculotome, 360 prolene suture and flexible microcatheter was visualized postoperatively and correlated with outcome.
Results: Pertinent postoperative features associated with canal cleavage include reclosure of the anterior and posterior leaflets, fibrosis, reformation, re-cannulation, PAS and persistent cleavage of the leaflets. The specific type of device used to open the angle correlated well with the ultrasonic appearance.
Conclusion: The high frequency ultrasonic appearance of the canal post trabeculotomy is correlated with the type of procedure and helps explain outcome. The ability to correlate ultrasound microanatomy with gonioscopy is a valuable learning tool for future angle surgery.
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P280 IN-VIVO SCHLEMM'S CANAL STUDY BY ULTRASOUND BIOMICROSCOPY: IMPLICATIONS TO THE CANAL SURGEON
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Purpose: To measure variances in the diameter and location of Schlemm's canal in vivo by ultrasound biomicroscopy.
Design: Prospective, single institution, consecutive case series.
Participants: Ninety-four patients with or without glaucoma.
Methods: Under topical anesthesia, 80 MHz iUltrasound machine was used to measure the diameter and location of the canal from the anatomical limbus(corneoscleral junction) and angle (the base of the canal and the angle of iris insertion)at the twelve o' clock position.
Main outcome measures: Size and location of the canal in relation to gender, age, intraocular pressure, race, diagnosis, filtering surgery, pachymetry, refraction, lens type, axial length, and keratometry.
Results: Average canal diameter was 122 microns. Females and hyperopes had larger canal sizes (compared to males and myopes) by 16 microns ($p = 0.02$) and 47 microns ($p < 0.001$) respectively. The distance between the angle and the canal was found to be larger in Caucasians (335 microns; $p = 0.04$) and myopes (335; $p = 0.03$) than that of other races and hyperopes. African-Americans had the most posteriorly located canals (655 microns; $p = 0.01$) from the limbus. Pachymetry > 555 microns was associated with more posteriorly located canals (684 microns; $p < 0.001$) from the limbus compared with thinner corneas (626 microns).
Conclusions: Schlemm's canal diameter measured significantly smaller in vivo (122 microns) with ultrasound biomicroscopy (UBM) as compared to previous histopathology studies. Its diameter varies by gender and refraction whereas location varies by race, refractive error, and corneal thickness.

6.13. Clinical examination methods: Provocative tests

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P282 THE RELATIONSHIP BETWEEN PROGRESSION OF GLAUCOMA AND SUPINE AND WATER DRINKING TESTS - PRELIMINARY RESULTS
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Purpose: To assess the relationship between intraocular pressure (IOP) after supine and water drinking tests and progression of open-angle glaucoma (OAG).
Design: Cross-sectional study.
Participants: Sixty-one eyes from 33 patients with OAG including primary open-angle glaucoma (POAG), normal tension glaucoma (NTG), pseudoexfoliative glaucoma (PXG), and pigment dispersion glaucoma (PDG).

Methods: All patients participated in both supine and water drinking tests. Baseline IOP was measured by Goldmann applanation tonometry (GAT), pneumotonometry (PT) and dynamic contour tonometry (DCT). For the supine test, IOP was measured by PT at 1 and 5 minutes in the supine position. A second baseline IOP was recorded 5 minutes after returning to an upright position. For the water drinking test, patients were asked to consume 800 ml of water within ten minutes and IOP was measured at 15 and 30 minutes. Baseline DCT and ocular pulse amplitude (OPA) measurements were also recorded and repeated 30 minutes after water consumption. Patients were then retrospectively classified by masked observer into 'glaucoma progression'group (16 eyes from 11 patients) and 'non-progression' (45 eyes from 27 patients) group based on serial Humphrey visual fields and HRT exams.
Main outcome measure: Change in IOP and OPA.
Results: The IOP readings were significantly different between the 'glaucoma progression' and 'non-progression' groups when measured with GAT 30 minutes after water drinking. The OPA values measured by DCT 30 minutes after drinking water were also significantly different between these two groups. The increase in IOP over baseline in the 'glaucoma progression' group was 3.93 mmHg compared to 2.31 mmHg for the 'non-progression' group (p = 0.032 independent t-test). Moreover the OPA values showed a statistical significant difference between the two groups: the progressive group showed a decrease of value of 0.2 mmHg and the non-progressive group showed an increase of 0.5 mmHg (p = 0.030 independent t-test).
Conclusion: The IOP increased significantly in both supine and water drinking test. However, only the increase in IOP 30 minutes after drinking water and the decrease in OPA were significantly associated with progression of open-angle glaucoma. Further studies are needed to determine if either of these parameters is predictive of progression.
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P284 UNDERSTANDING THE MECHANISM OF THE WATER DRINKING TEST: THE ROLE OF FLUID CHALLENGE VOLUME IN PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA
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Purpose: The provocative water drinking test provides a practical method of estimating peak diurnal intraocular pressure. However, the exact mechanism by which the water drinking test produces a rise in intraocular pressure is unknown. The purpose of this study is to determine the role of fluid challenge volume in intraocular pressure rise in patients with medically-managed primary open-angle glaucoma and to evaluate whether a 500-ml fluid challenge produces a different intraocular pressure response profile compared to a 1000-ml water drinking test.
Design: Prospective, observer-masked, cross-over, observational study.
Participants: Fifteen patients with primary open-angle glaucoma on topical ocular hypotensives with a mean deviation of -5.0 dB or worse.
Methods: Patients were prospectively recruited from a private specialist glaucoma practice with affiliations to the University of Auckland. One eye of each patient was included in the study. If both eyes fulfilled the eligibility criteria one eye was selected at random. No fluid or food ingestion was permitted 2 hours before the water drinking test. Patients were randomised to receive either a 500-ml or 1000-ml fluid challenge and were required to drink the required volume within 15 minutes. Baseline intraocular pressure was recorded with a Goldman applanation tonometer and then every 15 minutes for one hour following water ingestion by a masked examiner. A second water drinking test with the alternate volume of water was performed after a minimum wash-out period of 24 hours and at the same time of day. T test and one-way ANOVA statistical tests were performed.
Results: Fifteen patients were recruited. The mean patient age was 67.0 ± 10.2 years and 60% of patients were female. The mean MD on automated perimetry was -9.28 ± 3.73 dB. There was no statistically significant difference in IOP at baseline (P = 0.11). The 500-ml water drinking test was associated with a lower peak IOP of 17.1 ± 2.3 mmHg compared to 20.0 ± 1.6 mmHg compared to the 1000-ml water drinking test (P = 0.002).
Conclusion: Intraocular pressure rise associated with water drinking is volume dependent in patients with medically-controlled primary open-angle glaucoma.
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Controlled Glaucoma Patients Show Greater Increase in Intraocular Pressure than Surgically Controlled Patients with the Water Drinking Test. Ophthalmology (in press).

P285 COMPARISON OF THE VALUES OF PEAKS AND FLUCTUATIONS OF PRESSURE IN 2 WATER DRINKING TESTS IN DIFFERENT SCHEDULES

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Purpose: The water drinking test (WDT) has been used as a method for detention of peaks and fluctuations of intraocular pressure (IOP). The purpose of this study is to compare peaks and fluctuations of two different WDTs carried out, in different periods of the day.
Design: The 2 WDTs were performed in 29 patients at 6 am and 2 pm, on the same day.
Participants: Twenty-nine patients who are being treated for primary open-angle glaucoma and ocular hypertension, of both sexes (29 eyes), with an average age of 60,31 years.
Methods: All patients were submitted to the water drinking test. The WDT consisted of the ingestion of 1 liter of water, in the ambient temperature in up to 5 minutes, without previous ingestion of liquids and solid of 2 hours.
Main outcome measure: The IOP before the ingestion of the water and 15 in 15 minutes after was evaluated, during 1 hour. For analysis, only the measurements of the right eye were used. For mean values comparison between basal and peaks, in the same test and between the 2 WDTs, a students't-test was used for dependent samples (level of significance $p < 0,05$). For comparision of flutuations (difference between greater and minor value of intra-ocular pressure) was used Wilcoxon's test (level of significance $p < 0,05$).
Results: The mean of the basal IOP was 14,31 ± 3,38 mmHg and 12,72 ± 3,51, mmHg, respectively at 6 am and 2 pm ($p = 0,022$). The mean of the peaks of IOP was of 17,34 ± 4,52 mmHg and 16,79 ± 3,76 mmHg, respectively at 6 am and 2 pm ($p = 0,431$). Medium and the quartiles of the fluctuation were of 5,00 (3,00; 6,00) and 5,00 (3,50; 7,50), respectively at 6 am and 2 pm ($p = 0,387$).
Conclusions: Although the 2 different WDT began with different IOP values, the peak and fluctuation was similar in the 2 WDTs, suggesting that the WDT can be done in any period of the day.
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6.19. Clinical examination methods: Telemedicine

P287 PRACTICAL EXPERIENCE AND IMPACT OF SELF-TONOMETRY IN TELEMEDICAL HOME-MONITORING OF GLAUCOMA PATIENTS

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Objective: To determine acceptance, feasibility and impact of self-tonometry in patients with primary open-angle glaucoma in a telemedical home-monitoring scenario.
Design: In the project Teletonometry Mecklenburg-Vorpommern (TTMV) patients were equipped with a home-monitoring system for 24-hour self-measurements of intraocular pressure and blood pressure for a period of six months. All measurements were transmitted via telephone modem to an electronic patient record. This long-term investigation was designed as a randomised cross over study in two groups.
Participants: In this study we present the characteristics of 70 patients with primary open-angle glaucoma based on a total amount of 3282 self-measurements.
Methods: All patients measured blood pressure and intraocular pressure at home using a self-tonometer (Goldmann applanation principle). They subsequently transmitted all self-measurements via a 'telemedical interface' to an electronic patient record, which automatically calculated ocular perfusion pressure using the formula: (OPP = [2/3 * (2/3 * DBP + 1/3 * SBP)] - IOP). Physicians used a web frontend to access electronic patient records. Before, during and after home-monitoring we measured the patients' quality of life using the standardized SF-36 questionnaire.
Main Outcome Measure: We compared quality of IOP documentation in paper based glaucoma cards to electronic data management. We analyzed individual intraday fluctuations of intraocular perfusion pressure and ocular perfusion pressure. We determined quality of life at three different project stages with the SF-36 summary measures 'Physical Health' and 'Mental Health'.
Results: Glaucoma cards showed documentation gaps without IOP records corresponding to practice opening hours. Average IOP values were significantly higher in home-monitoring: 18.9 ± 4.7 mmHg RE and 18.2 ± 4.4 mmHg LE, glaucoma cards: 16.3 ± 2.9 mmHg for both eyes. We observed more frequent IOP fluctuations with higher value ranges. Between 7 am and 12 am ocular perfusion pressure was significantly depressed. The SF-36 summary measures showed no influence of home-monitoring and self-tonometry on the patients' quality of life: 'Physical Health' average was 51, 51, 51 and 'Mental Health' average was 46, 45, 44 at three project stages.
Conclusions: Home-monitoring represents an innovative and growing health service area in which suitable conditions have to be created for the attending doctor and also for the patient. For this it is necessary to offer the technical supply and also to establish simultaneously organizational structures based on prevalent experiences of general ambulant care. Glaucoma patients may benefit from an individually optimized patient-oriented therapy.
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6.20. Clinical examination methods: Progression

see also P272

P288 TREND OF VISUAL FIELD LOSS PRIOR AND AFTER THE TRABECULECTOMY IN PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA

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Objective: To evaluate whether the loss of visual field sensitivity is greater prior or after the glaucoma operation and whether surgery induces changes in the trend of visual field loss.
Method: Twenty patients with primary open-angle glaucoma were followed for six years with tonometry and automated perimetry, Octopus 500 EZ. Number of eyes for this investigation was limited due to the requirements for total 10 visual fields per eye , at least 5 before and at least 5 after the glaucoma operation (trabeculectomy without antimetabolites), in order to determine preoperative and postoperative slope of the regression line of visual field sensitivity. Linear regression analysis of the mean sensitivity value (dB) of each field test versus time (months) was compared before and after the operation. The mean of the percentage reduction in intraocular pressure (IOP) following the operation in comparison to initial preoperative value was calculated using the formula: postoperative IOP minus initial preoperative IOP X 100 divided by initial preoperative IOP. The results were statistically tested with Wilcoxon matched-pairs signed-ranks test.
Results: The mean of the percentage reduction in intraocular pressure (IOP) following the operation in comparison to initial preoperative value was 29.16%. The mean slope of the visual field sensitivity in time was -0.08 ± 0.25 dB/months prior as compared to -0.03 ± 0.07 dB/months after the operation. The decrease in mean sensitivity was on the average lesser after than before the operation. The difference was evident although statistically non-significant (p = 0.593).
Conclusions: According to our results, lowering of IOP has favorable effect on the prognosis of glaucoma. Better prognosis does not always imply stopping but merely slowing of visual field deterioration which is presented by decrease and not by elimination of the visual field loss.
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P289 COMPARISON OF OPTICAL COHERENCE TOMOGRAPHY AND VISUAL FIELDS TO DETECT PROGRESSION OF GLAUCOMA

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Purpose: To assess agreement between retinal nerve fiber layer (RNFL) thickness measurement of optical coherence tomography (OCT) and visual field (VF) tests criteria to detect progression of glaucoma.
Design: Retropective, longitudinal and comparative study.
Participants: Thirty-six eyes of 36 open-angle glaucoma patients (13 POAG eyes and 23 NTG eyes) with mean follow-up of 35.9 ± 6.3 months.
Methods: Progression of glaucoma was evaluated with stratus OCT and standard automated perimeter (Humphrey Field Analyzer, HFA). Visual field progression was determined by the progression criteria of the Collaborative Initial Glaucoma Treatment Study (CIGTS) and Glaucoma Progression Analysis (GPA) software incorporated into HFA. Progression of OCT was defined as RNFL thinning of at least 20 um from baseline in at least 1 clock-hour (OCT1), neighboring 2 clock-hours (OCT2) and 1 quadrant (OCTq).
Main outcome measure: Agreement between OCT and VF progression was evaluated by kappa analysis. The changes of RNFL thickness with time were analyzed by Repeated Measures ANOVA (RMANOVA) in progressing and non-progressing groups according to 2 different visual field criteria.
Results: Seven eyes (19.4%) and 4 eyes (11.1%) of 36 patients were progressed by the GPA and CIGTS criteria respectively. The progressing eyes according to the OCT were 14 (38.9%), 8 (22.2%), and 7 (19.4%) in OCT1, OCT2, and OCTq respectively. Kappa values between GPA criteria and OCT were 0.29 (OCT1), 0.58 (OCT2), and 0.47 (OCTq). Kappa values between CIGTS criteria and OCT were 0.19 (OCT1), 0.41 (OCT2), and 0.26 (OCTq). Among 7 GPA progressing eyes, 5 (71.4%) eyes were progressed by OCT2 and among 29 GPA non-progressing eyes, 26 (89.7%) eyes showed no progression by OCT2. The RMANOVA revealed that the rate of thinning in the inferior and temporal RNFL thickness was greater in GPA progressing group than in GPA non-progressing group during follow-up. Using CIGTS criteria, no significant difference in any quadrants was noted between progressing and non-progressing group.
Conclusion: GPA showed better agreement than CIGTS criteria with RNFL changes measured by OCT. OCT progression criteria using RNFL thinning in at least neighboring 2

clock-hours showed moderate agreement with visual field progression criteria.

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P290 PERFORMANCE OF THE VISUAL FIELD INDEX FOR ASSESSING GLAUCOMATOUS PROGRESSION

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Purpose: The purpose of this study was to evaluate the validity of the visual field index (VFI) in comparison with the pattern standard deviation slope (PSDS).

Subjects and Methods: The analysis in this study was conducted on 144 eyes (primary open-angle glaucoma (POAG), 22 eyes; normal-tension glaucoma (NTG), 122 eyes) in which it was possible to make measurements with the reliable Humphrey 30-2 SITA-Standard 5 or more times in patient with glaucoma diagnosed at The Jikei University. The PSDS and VFI were calculated.

Results: The PSDS indicated progression in 29 eyes (average mean deviation [MD] ± standard deviation [SD]: -4.17 ± 4.57 dB), and the VFI indicated progression in 24 eyes (average MD ± SD: -3.97 ± 3.69 dB). More specifically, progression was indicated by both the PSDS and VFI in 15 eyes, by only the VFI in 9 eyes, and only the PSDS in 14 eyes.

Conclusion: In a large percentage of eyes, the VFI and PSDS disagreed, and the results suggest that the VFI may be more affected by central weighting of the index than is traditional PSDS.

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P291 THE ANALYSIS OF THE OCULAR RESPONSE ANALYZER (ORA) MEASUREMENT ASSOCIATIONS WITH GLAUCOMA PROGRESSION

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Objective: This study compared measurements of the Ocular Response Analyzer (ORA) parameters to determine their association with glaucoma progression between the progression and the non-progression groups.

Design: Observational cross-sectional study.

Participants: Among patients previously diagnosed as primary open-angle glaucoma and normal-tension glaucoma, 46 eyes (46 patients) exhibiting observed glaucoma progression such as optic disc hemorrhage and visual field progression and 64 eyes (64 patients) not exhibiting such conditions.

Method: Corneal hysteresis (CH), corneal resistance factor (CRF), Goldmann-correlated IOP (IOPG), and corneal-compensated IOP (IOPcc) were measured by ORA. Furthermore, using Goldmann Applanation Tonometer (GAT), Dynamic Contour Tonometer (DCT), and Non-contact Tonometer (NCT), intraocular pressure and central corneal thickness were also measured and compared to previous measurements.

Main outcome measures: CH, CRF, IOPG, IOPcc were measured by ORA, IOP with GAT, DCT, NCT and compared between glaucoma progression group and non-progression group.

Results: The mean ± SD of CH measurements of the progression group and the non-progression group were 9.60 ± 1.45 and 10.47 ± 1.60, respectively, showing a statistically significant difference ($p = 0.019$); The mean ± SD of the IOPcc measurements were 14.11 ± 3.25 and 12.55 ± 2.67 for the progression and the non-progression groups, respectively ($p = 0.007$). However, CRF and IOPG did not show a statistically significant difference between the two groups. In addition, the intraocular pressure measured by GAT ($p = 0.016$) and DCT ($p = 0.024$) showed statistically significant differences, but the central corneal thickness and NCT did not. The odds ratios of the progressed group to the non-progression group for CH, IOPcc, GAT, and DCT measurements were 1.67, 2.37, 1.44, and 1.86, respectively, with IOPcc exhibiting the highest value ($p = 0.028$).

Conclusion: There were significant associations between glaucoma progression measured by the ORA for CH and IOPcc measures. Among the two, the IOPcc showed a greater odds ratio for intraocular pressure than the GAT or the DCT measures and can be used as a useful measure to detect glaucoma progression.

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P292 TO STUDY THE OCT PARAMETERS FOR GLAUCOMA PROGRESSION IN A LONGITUDINAL STUDY-AN INDIAN PERSPECTIVE

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Objective: To study the OCT Parameters for glaucoma progression in a longitudinal study –an Indian perspective.
Design: Retrospective observational longitudanal study in Indian Population with at least 2 measurements of OCT parameters between October 2004 and January 2009.
Participants: All patients attending the glaucoma clinic in a tertiary hospital in South India for whom OCT was possible at least twice, and did not have any other ocular pathology that would interfere with OCT parameters were studied. These included patients of established glaucoma, preperimetric glaucoma, ocular hypertensives and glaucoma suspects
Methods: Complete glaucoma evaluation-including tonometry, visual field examination, optic nerve head examination, pachymetry, gonioscopy, fast optic nerve head and fast retinal nerve fibre layer imaging on Stratus OCT. The parameters studied were mean RNFL, I max on the RNFL, and vertical integrated rim width (VIRA), horizontal integrated rim width (HIRW) and rim area 2 on the Optic nerve head mapping. the values and changes were plotted. The collected data was subjected to Statistical analysis using the SPSS software, student's paired t-test.
Main outcome measure: Change in Mean RNFL > 8 microns. Decline in VIRA, HIRW and rim area 2.
Results: Of the OCT parameters studied, the parameter that showed a decline in maximum number of patients is rim area 2. While only 7 patients had a significant change on HFA, 20% (n = 15) patients had a decrease in the rim area2. The no. of patients showing decline in OCT parameters was 13% for VIRA and HIRW both, 8% for Mean RNFL and 5% for I max values.
Conclusions: Greater likelihood of glaucomatous progression was identified by OCT *vs* automated perimetry. Stratus OCT detects progressive RNFL atrophy with high sensitivity. OCT changes in RNFL and especially ONH parameters may in future serve as a good guide to anticipate and indicate early glaucoma progression. Conversions to estabilished glaucoma from OHT needs larger patient base and a longer followup Rim area2 appears to have the earliest and consistent decline.
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P293 ANALYZING THE STRUCTURAL PROGRESSION OF PREPERIMETRIC GLAUCOMA

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Purpose: To evaluate the rate and pattern of visual field (VF) changes in preperimetric glaucoma patients during a median of 3.7 years follow-up.
Design: Observational cohort study.
Participants: One hundred-twelve eyes of 112 patients with optic nerve head changes typical for glaucoma but no detectable VF defects.
Methods: Anually obtained retinal nerve fiber layer (RNFL) thickness measurements by StratusOCT along with standard automated perimetry visual fields performed every 4 to 6 months were evaluated. VF progression was definied as a glaucoma hemifield test outside normal limits and/or a pattern standard deviation with $P < .05$. Independent samples T-test for means comparisons was employed using SPSS 16.0 statistical software. The change of RNFL thickness over time was defined by regression analysis.
Main outcome measure: Measurements of RNFL thickness over time by OCT.
Results: Twenty-three eyes (20%) from 112 detected eyes had VF progression during follow-up. Fifteen cases of 23 (65%) developed in those with average RNFL below 80 µm at baseline (mean: 73.3 ± 5 µm) together with -0.6 µm/year ($R^2 = 0.43$) rate of AVG RNFL loss, mainly in the temporal sector and in the 7, 8 and 9 o'clock segments. Subjects with thicker AVG RNFL (baseline mean: 95.3 ± 5.45 µm) had -2.08 µm/year decline ($R^2 = 0.8$) with a more diffuse pattern of RNFL loss. There was no significant age difference between the groups (64.3 ± 8.1 *vs* 60 ± 11.5 years).
Conclusions: No constant RNFL decline can be suspected in the process of glaucoma. In preperimetric glaucoma patients with thinner RNFL thickness at baseline, a more subtle structural change may precede the appearance of glaucomatous visual field loss. These data might also support our previous finding that a mean value of RFNL thickness around 70 µm – even considering its wide range of interindividual variability – can represent a profound threshold value in glaucomatous structural changes. Implication of these findings may have importance when evaluating progression of the disease.
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P294 CALCULATION AND PREDICTABILITY OF THE PROGRESSION RATE OF FIELD DAMAGE IN GLAUCOMA WITH GLAUCOMA DAMAGE PROBABILITY TREND – ALGORITHM: A LONG TERM FOLLOW UP

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Purpose: To analyze the possibility of predicting the rate of glaucoma damage progression and its acceleration over time periods ranging from 5 to 25 years.
Design: An original algorithm (Glaucoma Damage Probability Trend, GDPT©) based on the Brusini's Glaucoma Staging System 2© (GSS2) and inserted into the Glaucoma Management System© (GMS) is used to calculate the rate of progression.
Participants: n = 24 eyes of 24 glaucoma patients (average age 75, age range 58-84) who were studied over an average period of 10.8 years (from 8 to 20 years) with annual visual field tests (Humphrey 24/2, either full threshold or SITA) with an average of 11.8 tests per patient.
Methods: To calculate the probability of progression, the patient follow-up was divided into two parts; the first part (5 years with a minimum of 5 visual field tests) was used to calculate the progression rate of each patien. The GDPT© algorithm runs on visual field indexes (MD and PSD for Humphrey, MS and LV for Octopus) that the observer must input manually in the system. Thanks to the GSS2, data collected from both analyzers can be used to estimate progression rate in the individual patient.
Main outcome measure: GDPT was used to predict the progress of the disease and the nature of the progression, comparing the theoretical results obtained through the algorithm with the real ones which were verifiable from the second part of the patient follow-up.
Results: at the end of the follow up, the actual GSS stage was 3,06 (1,44 st.dev). The predicted GSS value was slightly lower, being 2,81 (1,63 st.dev). The mean square deviation based on was 0.25 of GSS2 stage.
Conclusions: The GDPT© algorithm offers a good estimate of the possible progression rate of visual field damage in glaucoma.
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6.30. Clinical examination methods: Other

P295 FACTORS AFFECTING THE OCULAR RESPONSE ANALYZER PARAMETER IN NORMAL KOREAN EYES

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Objectives: To identify normal range of factors which can be measured with Ocular Response Analyzer (ORA, Depew, NY, USA) in normal Korean eyes, and to analyze factors affecting ORA by measuring intra ocular pressure(IOP) of noncontact tonometer (NCT) and central corneal thickness (CCT).
Design: Three hundred-one normal Korean subjects who did not have special ophthalmological diseases and surgeries in the past were recruited for this study.
Participants: Three hundred and one normal Korean subjects.
Methods: Corneal hysteresis (CH), corneal response factor (CRF), corneal compensated IOP (IOPcc), Goldmann related IOP (IOPg), CCT and IOP of NCT were measured using ORA and the results and factors were analyzed. The results were divided into a juvenile group (n = 57) and an adult group over age 20 (n = 244) and compared.
Results: Mean CH measured among normal Koreans in this study was 10.7 ± 1.45 mmHg and distribution was 7.5~15.8 mmHg. The mean CRF was 10.40 ± 1.61 mmHg and distribution was 6.5~15.9 mmHg, having similar range to CH. The mean CH was 11.06 ± 1.42 mmHg for the juvenile group and 10.62 ± 1.45 mmHg for the adult group. The mean CRF was 11.06 ± 1.64 mmHg for the juvenile group and 10.25 ± 1.57 mmHg for the adult group. CH and CRF were significantly higher in the juvenile group. A positive correlation was found between CCT&NCT and CH and CRF, but the magnitude was weak ($P < 0.01$). IOPcc and IOPg as measures of IOP

in ORA had significant correlation with IOP of NCT. In particular, IOPcc appeared to be independent of corneal thickness.
Conclusion: Mean CH among normal Koreans were lower than those of Americans (P < 0.01), indicating racial differences. CH and CRF were significantly higher in the juvenile group, indicating difference in biomechanical properties of eye ball due to age. IOPcc and IOPg measured in ORA have significant clinical correlation with IOP of NCT. In particular, IOPcc will become more important as it is independent of corneal thickness which should be compensation in general measurement of IOP and reflects biomechanical properties. Further investigation should be advised to determine whether IOPcc as tonometer being independent of corneal thickness and incorporating new concept of biomechanics would be more useful than IOP of NCT.
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P296 CORNEAL BIOMECHANICAL PROPERTIES EVALUATED WITH OCULAR RESPONSE ANALYZER IN PATIENTS WITH OCULAR HYPERTENSION
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Objective: To evaluate the corneal biomechanical properties with Ocular Response Analyzer (ORA) in patients with ocular hypertension (OH).
Participants and Methods: We conducted a demographical characterization of patients an analysis of their diagnosis, medications, IOP and visual results. Retrospective revision of data of 21 patients (40 eyes) with diagnosis of OH, studied with ORA and Ultrasonic Pachimetry (USP).
Results: Twelve women (57%). Mean age 62,6 years ± 9, USP 542 ± 32 µm, mean Goldmann IOP 23,34 ± 3,7 mmHg v/s mean corneal compensated IOP 23,98 ± 3,9 mmHg (p = 0,0079); mean corneal resistence factor (CRF) 11,79 ± 1,5; mean corneal hysteresis (CH) 9,24 ± 1,5 mmHg.
Conclusions: Compared with normal literature values, USP resulted similar, CRF higher and CH significantly lower. Comparative, prospective studies should be done in order to set differences in ORA between normal population and OH patients, because little literature has been published.
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P297 THE AGREEMENT AMONG EXAMINERS AND THE S.T.A.R. II ON CLINICAL DECISIONS FOR OCULAR HYPERTENSIVE PATIENTS
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Purpose: The purpose of the study was to evaluate the degree of agreement between a group of physicians and the S.T.A.R. II, the second generation of risk calculator.
Design: A standard chart which included data regarding age, gender, ethnicity, family history, diabetes, visual acuity, intraocular pressure and central cornea thickness was created and given to three examiners along with a copy of the visual field exam and an optic disk print photograph. Each examiner was asked to calculate the risk for glaucoma conversion and to choose for each patient observation, consider treatment or no treatment. For each patient, the risk for glaucoma conversion in 5 years was calculated by the S.T.A.R. II and three possibilities were chosen according to the result: risk < 5%, observation; risk between 5% and 15%, consider treatment and risk < 15%, treatment.
Participants: The medical records of all patients with ocular hypertension from the private practice of one of the authors were selected based on the inclusion criteria, namely: older than 40 y, best corrected visual acuity over 20/25, absence of cataract or other media opacity, intraocular pressure above 21 mmHg and no ocular hypotensive drugs, cup to disk ratio less than 0.5 and asymmetry between eyes less than 0.2, and automated perimetry (full threshold 24-2).
Testing: In order to assess the degree of agreement among examiners and the risk calculator we used the chance-corrected proportional agreement statistic (kappa, K). Kappa can vary between 0 (no agreement) and 1 (perfect agreement). Values of Kwere assessed as suggested by Landis & Kock (1977): K≤ 0 (poor); 0-0.2 (slight); 0.2-0.4 (fair); 0.4-0.6 (moderate); 0.6-0.8 (substantial); 0.8-1.0 (almost perfect).
Main outcome measure: The degree of agreement was measured for the three examiner and the risk calculator, among the examiners, and for each examiner and the risk calculator.
Results: The agreement among examiners A, B, and C and the risk calculator was poor (K= -0,0550, z = -0,9457, P = 0,1722). The agreement among the examiners themselves was poor (K= -0,0123, z = 0,1519, P = 0,4396).

Conclusions: The calculator was developed based on the results of OHTS and takes into account only the risk factors identified in that study. The examiners probably included other possible risk factors in their decision to treat. Besides, in addition to risk, life expectancy, medical status, effectiveness, safety, tolerability, and cost of treatment are included in the decision to treat.

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P298 DATASET GENERATOR FOR GLAUCOMA DIAGNOSIS EMPLOYING HIGH DEFINITION OPTICAL COHERENCE TOMOGRAPHY AND STANDARD AUTOMATED PERIMETRY

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Purpose: To create an artificial population of glaucomatous and normal individuals based on OCT and SAP parameters, and to apply machine learning classifiers to this population in order to increase the sensitivity and specificity of glaucoma diagnosis.

Design: Prospective study.

Participants: Twenty-six patients with primary open-angle glaucoma and 44 healthy individuals.

Methods: An artificial data generator named GLOR (Glaucoma Oracle) was created based on the Monte Carlo method employing functional and structural data. Functional data was provided by Standard Automated Perimetry (SAP) and structural data by High Definition Optical Coherence Tomography (HD-OCT) instruments. The development of GLOR starts by generating values based on literature data on the distribution of 12 clock-hour retinal nerve fiber layer thickness measurements in normal and glaucomatous individuals. Subsequently, these values are translated to SAP data according to a structure-function relationship model between OCT and SAP [4]. Finally, the SAP data is converted to a graphic output, which improves readability by ophthalmologists, and is compatible with commercially available instruments. Following the creation of an artificial population, a multilayer perceptron classifier was trained, The sensitivity, specificity and area under the ROC curve (aROC) of the classifier were calculated. The classifier was then tested in a real population formed by 26 patients with primary open-angle glaucoma and 44 normal individuals.

Main outcome measures: Sensitivity, specificity, and area under the ROC curve (aROC) for glaucoma diagnosis.

Results: GLOR created an artificial population of 4500 normal and 500 glaucomatous subjects. The multilayer perceptron classifier trained over this population using age, SAP and OCT parameters and tested in the same artificial population resulted in 91% sensitivity, 99% specificity and aROC of 0.995. When tested on real patient data, the classifier resulted in 81% sensitivity, 75% specificity, and an aROC of 0.885.

Conclusion: The creation of a large artificial population of glaucomatous and normal individuals may be used to train machine learning classifiers, saving time spent during the collection of real data. The sensitivity and specificity of the machine learning classifier developed in this study were high and may be employed to help the diagnosis of glaucoma.

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P299 BINOCULAR INFRARED PUPILLOMETRY IN DETECTING RELATIVE AFFERENT PUPILLARY DEFECT IN GLAUCOMA PATIENTS

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Purpose: To determine the sensitivity and specificity with which a commercially available binocular infrared pupillometer, Procyon P3000, can differentiate patients with primary open-angle glaucoma from normal subjects based on relative afferent pupillary defect (RAPD).

Design: A method comparison study where the diagnosis accuracy of the pupillometer was tested against the diagnosis made clinically using dilated fundoscopy of optic nerve head, tonometry and visual field test. The pupillometer was designed to simulate the swinging flash light test. Data from direct pupillary responses were processed to obtain two measures of RAPD, direct (RAPDDIR) and consensual (RAPDCONS) in decibels (dB). The pupil reflexes were acquired at two intensity levels: scotopic (0.07 lux) and high mesopic (7 lux). Combination of the two RAPD results at each light level was used to determine if the patient had a clinically significant RAPD based on predetermined cut-off values.

Participants: Fifty-eight normal subjects and 58 unilateral or bilateral, primary open-angle glaucoma patients, regardless of asymmetry of the disease, were included. Participants were excluded if they had secondary glaucoma, visually sig-

nificant media opacity, amblyopia (VA worse than 6/9), large eso/exo tropia (> 40 prism dioptre), retinal disease or other optic nerve disease which might produce an RAPD, and any conditions that affect pupil dynamics.
Intervention: Before any pupillometric data was acquired, the subject was dark adapted for a period of 30 seconds. During acquisition, stimulus pulses were ON for 0.4 seconds and OFF for 1.6 seconds, and were alternated between left and right eyes. The stimulus sequence was repeated seven times during the acquisition.
Main outcome measures: The pupillary responses were recorded to determine the RAPDDIR and RAPDCONS using the amplitude of pupillary constriction. The output was on a continuous scale from 0dB and above zero. Sensitivity, specificity, positive and negative likelihood ratio were derived from the cross tables describing the variation in specificity and sensitivity with different cut-off values for each of RAPDDIR and RAPDCONS.
Results: Sensitivity of 86.2% (95% CI = 74.6% - 93.8%) and specificity of 84.4% (95% CI = 72.6% - 92.6%) were achieved when the optimal cut-off values of 0.09dB and 0.13dB were used for RAPDDIR and RAPDCONS. The positive likelihood ratio and the negative likelihood ratio for the chosen cut-offs were 5.6 and 0.84.
Conclusions: The RAPD elicited by the pupillometer can categorise a subject as normal or as having primary open-angle glaucoma with high sensitivity and specificity. The method is objective, reproducible, and quickly and easily administered. Although this pilot study has produced encouraging results, more subjects are required to confirm the usefulness of these settings.
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P300 PENTACAM OF ANTERIOR SEGMENT OF GLAUCOMATOUS EYES WITH CATARACT

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Purpose: To determine the anatomic and function changes of anterior segment in glaucoma before and after cataract surgery followed by a three-dimensional picture of Scheimpflug's rotating camera (PENTACAM). The observation group had primary open-angle glaucoma (POAG) and angle-closure glaucoma (PCAG). The aim was to examine behavior and changes of anterior segment of glaucomatous eye before and immediately after facoemulsification and follow-up care with reducing antiglaucomatous drugs.
Participants and Methods: Forty patients (42 eyes) in the prospective study were divided into 3 groups of 10 eyes with normal cataract (control group), 26 eyes with cataract and POAG and 6 eyes with cataract and PCAG. Central anterior chamber (AC) depth, APD (manual measurement of depth of the anterior chamber on the level of pupil before and after surgery), AC volume, AC angle and IOP were measured before, and 1 day, and 1 month after cataract surgery using PENTACAM and automatic non-contact tonometry. These data were measured: A. Average ± SD before / average ± SD 1st day after cataract surgery; B. Average ± SD before / average ± SD 1 month after cataract surgery.
Results: In the group of 10 normal cataracts with foldable IOL implantation: A. 2.6 ± 0,0005 / 4.2 ± 0,0005 mm, 2.2 ± 0.3 / 2.5 ± 0.3 mm, 147 ± 0.0005 / 200 ± 0.0005 mm^3, 33.5° ± 0.003 / 41° ± 0.003 and 15.6 ± 0.320 / 15.0 ± 0.320 mmHg. B. 2.6 ± 0.0005 / 4.9 ± 0.0005 mm, 2.2 ± 0.3 / 2.8 ± 0.3 mm, 147 ± 0.0005 / 208 ± 0.0005 mm^3, 33,5° ± 0.003 / 44° ± 0.003 and 15.6 ± 0.320 / 15.2 ± 0.320 mmHg. In the group of 26 cataracts with verified POAG and and foldable IOL: A. 2.3 ± 0.0005 / 4.0 ± 0.0005 mm, 1.7 ± 0.5 / 2.7 ± 0.5 mm, 110 ± 0.0005 / 150 ± 0.0005 mm^3, 28.1° ± 0.0005 / 42.3° ± 0,0005 and 16.3 ± 0,152 / 13,0 ± 0,152 mmHg. B. 2.3 ± 0,0005 / 4.1 ± 0,0005 mm, 1.7 ± 0.5 / 2.5 ± 0.5 mm, 110 ± 0.0005 / 170 ± 0.0005 mm^3, 28.1° ± 0.0005 / 40.6° ± 0.0005 and 16.3 ± 0.152 / 15.3 ± 0.152 mmHg. In the group of 6 cataracts with PCAG and foldable IOL: A. 1.9 ± 0.018 / 4.3 ± 0.018 mm, 0.99 ± 0.5 / 2.0 ± 0.5 mm, 89.5 ± 0.028 / 140 ± 0.028 mm^3, 30.4° ± 0.018 / 36° ± 0.018 and 32.4 ± 0.028 / 11.8 ± 0.028 mmHg. B. 1.9 ± 0.018 / 4.6 ± 0.018 mm, 0.99 ± 0.5 / 2.5 ± 0.5 mm, 89.5 ± 0.028 / 156.3 ± 0.028 mm^3, 30.4° ± 0.018 / 38.0° ± 0.018 and 32.4 ± 0.028 / 13 ± 0.028 mmHg. There were statistically significant differences between the ACD, size of the iridocorneal angle before and after surgery in all mentioned groups. In POAG were no statistically significant differences in the IOP before and after surgery because of reducing of the quantity of antiglaucomatous drugs (only 2 patients need medication again).
Conclusion: We have documented the significant influence of cataract surgery on IOP, AC depth, AC volume and AC angle in all mentioned groups. The most significant effect was measured in the group of cataract with chronic closure angle glaucoma. In both types of glaucoma is cataract surgery very good therapy for reducing quantity of antiglaucomatous drugs and for improvement patient's compliance.
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P301 HIERARCHY ANALYSIS METHOD IN DECISION SUPPORT FOR OPEN-ANGLE GLAUCOMA RISK ASSESSMENT

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Objective: To develop decision support for open-angle glaucoma risk assessment based on hierarchy analysis method.
Design: Retrospective case series study.
Participants and controls: Sixty-five open-angle glaucoma and 35 age-matched healthy subjects.
Methods: Visual acuity (LogMAR), intraocular pressure (Goldmann applanation), central corneal thickness (ultrasonic pachymeter), blood flow (colour Doppler imaging), nerve fiber layer thickness (scanning laser polarimetry), pattern electroretinogram alterations (Veris), and standard automated perimetry. A generalized estimation of the patient's condition was obtained while transforming a vector parameter to a scalar one. The comparison of the pairs in terms of the qualitative definition was performed using modified hierarchy analysis method. Decision support compatability index was verified.
Main outcome measure: Glaucoma risk assessment.
Results: The developed decision support tool based on hierarchy analysis method enables to define the correct open-angle glaucoma diagnostics regarding visual acuity, intraocular pressure, central corneal thickness, blood flow alterations in central retinal artery, mean deviation and pattern standard deviation in perimetry, and nerve fiber index changes in 98.7% of all the case ($p < 0.01$). Determination of glaucoma risk was achieved with 95.0% sensitivity, and specificity was 91.0% with a reliability threshold of $p < 0.001$. Expert decision deviation was not statistically significant.
Conclusions: Decision support analysis based on hierarchy analysis method is a reasonable one for assessing the risk of open-angle glaucoma and further a strategic potential for particular subject.
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8.4. Refractive errors in relation to glaucoma: Refractive surgical procedures

see also P124, P132

P302 CHANGE OF VISUAL FIELD AFTER IRIS CLAW PHAKIC INTRAOCULAR LENS IMPLANTATION FOR CORRECTION OF MYOPIA IN GLAUCOMA SUSPECTS

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Purpose: To evaluate the clinical characterics of glaucoma suspects after artisan phakic IOL implantation for correction of high myopia
Design: retrospective case control study
Participants: Twenty-one subjects (10 glaucoma suspects with high myopia, 11 controls with high myopia).
Method: Visual field test was performed using SITA 24-2 program of the Humphrey field analyzer before and after surgery. Central corneal thickness, cup to disc (C/D) ratio and intraocular pressrue were compared perioperatively.
Main outcome measure: Mean deviation (MD) and pattern standard deviation (PSD) from Humphrey SITA strategy.
Results: The mean refractive error was -10.54 ± 3.8 D and the follow-up period was 12 months after artisan phakic IOL implantation. Photopic pupil diameter was 3.01 mm (range: 2.53-3.5 mm). Vertical C/D ratio was 0.68 and the ratio was not changed until 12-month postoperative. No significant change of MD and PSD was recognized after the surgery.
Conclusion: artisan phakic IOL implantation may be a viable option in some glaucoma suspects. But, careful patients education and lifelong follow-up is mandatory after surgery.
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9.1.1. Clinical forms of glaucomas: Developmental glaucomas: Congenital glaucoma, Buphthalmos

see also P278, P504, P523

P303 LONG-TERM RESULTS OF COMBINED VISCOTRABECULOTOMY-TRABECULECTOMY IN REFRACTORY DEVELOPMENTAL GLAUCOMA

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Background: To evaluate the outcomes of combined viscotrabeculotomy-trabeculectomy in patients with refractory developmental glaucoma and to compare the success and complications rates with classical trabeculotomy-trabeculectomy procedure.

Methods: Patients who were selected for this study had cloudy corneas with a diameter of 13 mm or greater and with an initial IOP of 27 mmHg or more, and they were divided into two groups. Group 1 consisted of 40 eyes of 24 patients who had undergone combined viscotrabeculotomy-trabeculectomy, and group 2 consisted of 35 eyes of 20 patients who had undergone classical viscotrabeculotomy-trabeculectomy. Pre-and postoperative intraocular pressures (IOPs), mean antiglaucoma medication, mean corneal diameter, success rates, intra-and postoperative complications were compared between two groups.
Results: Mean IOP reduced from a preoperative level of 33.2 ± 5.3 and 32.8 ± 5.2 mmHg to 14.2 ± 3.1 and 15.3 ± 3.3 mmHg in group 1 and group 2, respectively ($P < 0.001$). The mean number of antiglaucoma medications used after surgery was significantly lower in group 1 ($P < 0.05$). Kaplan-Meier survival analysis showed that the success probability at the last visits was 90% and 71.4% in group 1 and group 2, respectively, and the difference was statistically significant ($P < 0.05$). The most common early postoperative complication was transient IOP elevation in group 1 and hyphema in group 2 (for each, $P < 0.05$).
Conclusion: Use of viscoelastic materials during trabeculotomy-trabeculectomy may increase the success rate of the procedure by prevention of postoperative hemorrhage, anterior chamber shallowing, adhesion of the incision lips or fibroblastic proliferation.

P304 IRIS NEOVASCULARIZATION IN PATIENTS WITH PRIMARY CONGENITAL GLAUCOMA AND ITS IMPACT ON THE SEVERITY OF GLAUCOMA AND OUTCOME OF SURGICAL TREATMENT

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Purpose: To report iris neovascularization as a histopathologic finding in patients with primary congenital glaucoma, and its impact on the surgical outcome, as a possible contributing factor to the pathogenesis in those patients.
Design: Case series.
Participants: Eleven eyes of 6 consecutive infants (3 males and 3 females), with primary congenital glaucoma, presenting to the department of Ophthalmology, Assiut University Hospital, from January 2006 to October 2008 were included. Their ages ranged from 1 week to 4 months with a mean of 40 ± 36.26 days. Infants who had any previous intraocular surgery were excluded.
Methods: Examination under general anesthesia, and preoperative A and B-scan ultrasound were performed, to establish the diagnosis of primary congenital glaucoma, and to exclude any detectable cause of secondary congenital glaucoma. All eyes underwent combined trabeculotomy-trabeculectomy with Mitomycin C. Histopathological examination of the peripheral iris tissue specimen obtained during surgical iridectomy was done in all cases. Successful surgical outcome was defined as IOP less than 18 mmHg for at least 6 months after surgery.
Main outcome measure: Histopathological findings of iris biopsy and intraocular pressure following surgery.
Results: All eyes presented with enlarged globes, with a mean axial length of 27.43 ± 4.87 mm, and cloudy corneas, with a mean horizontal diameter of 13.44 ± 0.41 mm. Fundus examination and refraction could not be done due to corneal edema. B-scan ultrasound did not reveal posterior segment abnormalities in any of the eyes included. In 6 out of the 11 eyes, histopathological examination of the iris specimen revealed neovasularization with a fibrovascular membrane over the iris surface. The rest of the specimens showed normal iris tissue. The operative success rate in the first group (eyes with iris neovascularization) was 1 out of 6 eyes (16.6%), while the success rate in the second group (eyes without iris neovascularization) was 80% (4 out of 5 eyes). Intra operative bleeding during iridectomy occurred in 5 eyes, all had neovasularization in their iris samples.
Conclusion: Iris neovascularization is sometimes present in patients with congenital glaucoma. The exact origin of iris neovascularization, and its rule in the pathogenesis of congenital glaucoma is unknown. Those patients carry worse surgical outcome following combined trabeculotomy-trabeculectomy with Mitomycin C, compared to those patients without iris neovascularization. Identifying neovascularization in patients with congenital glaucoma, is essential for management of these cases. The classic surgical options in our series were ineffective, and carried a bad prognosis in this group. So we recommend a more aggressive surgical approach for those infants. Further research is required to investigate the etiology of iris neovascularization in patients with congenital glaucoma, and to compare the outcome of different treatment options for those patients.
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P305 CORRELATION BETWEEN PHENOTYPE AND GENOTYPE IN PRIMARY CONGENITAL GLAUCOMA

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Purpose: To evaluate the correlation between CYP1B1 mutations and clinical manifestations of primary congenital glaucoma (PCG).
Design: Observational case series.
Participants: Seventeen unrelated PCG patients (34 eyes) with known CYP1B1 mutation profile.
Methods: A clinical and molecular genetics study was performed on 17 Iranian patients with PCG. Hospital records were reviewed and findings were correlated with presence or absence of mutations in CYP1B1 as determined by sequence analysis of genomic DNA obtained from peripheral blood samples. A severity index for PCG phenotype was developed based on age of onset, presenting IOP, corneal diameter, cup-disc (CD) ratio, and number of operations.
Main outcome measures: Phenotypical severity of PCG.
Results: Ten patients (58.8%) harbored CYP1B1 mutations while 7 (41.2%) subjects did not. Consanguinity was seen in 8 (47.1%) cases, while 3 (17.6%) patients had a positive

family history of primary congenital glaucoma. Mean follow-up was 74.6 ± 42.8 (median 68.4) months overall, and 79.1 ± 49.8 months versus 68.1 ± 33 months in subjects with and without mutations respectively (P = 0.62). The male/female ratio was 4/6 in the subset of subjects with mutations versus 6/1 in those with no mutations (P = 0.134). Onset of the disease was earlier than one month of age in 9 of 10 (90%) cases with mutations as compared to 2 of 7 (28.6%) patients without mutations (P < 0.008). Baseline IOP was 29.3 ± 6.5 mmHg in the mutation group versus 17.6 ± 3.7 mmHg in subjects without mutations (P < 0.001), furthermore patients with mutations had significantly higher IOP throughout follow-up (P = 0.002). There was no statistically significant difference in cup/disc ratio and corneal diameter between the study subgroups. Mean severity score was higher in patients with as opposed to those without CYP1B1 mutations (P < 0.001). The number of operations was significantly larger in subjects with as compared to those without mutations (3.33 versus 1.71 procedures, P < 0.025). The rate of complications, however, was comparable in subjects with and those without mutations (P = 0.85).

Conclusion: Patients with CYP1B1 mutations seem to have earlier onset disease, display more severe manifestations of PCG and also require more operations as compared to subjects without such mutations. These findings may have implications in prognosticating PCG, guiding therapy to prevent end-organ damage and pre-marital genetic counseling.

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P306 SURGICAL OUTCOME OF INFANTILE GLAUCOMA WITH ACUTE CORNEAL HYDROPS

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Purpose: To evaluate outcome of infantile glaucoma presented with acute corneal hydrops.

Design: Retrospective analysis.

Participants: Eleven consecutive children (20 eyes with mean age at surgery 6.4 ± 1.8 months) were included.

Intervention: All underwent combined Trabeculotomy-Trabeculectomy (CTT) between 1990 and 2006.

Main outcome measures: IOP-control, refractive status, corneal clarity and vision.

Results: IOP reduced from 26.6 ± 4.8 to 12.0 ± 2.8 mmHg (P < 0.0001) with a mean follow-up of 41.5 ± 49.4 months (median, 12 months). All eyes achieved good IOP control (16 mmHg), but 2 eyes required one medication. Post-operatively all eyes had clear cornea with Haab's striae while 17 eyes (85%) had > 1D of astigmatism. All the patients had age-appropriate normal visual acuity.

Conclusions: CTT is safe and effective with excellent IOP control and good functional outcome.

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P307 PRIMARY CONGENITAL GLAUCOMA: CAN WE MAKE THE DIAGNOSIS IN UTERO?

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Purpose: To describe some parameters of eye growth measurements in utero and to observe if they have correlation in-between. These measurements can be useful for early diagnosis of primary congenital glaucoma.

Setting: Centro Paulista de Medicina Fetal

Methods: The study group comprised 34 fetuses' eye of 24 pregnant women. Fetuses' eye measurements were obtained during routine ultrasonographic examination.

Results: The average of axial diameter in the second trimester was 10,47 ± 1,17 mm and 15,64 ± 1,5 mm in the third trimester. The average of posterior chamber was 6,3 ± 0,75 mm in the second and 9,98 ± 1,43 mm in the third trimester. The ocular volume showed a good correlation with axial diameter (R^2= 0,81).

Conclusion: This study showed a linear relationship between axial ocular dimensions and volume in normal fetuses. These measurements may be used to help early primary congenital glaucoma diagnosis.

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9.1.2. Clinical forms of glaucomas: Developmental glaucomas: Juvenile glaucoma

see also P195

P308 LONG TERM STRUCTURAL AND FUNCTIONAL CHANGES IN TREATED PRIMARY JUVENILE OPEN-ANGLE GLAUCOMA

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Purpose: To longitudinally evaluate optic disc and visual field changes in treated primary juvenile onset open-angle glaucoma (JOAG) eyes.
Design: Retrospective comparative study.
Participants: JOAG patients presenting between 10-40 years with IOP > 22 mmHg (on two separate occasions) in the presence of gonioscopically wide-open angle and glaucomatous optic neuropathy with or without corresponding glaucomatous visual field defects. Exclusion criteria were: 1) eyes in which IOP could not be measured due to corneal opacity or non-cooperation; 2) eyes with corneal diameters > 12 mm; 3) pigmentary dispersion; 4) those with a history of steroid intake; 5) presence of retinal or neurological pathology; 6) those in whom visual acuity in the better eye was < 6/36; and 7) patients with consistently unreliable visual fields.
Method: Morphometric and functional evaluation of the optic disc of 42 treated JOAG eyes (42 patients) referred to our centre between January 2000-January 2002 was performed over a 5-year period. Visual fields using Humphrey perimetry and disc characteristics on scanning laser Ophthalmoscopy (HRTII) were evaluated at baseline and over the five-year follow-up. These were compared between those JOAG eyes treated medically and those treated surgically.
Results: Average number of HRT examinations per patient were 11.1 ± 3.2 and Visual Field examinations were 9.5 ± 4.1. Lower age among the JOAG was correlated to larger cup area (r = -0.34, p = 0.04), larger cup-disc ratio (r = -0.34, p = 0.038) greater mean cup volume (r = -0.288, p=0.08) and cup depth (r = -0.22, p=0.19) at baseline.
Fifteen eyes (35.7%) had undergone surgery (trabeculetomy with mitomycin), while the rest were controlled on medical therapy alone. Mean IOP drop at the 5 year follow-up in the surgically treated eyes (19 ± 10.5 mmHg) was not significantly different from those treated medically (16.35 ± 13.2 mmHg); (p = 0.67). Three of the surgically treated eyes (20%) showed improvement of disc parameters on HRT compared to none of the medically treated eyes (p = 0.39).
Conclusion: Medical therapy can be an equally effective option as surgery for long-term IOP control in JOAG eyes. Trabeculectomy to control IOP may reverse cupping in younger juvenile onset open-angle glaucoma patients.
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P309 RELATIONSHIP BETWEEN THE THE GDX VCC AND STRATUS OCT IN JUVENILE GLAUCOMA

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Purpose: To compare the ability of scanning laser polarimetry (GDx VCC), and optical coherence tomography (OCT) to discriminate eyes with juvenile glaucoma from normal eyes and to assess the relationship between their parameters.
Methods: Twenty-four glaucomatous eyes of 24 patients and 24 normal eyes were enrolled. Patient age range was 11 to 40 with a mean age of 25.1 ± 8.2 years. Contol groups consisted 24 eyes of 24 idividual without glaucoma with a mean age of 33.2 ± 8.2. All subjects underwent a full ophthalmic examination, automated perimetry, GDx VCC and OCT. Correlation coefficients between the parameters of OCT and GDx VCC were calculated. We calculated area under the receiver operating characteristic curve (AROC) for GDx VCC and OCT main parameters.
Results: Statistically significant correlations were observed between GDx VCC and OCT parameters. Pearson coefficients ranged from 0.75 for inferior average to 0.86 for nerve fiber indicator (NFI)/average thickness. The greatest area under AROC parameter in OCT (inferior average 0.92) had a lower area than that in GDx VCC (NFI; 0.99). There were a significant statistical significance in all visual field, GDx VCC , and OCT variables between two groups.
Conclusion: Many GDx VCC parameters were significantly correlated with those of the OCT. Inferior average and NFI had the greatest area under AROC parameter in OCT and GDx VCC, respectively. NFI had high sensitivity and specificity for the diagnosis of JOAG.
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9.1.3. Clinical forms of glaucomas: Developmental glaucomas: Syndromes of Axenfeld, Rieger, Peters, aniridia

P310 CENTRAL CORNEAL THICKNESS IN CONGENTIAL ANIRIDIA PATIENTS OF A SOUTH-EAST ASIAN ORIGIN

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Purpose: To compare the mean central corneal thickness (CCT) in congenital aniridia patients to that of a group of age and sex matched control subjects.
Design: A hospital-based prospective case-control series.
Participants and controls: Thirteen cases (23 eyes) of congenital aniridia and 13 controls (23 eyes) of normal age and sex-matched control subjects.
Method: The mean values of ten consecutive pachymetry measurements of patients with aniridia and control subjects were used for analysis. Statistical analysis was performed using the student's t-test.
Main outcome measure: A statistically significant mean difference between the cases and controls.
Results: All patients were of Bangladeshi origin (five male and eight female patients). Mean age was 13.2 ± 10.7 years (Range: 1-33 years). Visual acuity of our aniridia patients ranged from 6/18 to perception of light. Six patients (46.2%) of our patients were diagnosed with glaucoma. The mean CCT for congenital aniridia patients was 632.17 ± 25.52 µm and for the control group was 534.26 ± 36.49 µm with a range of 566-695 µm. The mean difference of the CCT between cases and controls was 97.91 ± 40.27 µm (95% CI: 115.33-80.49 µm) ($p < 0.000$).
Conclusion: The mean CCT of patients with congenital aniridia was statistically greater than the age and sex-matched controls. The mean difference between the two groups was approximately 100 m.

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9.2.2. Clinical forms of glaucomas: Primary Open-angle glaucomas: Other risk factors for glaucoma

see also P114

P311 EVALUATION OF OCULAR RISK FACTORS RELATED TO ASYMMETRIC VISUAL FIELD DEFECTS IN NORMAL TENSION GLAUCOMA

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Purpose: To evaluate ocular risk factors related to asymmetric visual field defects in normal tension glaucoma (NTG).
Design: Retrospective intra-individual comparison.
Participants: Ninety-two NTG patients with asymmetric visual field defects.
Methods: We retrospectively evaluated 92 NTG patients (184 eyes) with asymmetric visual field defects; these patients were classified as having more affected eye (ME) group or less affected eye (LE) group. The differences between ME and LE based on the intra-individual comparison were assessed with several ocular risk factors.
Main outcome measure: Refractive error, intraocular pressure (IOP), central corneal thickness, disc hemorrhage, zone of peripapillary atrophy (PPA), and disc size.
Results: The MD was -11.2 ± 6.5 in the ME group, and -5.9 ± 5.4 in the LE group ($p = 0.00$). The optic disc size was 2.62 ± 0.8 in the ME group, 2.48 ± 0.5 in the LE group ($p = 0.00$), and there were no statistically significant differences in the other factors. Regarding the difference in the MD, the optic disc size was statistically significant in the less different group, and the angle of PPA was statistically significant in the more different group ($p = 0.00$ and $p = 0.01$, respectively).

Conclusions: The optic disc size is a risk factor related to visual field defects in the ME group and the less affected patients, and the PPA is a risk factor, thought to be associated with ischemia, related to visual field defects in the more affected patients with asymmetric normal tension glaucoma.

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P312 RISK FACTORS FOR PROGRESSION TO END STAGE GLAUCOMA

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Objective: To examine the medical records of patients with open-angle glaucoma (OAG) and assess certain clinical factors which might contribute to progression to end stage glaucoma.

Design: A retrospective chart review of patients of a tertiary glaucoma referral service from the Hermann and Cizik Eye Center from January 1998 until December 2008 was conducted. Patients were followed from initial diagnosis until either endpoint or the time frame of the study was reached.

Participants: Patients > 35 years old with uni- or bilateral open-angle glaucoma, including primary open-angle glaucoma, pseudoexfoliation, and pigmentary glaucoma were included. All other forms of glaucoma were excluded.

Methods: This was a retrospective chart review with statistical data analysis. Data was summarized using mean and standard deviation for continuous variables and frequency and percentage for categorical variables. A stepwise Cox regression analysis was employed to identify the factors which had a significant effect on short term outcome. 207 charts were reviewed, of which 65 were included. The remaining 142 charts could not be used because the patients had already reached the endpoint at their initial visit, did not have follow-up visual fields, or did not have a diagnosis of OAG. Data on age, race, sex, visual acuity, intraocular pressure, central corneal thickness, refractive error, blood pressure/diastolic perfusion pressure, visual field, medical history, family history, glaucoma diagnosis, previous surgeries, previous laser procedures, and presence of optic disc hemorrhages was recorded. The visual field data was recorded using the Advanced Glaucoma Intervention Study (AGIS) criteria. The mean deviation of the visual field test was also noted. Data was recorded for the initial baseline visit and follow-up visits.

Main outcome measure: The endpoint was a visual acuity of less than or equal to 20/70. A visual field defect having three contiguous points with more than 10db depression on two consecutive fields, and within 20 degrees of fixation nasally or temporally also qualified as endpoint.

Results: The p-value for age was .0202 with a hazard ratio of 1.049. The visual field p-value was < .0001 with a hazard ratio of .342. All other factors were not statistically significant.

Conclusion: Age and visual field are significant risk factors for progressing to end stage glaucoma. Surgical and laser interventions were found to have a protective effect. More patients and a longer follow-up time is needed to reinforce these conclusions.

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9.2.3. Clinical forms of glaucomas: Primary open angle glaucomas. Open angle glaucoma with elevated IOP

see P326

9.2.4. Clinical forms of glaucomas: Primary Open-angle glaucomas: Normal pressure glaucoma

see also P007, P080, P120, P146, P194, P201, P216, P378

P313 iSTENT® TRABECULAR MICRO-BYPASS AND CONCURRENT CATARACT SURGERY: 24 MONTH RESULTS

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Objective: The iStent® trabecular micro-bypass system (Glaukos Corp. Laguna Hills, CA) was developed to address the limitations of current medical and surgical therapies for the treatment of glaucoma. Implantation of this stent into Schlemm's canal allows aqueous humor to drain directly from the anterior chamber into Schlemm's canal, bypassing the obstructed trabecular meshwork. The purpose of this study is to report the iStent long term safety and efficacy results.
Design: Prospective, open-labeled, 24-month, multi-country evaluation.
Participants: Fifty-three patients with concurrent cataract and primary open-angle glaucoma uncontrolled by medication.
Intervention: Patients underwent clear cornea phacoemulsification followed by ab-interno implantation of the iStent through the same temporal incision used in the phaco procedure. Ocular hypotensive medications were discontinued on the day of surgery. Postoperatively, hypotensive medication was added back only if necessary.
Main outcome measure: Primary outcome was mean IOP at all time points. Secondary outcome was medication use.
Results: At baseline, mean (±SD) IOP was 21.5 ± 4.07 mmHg. At 24 months, 45 patients (84.9%; n = 53) had an IOP of ≤18 mmHg, with a mean IOP of 15.8 ± 2.08 mmHg. Of those 45 patients, 26 (57.8%) had a mean IOP of 15.6 ± 1.75 mmHg and were on no medications. At 24 months, the average IOP decrease from the medicated baseline was 5.1 mmHg. The IOP reduction reported in this group of patients is greater than that reported in the literature in phaco-only patients. At baseline, the mean number of medications was 1.7 ± 0.93 and this decreased to a mean of 0.5 ± 0.72 at 24 months. The most commonly reported device-related adverse events were the appearance of stent lumen obstruction (7 eyes) and stent malposition (9 eyes); most of the patients still achieved significant IOP reduction. None of the adverse events were considered serious.
Conclusion: iStent implantation in open-angle glaucoma patients undergoing cataract surgery should be considered as an alternative surgical approach to provide clinically significant reductions in IOP and drug burden. A prospective randomized, comparative, controlled clinical trial (iStent placement compared to cataract extraction alone) is currently in progress in the USA as part of the FDA approval process.
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P314 RETINAL VESSELS CALIBROMETRY IN NORMAL-PRESSURE GLAUCOMA EVALUATION

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Purpose: The aim of the study was to assess caliber of retinal vessels in normal-pressure glaucoma (NPG) patients. The study was designed as nonrandomized prospective clinical trial.
Participants and controls: Twenty-five NPG patients (48 eyes, mean age 62,5 ± 7,64) and 25 healthy volunteers (50 eyes, mean age 61,7 ± 8,27) were enrolled. Initial NPG was diagnosed in 36 eyes and moderate NTG was diagnosed in 12 eyes.
Methods: Retinal vessel diameter was evaluated in images obtained during optic nerve head (ONH) imaging - HRT III.
Main outcome measure: Diameter of upper and lower temporal retinal arteries and veins measured in area from 0,5 to 1,0 ONH size from the ONH margin.
Results: Arteries and veins were narrower ($p<0,05$) in NPG patients. There was no difference in retinal vessel diameter in initial and moderate NPG.
Conclusions: Retinal tomography (HRT III) revealed that in NPG patients there is a vessel narrowing in the peripapillary area, and the degree of narrowing does not depend on the stage of the disease.
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P315 C-REACTIVE PROTEIN AND HOMOCYSTEINE LEVELS IN NORMAL TENSION GLAUCOMA

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Purpose: Our aim was to investigate the possible relationships between C-reactive protein (CRP), homocysteine (Hcy) and normal tension glaucoma (NTG).

Design: Case-control study.
Participant and/or controls: This study consisted of 32 NTG patients and 26 healthy controls.
Methods: On ophthalmological examination, the anterior and posterior segments of all the cases were evaluated and intraocular pressures (IOP) were measured with Goldmann applanation tonometry. The serum CRP and Hcy levels were measured in all participants.
Main outcome measures: To determine CRP and , Hcy concentration in NTG patients.
Results: The mean CRP level was significantly higher in NTG patients than in controls (2,60 ± 2,17 mg/l, and 1,93 ± 2,39 mg/l, respectively)(p = 0,040). Twelve (37,5%) of the 32 NTG patients and 2 (7.7%) of the 26 controls had pathologically increased levels of CRP. We found statistically significant differences for number of NTG patients and controls with pathologically increased CRP levels between two groups (p = 0,008).The mean Hcy level was found significantly elevated in NTG patients (13,79 ± 4,61 umol/l and 10,84 ± 2,77 umol/l, respectively) (p = 0,009). Of 32 NTG patients, fifteen (46,9%) had pathologically increased levels of Hcy, whereas in control group, four (15,4%) had pathologically elevated Hcy (p = 0,011).
Conclusions: These results suggest that CRP and Hcy may involve in the pathogenesis of NTG.
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P316 RISK FACTORS ASSOCIATED WITH OPTIC DISC HEMORRHAGE IN PATIENTS WITH NORMAL-TENSION GLAUCOMA

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Purpose: To evaluate risk factors associated with optic disc hemorrhage in patients with normal-tension glaucoma.
Design: Combination of prospective and retrospective study.
Participants and controls: Normal-tension glaucoma patients of Seoul National University Hospital.
Methods: Two hundred and eighty-one eyes of 281 patients with normal-tension glaucoma (113 eyes with optic disc hemorrhage and 168 eyes without hemorrhage) were included in this study. Associations between optic disc hemorrhage and various patient-related variables (diabetes; hypertension; hypotension; cardiac disease; stroke; cold hand; migraine; constipation; use of steroids, aspirin, anticoagulant, or gingko extract; smoking history; and glaucoma family history) and eye-related variables (baseline intraocular pressure [IOP]; maximum, minimum, and range of IOP; vertical and horizontal cup/disc ratio; mean deviation and pattern standard deviation of the visual field; corneal thickness; and average retinal nerve fiber layer [RNFL] thickness measured by optical coherence tomography [OCT]) were investigated by univariate and multivariate logistic regression analyses. Differences in risk factors between patients with single optic disc hemorrhages and recurrent hemorrhages were also analyzed.
Main outcome measure: Study questionnaires were completed in-clinic, by telephone, and by mail. Medical records were retrospectively reviewed. Uinvariate and multivariate logistic analyses were used to determine factors related to frequency of hemorrhage.
Results: Optic disc hemorrhage was associated with systemic hypertension (odds ratio 1.998; 95% confidence interval, 1.094-3.651; P = 0.001). IOP range (P = 0.080), diabetes (P = 0.056), and use of aspirin (P = 0.079) also tended to be associated with optic disc hemorrhage. No risk factor was significantly different between the single hemorrhage group and the recurrent hemorrhage group.
Conclusion: Optic disc hemorrhage was associated with systemic hypertension in patients with normal tension glaucoma.
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P317 THE ROLE OF HEMORHEOLOGIC FACTORS IN ETIOPATHOGENESIS OF NORMAL TENSION GLAUCOMA

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Purpose: The etiopathogenesis of normal tension glaucoma (NTG) is still controversial. Systemic hypotension, cerebrovascular disease risk factors, abnormal blood flow and coagulability may have a role in NTG etiopathogenesis. Matsumoto et al. showed increased platelet aggregation in NTG patients. Backhouse et al. reported two hyperhomocysteinemia and one Factor-5 Leiden mutation in 27 NTG patients. The pur-

pose of our study was to investigate the role of hemorheologic factors in etiopathogenesis of NTG.
Design: Prospective study.
Participants and controls: Study and control groups were conducted from 31 NTG patients and 32 healthy subjects (age and sex matched), respectively.
Methods: The subjects were enrolled after Institutional Review Board approval. Written informed consent was taken from all participants. None of the participants were using cigarette or a drug that can alter hemorheologic system. Hemorheologic factors were evaluated by studying protrombin time, activated partial thromboplastin time, fibrinogen levels and factor 5, protein C, protein S, antitrombin-3 activities. The student-t test was used to compare the data gathered from the study and control groups. A p value less than 0.05 were considered as statistically significant.
Main outcome measures: Protrombin time, activated partial thromboplastin time, fibrinogen level and factor 5, protein C, protein S, antitrombin-3 activities.
Results: In NTG and control groups, the mean protrombin time was 13.61 ± 3.01 and 14.22 ± 2.02 seconds; activated partial thromboplastin time was 26.97 ± 2.68 and 27.97 ± 3.23 seconds; fibrinogen level was 373.7 ± 67.93 and 313.59 ± 62.85 mg/dl; factor 5 activity was 77.31 ± 21.95% and 85.24 ± 24.40%; protein C activity was 101.29 ± 19.59% and 93.05 ± 14.75%; protein S activity was 89.61 ± 28.08% and 96.32 ± 34.48% and antithrombin-3 activity was 96.01 ± 24.55% and 90.20 ± 20.72%, respectively. There was not any statistically significant difference between two groups in respect to protrombin time (p = 0,350), activated partial thromboplastin time (p = 0,188), factor 5 activity (p = 0,181), protein C activity (p = 0,064), protein S activity (p = 0,401) and antitrombin-3 activity (p = 0,313). NTG group mean fibrinogen level was statistically significantly higher than the control group (p = 0,001).
Conclusions: Fibrinogen is a major determinant of the plasma viscosity. Garcia-Salinas et al. demonstrated that low blood viscosity has a protective role on optic nerve damage. We demonstrated that fibrinogen levels were higher in NTG patients than normal subjects. Fibrinogen may have a role in the etiopathogenesis of NTG.
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P318 TO STUDY THE ROLE OF DISC HAEMORRHAGE AND VISUAL FIELD DEFECT IN RECENTLY DIAGNOSED NORMAL-TENSION GLAUCOMA IN YOUNG ADULT
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Purpose: To study the role of disc haemorrhage and visual field defect in recently-diagnosed normal-tension glaucoma in young adults.
Method: Prospective analysis of 17 patients with disc haemorrhage, who underwent all glaucoma work up mainly in young adults. Over the next year, a progression of visual field defect was noticed in 52.9% of the cases. We excluded ischemic optic neuropathy and systemic disorders which effect the optic nerve, and evaluated the patients with normal vision or with minimal refractive errors, who came in for a routine eye check-up.
Result: Most patients (88.4%) were male. Most of the cases (52.9%) had progression of visual field defect within a year, otherwise normal and systemic examination. Forty-seven percent of the cases had an improved visual field after 3-4 months after diagnosis; then detoriation was noticed in visual field record and at the same time, disc haemorrhage absorbed in these cases. We treated with topical agent to make 30% reduction from base line intra ocular pressure to prevent the visual field detoriation.
Conclusion: It is important to identify and treat normal-tension glaucoma to prevent further progression of visual field detoriation. Detailed opthalmological examination and medical examination is a must in all cases. Frequent disc photography, visual field, recording of intraocular pressure and proper documentation is important and helpful to understand the status of optic nerve at baseline and for future comparison.
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P319 PREPERIMETRIC NORMAL-TENSION GLAUCOMA STUDY: RISK FACTORS FOR GLAUCOMA PROGRESSION
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Purpose: To determine systemic and ocular risk factors for the development of visual field loss or structural progression in preperimetric normal-tension glaucoma (NTG).
Design: Observational cohort study.
Participants: Forty-seven eyes of 47 consecutive patients with preperimetric NTG were enrolled from the Glaucoma Clinic of Seoul National University Hospital.

Methods: During the follow-up time, all patients underwent repeated evaluation of color stereo optic disc photographs and red-free retinal nerve fiber layer (RNFL) photographs, and visual field examination including frequency doubling technology (FDT) perimetry and standard automated perimetry.
Main outcome measure: Univariable and multivariable Cox regression analyses were used to identify factors that predicted progression.
Results: Median follow-up was 47.1 months (range, 12.0-144.0 months). Development of glaucomatous visual field defects or progression of RNFL defects and/or glaucomatous optic disc damage was detected in 15 (31.9%) eyes. Presence of disc hemorrhages (hazard ratio [HR], 10.88; 95% confidence interval [CI], 3.34-35.43), female gender (HR, 3.89; 95% CI, 1.09-13.83), and FDT abnormality (HR, 3.73; 95% CI, 1.05-13.22) were associated with glaucoma progression.
Conclusions: This study identified 3 independent predictive factors for the structural or functional progression in preperimetric NTG eyes.
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9.3. Clinical forms of glaucomas: Primary angle-closure glaucomas

see also P539

P320 STUDY OF PRIMARY ANGLE CLOSURE DISEASE WITH LONG TERM FOLLOW-UP

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Purpose: To evaluate long term management in different stages of angle-closure disease.
Design: Retrospective, noncomparative, interventional case series.
Methods: Eighty-six eyes of 47 patients; primary angle closure suspects (PACS): 22 eyes, primary angle closure (PAC) 40 eyes, and primary angle closure glaucoma (PACG) 24 eyes.
Results: Analyzed at the end of five years. In PACS, 81.81% did not require any further treatment after laser peripheral iridotomy (LPI). Four eyes converted to PAC and required medications. In PAC, the majority of the patients (77.5%) required medications (1.29 average) in addition to LPI. None required filtering surgery for IOP control. Ten eyes of PAC, in whom angle closure was overlooked (elsewhere), were better controlled after LPI. In PACG, 50% controlled with LPI and medications (1.83 average), 41.67% required trabeculectomy, 8.35% underwent combined surgery. Of PACG, 54.17% presented with advanced visual field defects of whom 69.2% underwent filtering surgery. In four eyes presenting with acute angle-closure attacks, 3 (PAC) were controlled with LPI and medications, 1 (PACG) required filtering surgery.
Conclusion: Management in PACS, PAC was essentially nonsurgical. A significant number of patients in PACG required filtering surgery. International Society for Geographical and Epidemiological Ophthalmology (ISGEO) staging of primary angle closure disease is clinically relevant and meaningful (versus traditional classification based on symptomatology into acute or chronic disease) with more advanced stages requiring more aggressive management of glaucoma.
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P321 A FAMILY SCREENING CLINIC FOR PRIMARY ANGLE-CLOSURE GLAUCOMA

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Purpose: To describe the ocular characteristics of white British families with primary angle-closure (PAC) seen in a research screening clinic.
Design: Observational cross-sectional study.
Participants: Relatives of subjects with primary angle-closure (PAC) were invited to a glaucoma screening clinic.
Methods: Full medical history including presentations of 'acute' angle closure, any positive family history of angle-closure or glaucoma, and detailed pedigree charting was performed. Subjects were examined with slit-lamp biomicroscopy, gonioscopy, axial biometry for anterior chamber depth

(ACD) and axial length (AL), and anterior segment optical coherence tomography. Visual field examinations and optic head topography were performed if glaucoma was suspected. Venous blood samples were taken for future genetic studies. Subjects 'affected' by PAC were defined by iridotrabecular contact (ITC) in ≥ two quadrants with elevated IOP/ evidence of peripheral anterior synechiae. Subjects with ITC only were PAC suspects (PACS). PAC glaucoma (PACG) was defined as a visual field defect of < -5.00dB mean deviation/ cup: disc ratios of ≥0.7. Average ACD and AL for affected and unaffected participants were compared to age-specific means derived from the EPIC-Norfolk population-based study (n = 1,961). Only data from right eyes were used for analysis of ACD and AL. Statistical significance was tested with an independent samples t-test. Further management as a result of screening was performed as clinically indicated.

Main outcome measures: (A) Gonioscopic evidence of ITC in ≥two quadrants to define affected status. (B) Categorical diagnosis per subject using the worse affected eye. (C) ACD and AL for affected and unaffected individuals compared to age-specific means of the normative EPIC-Norfolk cohort.

Results: Eighteen families (129 subjects) are presented. One hundred-nine had full phenotyping examinations; 9 had some clinical data available; 11 provided blood samples only. Six families (33%) had a relative presenting with 'acute' angle-closure and 40% of relatives screened (n = 45) were previously unaware of a positive family history of the disease. Fifty-one cases had PACS (n = 19), PAC (n = 22), PACG (n = 10). No statistical difference was found between sex and affected status (chi-squared test, p = 0.71). The mean age(s) for unaffected/PACS/ PAC/ PACG subjects were 49, 50, 59, and 69 years. Affected subjects in each diagnostic group had shorter axial biometry relative to age-specific means. Average ACD = 2.6 mm and AL = 22.2 mm was shorter for affected individuals ($p < 0.001$, $p < 0.001$) compared to population-controls. Average ACD and AL for unaffected subjects were 3.2 mm and 23.7 mm compared to 3.1 mm and 23.4 mm for EPIC-Norfolk ($p = 0.14$, $p = 0.18$). Excluding the probands, 1 in 4 relatives screened required prophylactic laser iridotomy.

Conclusions: Majority of the families seen had asymptomatic angle-closure and were unaware of a positive family history. Thirty percent of relatives required either prophylactic laser treatment or monitoring for PAC. Shorter axial biometry observed in affected subjects is consistent with previous family studies of PACG. A family-based approach to screen for PAC is highly recommended. These families represent an excellent resource for genetic studies in the future.

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P322 - withdrawn

9.3.1. Clinical forms of glaucomas: Primary angle-closure glaucomas: Acute primary angle-closure glaucoma (pupillary block)

see also P031

P323 CORNEAL ENDOTHELIAL CELL LOSS AFTER ACUTE ANGLE-CLOSURE GLAUCOMA

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Purpose: To determine the effect on the corneal endothelium following acute angle-closure glaucoma attack.

Methods: Consecutively, 42 cases of angle-closure glaucoma with acute attack were enrolled. After the acute attack was resolved with medical treatment, the central endothelial cell density was measured by specular microscopy and the number of acute angle-closure attacks, best corrected visual acuity and intraocular pressure during the acute attack were reviewed from medical records.

Results: The mean central endothelial cell density, average area, average area of the 42 eyes was 2171 ± 708 cells/ mm^2, 537 ± 309 μm respectively. The average endothelial cell density of 32 eyes (76.2%) with one documented attack (group A), two attacks (group B), three attacks (group C) were 2346 cells/ mm^2, 1878 cells/ mm^2, 882 cells/mm^2 respectively. There was a clear correlation between the number of acute angle closure attack and the number of central corneal endothelium cell lost.

Conclusions: Our results show that significant cell loss occurs after the recurrence of acute angle-closure attack. Proper management is necessary not to recur acute attack to preserve corneal endothelial cell in patients with one or more acute angle closure attack.

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P324 CLINICAL CHARACTERISTICS OF PATIENTS WITH SIGNIFICANT REDUCTION OF PERIPAPILLARY RETINAL NERVE FIBER LAYER THICKNESS AFTER PRIMARY ANGLE CLOSURE

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Purpose: To analyze the clinical characteristics of patients with the significant reduction of peripapillary retinal nerve fiber layer (RNFL) thickness after acute primary angle-closure attack.

Design: Retospective case series study.
Participants: Twenty-two patients who had a single unioocular acute primary angle-closure attack (intraocular pressure (IOP) ≥40 mmHg and attack symptom).
Methods: During the attack, each patient underwent visual acuity measurement, applanation tonometry, gonioscopy, and slit-lamp examination. At 3 months after remission, Stratus optical coherence tomography (OCT) was used to measure the peripapillary RNFL thickness (fast RNFL scan) and optic disc parameters in affected and fellow eyes. Significant RNFL thinning in superior-temporal and inferior-temporal region of optic disc was judged by the clock-hour analysis (≤5 percentile and ≥1 hour).
Main outcome measures: Clinical characteristics between affected normal RNFL group and abnormal group.
Results: Average, superior, and inferior RNFL thickness of affected eyes were significantly reduced in comparison with fellow eyes (P < 0.05). Among the affected eyes, 9 eyes had a significant decrease of RNFL thickness. Affected abnormal RNFL group and affected normal RNFL group were similar in IOP, refraction, disc area, and cup area, but abnormal group had significantly older age, thinner central corneal thickness (CCT), and more prolonged attack duration (P < 0.05). In addition, OCT showed that thickness of average, superior, and inferior RNFL and rim area were diminished but cup-disc vertical ratio (CDVR) was increased in affected abnormal group compared to affected normal group (P < 0.05). Diabetes and hypertension had no effect on the change of RNFL thickness in affected eyes (P = 0.3328, 0.8059).
Conclusions: After acute primary angle-closure attack, there may be the reduction of RNFL thickness. This study demonstrates that patients with more significant decrease of RNFL thickness have usually old age, thin CCT, and prolonged attack duration.
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P325 RISK FACTORS FOR FAILURE OF PROPHYLACTIC IRIDOTOMY AND PREVENTION OF ACUTE ANGLE CLOSURE

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Objective: To identify risk factors for acute presentation of primary angle closure in a hospital based setting in Australia.
Design: A hospital based retrospective, case control study.
Materials and Methods: A total of 55 patients who visited with an acute angle-closure attack (cases) and 43 who came to the hospital for an iridotomy (controls) from January 2005 through December 2007 were questioned regarding their demographic background, socio economic status along with accessibility to and frequency of eye examinations. The odds ratio for missing primary angle-closure patients resulting in their presentation to the hospital with an acute attack were analysed utilizing the logistic regression model.
Results: Of the 55 cases with an acute angle closure attack included in the study, 30 (55%) confirmed to having annual or biennial eye examination compared to 30 of 43 (70%) control patients who had a timely iridotomy (p = 0.14). However, those presenting with an acute angle-closure attack were less likely to have had an eye examination within 12 months of presentation (odds ratio = 3.25, CI = 1.12,9.39, p-value 0.029), despite being symptomatic (odds ratio = 7.07, CI = 2.32,21.53, p-value 0.001) compared to those who had a timely iridotomy. Use of eye drops was found to decrease the likelihood of missing patients with an angle closure (odds ratio = 0.31, CI = 0.10,0.99, p-value 0.048). Demographic and socioeconomic profile of patients did not increase the likelihood of primary angle-closure (PAC) patients being missed and thereby presenting with an acute attack (not having a timely iridotomy).
Conclusions: Lack of early intervention (iridotomy) among symptomatic angle-closure patients is associated with their presentation as an acute angle closure attack. Despite routine eye examination and accessibility to eye care, a large proportion of the PAC patients fail to be treated. While socioeconomic deprivation is less likely to be associated with a failure to have a timely intervention (iridotomy) among PAC patients lack of awareness towards angle closure may be one of the reasons, in a developed country like Australia.
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9.3.2. Clinical forms of glaucomas: Primary angle-closure glaucomas: Chronic primary angle-closure glaucoma (pupillary block)

see also P062

P326 PRESENTING CHARACTERISTICS OF CHRONIC PRIMARY ANGLE-CLOSURE GLAUCOMA VERSUS PRIMARY OPEN-ANGLE GLAUCOMA IN SINGAPORE

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Purpose: Chronic primary angle-closure glaucoma (CPACG) is a major health problem in Singapore which results in severe visual loss. This study aims to describe the presenting disease characteristics of a consecutive cohort of Asian CPACG patients, and compare them directly with a similarly collected sample of POAG patients.
Design: This is a prospective comparative study of new CPACG and POAG patients in Singapore.
Participants: A consecutive cohort of new CPACG patients and POAG patients.
Methods: CPACG is defined as glaucoma (visual field defect, glaucomatous optic neuropathy and at least one recorded IOP greater than 21 mmHg) in the presence of an occludable angle and peripheral anterior synechiae (PAS). POAG is defined as glaucoma in the presence of an open angle. Slit-lamp examination, tonometry, gonioscopy, refraction, scanning laser ophthalmoscopic optic nerve assessment (HRT) and Humphrey visual field assessment (HVF) was performed for each patient.
Results: There were a total of 50 CPACG and 44 POAG eyes. The average age of presentation was 66.5 in CPACG eyes and 64.3 in POAG eyes. The male to female ratio of CPACG eyes was 2:3 and POAG eyes was 2:1 ($p = 0.01$). Severity of disease at presentation was determined by presenting IOP, HVF and HRT findings. The average presenting IOP of CPACG eyes was 26.9 mmHg and that of POAG eyes was 24.5 mmHg ($p = 0.035$). There was a mean of 4 quadrants of PAS at initial CPACG presentation. The mean MD of the HVF for CPACG eyes was -9.70 and POAG eyes was -8.94 ($p = 0.67$) and mean PSD of the HVF for CPACG eyes was 4.86 and POAG eyes was 5.36 ($p = 0.481$). The mean linear cup: disc ratio on HRT was 0.68 for CPACG eyes and 0.67 for POAG eyes ($p = 0.857$); rim area was 1.32 in CPACG and 1.17 for POAG eyes ($p = 0.126$)
Conclusions: CPACG affects women significantly more than men as compared to POAG and the presenting IOP in CPACG is higher than in POAG. However, the severity of optic nerve damage at presentation as determined by HVF and HRT findings are not significantly different between POAG and CPACG. A long-term follow-up study would help to further characterize and compare the progression of the two diseases.
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P327 THE RESULT OF MANAGEMENT IN PRIMARY ANGLE-CLOSURE GLAUCOMA FOR INDONESIANS' EYES

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Purpose: To evaluate the result of various management on PACG for Indonesians' eyes.
Methods: A retrospective descriptive study of Indonesian PACG subjects was conducted at the Glaucoma unit, Departement of Ophthalmology, Dr Cipto Mangunkusumo General Hospital (CMGH). The data were collected from medical records starting from January 2005 until December 2008. All PACG patients underwent full glaucoma eye examination upon admission and followed their up for one year. We assessed the result of laser peripheral iridectomy, surgery (trabeculectomy and/or facoemulsification + IOL) and glaucoma medical treatment in terms of intraocular pressure.
Results: This study asseessed the result of various management on 166 eyes of 83 PACG patients. The mean age was 61 years and 70% of the patients were female. Forty-nine eyes were already blind; 24% were patients, blind in both eyes and 76% was blind in one eye. Of the remaining 117 eyes, 92 eyes had an advanced stage of glaucoma and 48 eyes had a mild stage. Various management had been done: iridectomy on 81 eyes, trabeculectomy on 15 eyes and phacoemulsification +IOL on 19 eyes. Combined phacoemeulsification + IOL and trabeculectomy had been done on 2 eyes. One year after surgery, 40% of the eyes had an IOP of less than 15 mmHg, 85% had an IOP of less than 21 mmHg and 15% eyes had an IOP of more than 21 mmHg. Long-term IOP more than 21 mmHg after laser iridectomy was in 20% patients, which may coincide with other factors beside the pupillary block. However, all eyes were still having glaucoma medication despite of glaucoma surgery to prevent progression.
Conclusions: Management using PACG was suggested according to indications of: visual acuity, degree of angle closure, with cataract or not, medical requirement and optic nerve damage.
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9.3.5. Clinical forms of glaucomas: Primary angle closure glaucomas: Primary angle closure

see P225, P401, P443, P531

9.3.10. Clinical forms of glaucomas: Primary angle closure glaucomas: Other

see P063

9.4.1. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Steroid-induced glaucoma

P328 CONTROL OF STEROID-INDUCED GLAUCOMA WITH SURGICAL EXCISION OF SUBCONJUNCTIVAL TRIAMCINOLONE ACETONIDE DEPOSITS: A CLINICAL AND BIOCHEMICAL APPROACH

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Purpose: To assess the efficacy of surgical excision of subconjunctival triamcinolone acetonide (TA) deposits in the control of steroid-induced glaucoma.
Design: Interventional clinical study.
Participants: Fourteen subjects presented with increased intraocular pressure (IOP) within 6 months following sub-Tenon TA injection with the diagnoses of diabetic macular edema, retinal vein occlusion, uveitis and choroid neovascular membrane.
Methods: Under topical anesthesia, the plaque of steroid deposits was completely excised and placed in ethyl-alcohol for the determination of the TA amount using high-pressure liquid chromatography. All patients were followed for IOP after the excision of the plaques. Correlation between the amount of excised steroid and IOP decrease after the excision was analyzed using Spearman correlation coefficient.
Main outcome measure: IOP decrease after excision of steroid deposits.
Results: The mean IOP levels before and after the sub-Tenon steroid injections were 15.9 ± 2.9 mmHg and 36.4 ± 8.4 mmHg, respectively ($p < 0.001$). IOP levels decreased significantly within one month after the removal of the deposits (mean; 15.3 ± 2.1 mmHg) ($p < 0.001$). In 9 subjects, all glaucoma medications were stopped without further IOP increase, whereas, IOP control in 5 subjects has necessitated using glaucoma medications. Median TA concentration was found as 7.35 mg (range between 3.33-29.68 mg). No correlation could be found between the amount of excised steroid and IOP decrease after the excision ($p = 0.5$).
Conclusions: Surgical excision of the subconjunctival depot steroid should be considered as the primary treatment for steroid-induced glaucoma refractory to medical treatment, as it is very effective on IOP lowering with no significant complications.

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P329 INTRAOCULAR PRESSURE ELEVATION ASSOCIATED WITH USE OF NASAL CORTICOSTEROIDS SPRAYS

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Objective: To evaluate the incidence of steroid induced ocular hypertension in patients receiving chronic therapy with nasal corticosteroids sprays.
Design: Observational clinical study.
Participants: Thirty-five patients with allergic rhinosinusitis.
Methods: The patients enrolled in the study were receiving corticosteroid nasal sprays for allergic rhinosinusitis and allied sinonasal pathology like nasal polyposis. All patients underwent detailed ocular examination including gonioscopy with goldmann single mirror, optic disc assessment with 90D lens, Intraocular pressure (IOP) estimation with Tonopen XL tonometer (3 readings). All patients underwent standard automated perimetry using 30-2 SITA standard program. Central corneal thickness (CCT) was measured using ultrasonic pachymetry. None of the enrolled patients had a family history of glaucoma.
Main outcome measures: Intraocular pressure, disc changes and visual field defects if any.
Results: The mean age of the subjects was 33.6 ± 6.8 yrs. Out of 35 patients, 28 were on fluticasone propionate (50 µg BD), 4 on budesonide (100 µg BD), 2 on mometasone furoate (50 µg BD) and 1 on ciclesonide (50 µg BD). The mean duration of steroid use was 5.3 ± 2.6 months (range 3-9 months). Elevated IOP (> 22 mmHg) was detected in 5 out of 35

patients (14.3%). Four patients had IOP elevation in both eyes, while one patient had uniocular IOP elevation (range from 23-28 mmHg). The CCT in eyes with elevated IOP ranged from 500-540 µm. Optic discs and visual fields did not show any changes suggestive of glaucomatous damage.
Conclusions: Corticosteroids administered by the nasal route in the form of sprays may cause ocular hypertension in susceptible patients. Baseline IOP assessment and regular IOP monitoring is recommended in patients using nasal steroid sprays on regular basis.
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9.4.3.1. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas associated with disorders of the iris and ciliary body: Pigmentary glaucoma

P330 WHAT MAINTAINS THE IRIS CURVATURE IN PIGMENT DISPERSION SYNDROME?

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Purpose: Eyes with pigment dispersion syndrome (PDS) demonstrate posterior bowing of the iris which has been shown to reverse with the prevention of blinking and increase with accommodation. Using anterior segment optical coherence tomography (AS-OCT) technology, we sought to evaluate these findings by observing the changes in iris contour of PDS patients following blinking, accommodation and pharmacological miosis.
Design: Observational case series.
Participants: Seven eyes of 5 patients with clinically diagnosed PDS and no previous history of laser iridotomy were examined.
Methods: Subjects were imaged using the Visante AS-OCT (Carl Zeiss Meditec, Dublin, CA). Scans were obtained in the 0-180 degree meridian at t = 0 and 5 minutes during which the subjects were asked to focus steadily on the internal fixation target (which was monitored using the pupil tracking screen) and allowed to blink. After 5 minutes, the subjects continued to focus on the target and further scans were obtained after being asked to blink continuously for 10 seconds, placing a -3.0 D and then a -6.0 D lens in front of the study eye respectively (to induce accommodation) and instilling pilocarpine 2%.
Main outcome measure: The iris curvature was evaluated by drawing a line from the iris root to the point of iridolenticular contact closest to the pupil margin, then measuring the maximum perpendicular distance to the posterior iris.
Results: After 5 minutes of fixation, the iris became planar with the curvature decreasing from 255 ± 127 µm to 29 ± 97 µm. Blinking failed to restore the posterior iris concavity in all PDS patients, but the iris curvature increased to 229 ± 101 µm and 250 ± 109 µm with the -3.0 D and -6.0 D lens respectively. Pilocarpine-induced miosis produced a planar iris configuration in all subjects.
Conclusions: Our results show that the iris assumes a planar configuration when fixating, even when blinking was permitted. Accommodation, instead of blinking, restored iris concavity, which suggests that the posterior curvature of the iris in PDS is maintained by the accommodative changes of the lens.
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P331 CLINICAL CHARACTERISTICS OF PIGMENT DISPERSION SYNDROME IN CHINESE PATIENTS

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Purpose: To report clinical findings and characteristics of pigment dispersion syndrome (PDS) in Chinese patients.
Design: Prospective consecutive clinical series.
Participants: All outpatients presenting for care at the glaucoma specialty clinic at Beijing Tongren Eye Center, Beijing from May 2006 to April 2007 were evaluated for PDS if the patient had any one of the following signs: corneal endothelial pigmentation, anterior iris stromal pigment dusting, ITDs, posterior iris bowing, increased TM pigmentation, and pigment granule dusting on lens zonules or peripheral posterior surface.
Methods: All enrolled patients received detailed ophthalmic examinations included visual acuity measurement, IOP measurement, refraction, slit lamp biomicroscopy pre- and post-mydriasis, gonioscopy, funduscopic examination, and automated Humphrey SITA-standard 30-2 visual field test. Systemic and ocular medical history of each subject was also recorded. Diagnostic criteria for PDS included at least two of the following three signs: Krukenberg spindle, homogenous moderate to heavy (≥Scheie II) TM pigmentation, and any degree of zonular and/or lenticular pigment granule dusting. Patients with a history of uveitis, trauma, previous ocular surgery or anterior segment laser treatment, or any evidence of exfoliation material were excluded.

Main outcome measure: Age and gender distribution, family history for both glaucoma and PDS, initial intraocular pressure at diagnosis, refractive error, occurance of Krukenberg spindle, iris transillumination defects, homogenous increased trabecular meshwork pigmentation and zonular and/or lenticular pigmentation.
Results: Eighteen subjects (12 males and 6 females) were identified as having PDS out of 94 PDS suspects in the glaucoma specialty clinic according to the diagnostic criteria. Mean age of the PDS patients was 35.5 ± 7.0 years (range, 22-49). The average ages for male and female subjects were 35.7 ± 6.9 (range, 22-48) and 35.2 ± 8.0 (range, 26-49) years, respectively. All subjects except two eyes of two patients had myopia of -0.5 D or greater, with mean refractive error of -5.20 ± 5.79 spherical equivalent diopters (range, -24.75-+0.5). Seventeen of 18 patients had increased initial IOP of greater than 21 mmHg in at least one eye at the time of diagnosis, with an average of 33.8 ± 10.4 mmHg (range, 17-56). Three subjects had family history of glaucoma. Another four had family history of PDS. Eleven patients (61.1%) had Krukenberg spindles, which were bilateral in eight and unilateral in three. The typical appearance of 'Krukenberg spindle' in these patients was somewhat more like a 'triangle', rather than a spindle. Of the remaining seven, three had trace diffuse corneal endothelial pigmentation and four had no corneal pigment dusting. Typical spoke-like radial ITDs were not discerned in any of the subjects. In two patients, the most myopic of the group, isolated short slit-like transillumination defects were visualized in iris crypts. Homogeneous TM pigmentation and pigment granule dusting on lens zonules and/or peripheral posterior lens surface were seen in all patients.
Conclusions: The clinical characteristics of Chinese PDS patients are different from those of typical form in white patients. ITDs are uncommon in Chinese PDS patients. The most common clinical findings in Chinese PDS patients include homogeneous TM pigmentation and pigment granule dusting on lens zonules and/or posterior peripheral lens surface.

9.4.4. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas associated with disorders of the lens

P332 VISUAL OUTCOME AFTER PHACOEMUSIFICATION AND IOL IMPLANTATION IN LENS-INDUCED GLAUCOMAS

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Objective: Lens-induced glaucomas are a common occurrence in India and remain one of the important cause of secondary glaucoma in remote part of Indian population. The objective of this study was to evaluate visual outcome and IOP control phacoemusification and IOL implantation in lens-induced glaucomas.
Design: Retrospective study.
Participants: Fifty-four cases of lens-induced glaucoma presenting to SuVi Eye Institute & Research Centre, Kota, Rajasthan, India from February 2006 to January 2009 were analyzed to find the visual outcome, IOP control, and duration between appearance of symptoms and surgical invention.
Interventions: Phacoemulsification and phacoemulsification combined with trabeculectomy.
Main outcome measure: Visual acuity and IOP control.
Results: A total of 54 cases 50 cases underwent phacoemulsification and IOL implantation. Four cases underwent phacoemulsification with trabeculectomy. Phacomorphic glaucoma was seen more than phacolytic type (70:30). Visual recovery was good in 40% cases (20/40-20/200) and moderately fair in 30% cases (VA < 20/200). Preoperative IOP ranged from 26.0-48.0 mmHg (Applanation). Postoperative IOP ranged from 12-24 mmHg. Duration between symptoms and surgery was 2 days to 3 months. The main causes for poor outcome in were corneal edema, uveitis and glaucomatous optic atrophy.
Conclusion: The population in remote part of country has a belief that they should undergo cataract surgery once cataract is' ripe' (fully matured). Results of this study highlight the importance of early diagnosis and treatment of visually disabling cataract specially in the remote part of country. There is a need to educate both the patient and the cataract surgeon of the dangers of lens-induced glaucoma and of the poor outcome if treatment is delayed.
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9.4.4.1. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas associated with disorders of the lens: Exfoliation syndrome

see also P044, P096, P103, P202, P354, P425, P430, P451, P554

P333 SYSTEMIC ENDOTHELIAL DYSFUNCTION IN PATIENTS WITH PSEUDOEXFOLIATION GLAUCOMA

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Introduction: Endothelial dysfunction was found in pseudoexfoliation (PEX) syndrome and normal-pressure glaucoma patients. Impaired vascular endothelial dysfunction is associated with an increased cardiovascular risk. Brachial artery flow-mediated dilatation (FMD) and carotid intima-media thickness (IMT) has emerged as the most common assessment tools of systemic endothelial function and an independent predictor of cardiovascular events.

Purpose: To evaluate endothelial function of the brachial artery (FMD) and IMT in patients with PEX glaucoma
Design: A case-controlled prospective study.
Participants: We prospectively examined 38 patients with PEX glaucoma and 31 age- and sex-matched individuals as a control group.
Methods: IMT and brachial artery endothelial response to flow-mediated dilation was assessed by using high-resolution Doppler ultrasound.
Main outcome measure: Dilation of brachial artery was expressed as the percent change in diameter relative to the baseline diameter. The mean IMT of the four measurements of both the left and right common carotid artery was calculated in each patient carotid plaque was defined as IMT > 1.3 mm.
Results: Patients with PEX glaucoma had significantly lower FMD (5.4 ± 0.6 *vs* 5.9 ± 0.4 in the control group, p = 0.003). No significant difference in IMT (1.24 ± 0.4 *vs* 1.14 ± 0.8) was found. FMD was correlated negatively with IMT.
Conclusions: This study showed a statistically significant association between PEX glaucoma and systemic vascular endothelial dysfunction. FMD evaluation can be considered in PEX glaucoma patients as a predictor of cardiovascular events.
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P334 EXFOLIATION SYNDROME AND ABDOMINAL AORTIC ANEURYSM

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Aim: We assessed the association between exfoliation syndromes, a common age related fibrillopathy of unknown cause, and vascular diseases, especially aneurysms of the abdominal aorta.
Patients and method: In this prospective study we examined 170 pathogens, suffering from exfoliation with and without glaucoma. All patients were categorized in three grades based on the density of exfoliative material observed with biomicroscopy, as well as the presence or absence of glaucoma.
Results: Among them 28 (16,7%) patients were recently operated for abdominal aortic aneurisym. Eighteen of these 28 (64%) with aortic aneurisym showed signs of manifest, 2 (7,14%) showed early stage, and 8 (28,6%) showed signs of similar exfoliation syndrome with grades II. Of the patients suffering from exfoliative syndrome without abdominal aneurisym, 32 of 142 (22%) showed signs of manifest, 85 of 142 (40%) were in second group, and 52 of 142 (36%) showed early stage.
Conclusion: The findings suggest an association between aneurysms of the abdominal aorta and exfoliation syndrome.
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P335 RETROBULBAR HEMODYNAMIC PARAMETERS IN PSEUDOEXFOLIATION SYNDROME AND PSEUDOEXFOLIATIVE GLAUCOMA

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Purpose: To compare the hemodynamic parameters in the retrobulbar vessels in pseudoexfoliative syndrome (PXS), pseudoexfoliative glaucoma (PXG), and age-matched healthy subjects by using color Doppler imaging (CDI).
Design: A prospective and randomized study.
Participants: Twenty-five eyes from 25 patients with PXS, 25 eyes from 25 patients with PXG, and 20 eyes from 20 age-matched healthy subjects were included in this prospective study.
Methods: Peak systolic velocity (PSV), end-diastolic velocity (EDV), pulsatility index(PI) and resistance index (RI) were assessed in the ophthalmic artery (OA), central retinal artery (CRA), temporal and nasal short-posterior ciliary arteries by using CDI.
Main outcome measures: Peak systolic velocity (PSV), end-diastolic velocity (EDV), pulsatility index(PI) and resistance index (RI) were assessed in the ophthalmic artery (OA), central retinal artery (CRA), temporal and nasal short-posterior ciliary arteries measured by using CDI.
Resuts: The RI in the OA and the CRA was increased sig-

nificantly ($p < 0.05$) in the eyes of PXG patients compared with controls and PSX, but we did not find a statistically significant difference beteen PSX patients and healthy subjects ($p > 0.05$). On the other hand the EDV in the CRA was significantly lower ($p < 0.005$) in the eyes of PXG patients compared with healthy controls and PSX patients.
Conclusion: In this study we found that significant retrobulbar hemodynamic changes take place in the eyes with pseudoexfoliative glaucoma. Our results have found no significant differences in the retrobulbar hemodynamic parameters between pseudoexfoliative syndrome patients and age-matched healthy subjects.
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P336 CORNEAL ENDOTHELIAL CHANGES IN PSEUDOEXFOLIATION SYNDROME AND PSEUDOEXFOLIATION GLAUCOMA

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Purpose: To compare corneal endothelial changes in pseudoexfoliation syndrome (PXFS) and pseudoexfoliation glaucoma (PXFG).
Study design: Prospective, comparative hospital based study.
Material and methods: Seventy eyes of PXFG and 62 eyes of PXFS underwent confocal microscopy. Patients with PXFS were included, based on the identification of pseudoexfoliative material in any site within the eye. PXFG patients among these were identified by presence of raised IOP, opic disc changes and visual field changes. Corneal endothelial cell count was done following confocal microscopy on HRT II Rostock cornea module.
Results: In our study, the mean cell density (MCD) in eyes with PXFG was 2240.70 (± 354) cells/mm^2 compared with MCD in eyes with PXFS that was 2334.42 (± 256) cells/mm^2. There was no statistically significant difference between the two groups ($p = 0.087$). These MCD counts were lesser than the normal MCD by confocal microscopy reported in literature as 2979 (± 301) cells/mm^2. All PXF and PXFG eyes showed pleomorphism and polymegathism.
Conclusion: Pseudoexfoliation keratopathy may potentiate the known complications of cataract and glaucoma surgery and may result in corneal decompensation in these patients even with normal IOP. In-vivo confocal microscopy helps in measuring mean endothelial cell density and identifying those patients with low endothelial cell counts. Both PXFS and PXFG are associated with lower endothelial cell counts compared to normal reported in literature. The presence or absence of glaucoma does not significantly affect the corneal endothelial cell status in pseudoexfoliation patients.
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9.4.4.5. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas associated with disorders of the lens: Other

P337 BILATERAL PHACOMORPHIC GLAUCOMA IN A HIGHLY MYOPIC PATIENT SECONDARY TO SPHEROPHAKIA

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Objective: To present the diagnosis, pathophysiologic mechanism, and management of a patient with both high myopia and bilateral advanced phacomorphic glaucoma due to spherophakia.
Design: Interventional case report.
Participants: Forty-year old asymptomatic (-) 17.50 diopter male with chronic angle closure, intraocular pressure of 42 mmHg OU, a non-myopic fundus, and 24-mm axial length with a clear crystalline lens protruding through pupillary plane. B-scan ultrasonography reveals a round lens protruding through the pupillary plane.
Methods: Gonioscopy, A-scan and B-scan ultrasonography identify pathogenesis of intraocular pressure elevation and nature of lens-induced angle closure and high myopia.
Main outcome measure: Pupil block angle closure and high myopia both demonstrated to be a result of spherophakia.
Results: Initial medical therapy and subsequent laser iridotomy relieved pupil block and successfully lowered intraocular pressure.
Conclusions: Angle closure can occur in highly myopic eyes. This report details one such cause. Careful gonioscopy and ultrasonography can lead to the correct diagnosis and tailored management for these eyes.
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9.4.5. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas associated with disorders of the retina, choroids and vitreous

P338 THE EFFECT OF PROPHYLACTIC USE OF ANTI-GLAUCOMA MEDICATIONS ON IOP SPIKES AFTER INTRAVITREAL INJECTIONS OF ANTI-VEGF FOR EXUDATIVE AMD

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Purpose: To determine if prophylactic use of anti-glaucoma medication is effective in reducing the IOP spikes after intravitreal injections of pegaptanib, bevacizumab, and ranibizumab in patients with exudative AMD.
Methods: Seventy-one patients (total of 300 injections) with exudative AMD received intravitreal injections of one of three anti-VEGF medications: 100 eyes received pegaptanib (0.09 ml), 100 received bevacizumab (0.05 ml), and 100 ranibizumab (0.05 ml). IOP lowering medication, one hour prior to the injection, was used in 84%, 56% and 68% times in eyes that received pegaptanib, ranibizumab, and bevacizumab respectively. IOP was measured prior to injection, within one minute after injection, and every 5-10 minutes until the pressure was reduced to a safe level.
Results: All three intravitreal injections caused significant initial IOP spikes-mean IOP of 41.25 ± 12.76 mmHg in pegaptanib group, 37.31 ± 8.48 mmHg in ranibizumab group, and 36.28 ± 10.34 mmHg in bevacizumab group. The IOP reduced to less than 30 mmHg in all the three groups within 20 minutes. Prophylactic medication did not prevent post-injection IOP spikes. Patients with and without glaucoma showed a similar rate of IOP normalization over time in all the three groups.
Conclusion: Prophylactic use of IOP lowering medications is essentially ineffective in preventing IOP spikes after intravitreal injection of pegaptanib, ranibizumab, and bevacizumab and therefore not necessary before the injection.
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P339 BEVACIZUMAB IN INTRACAMERAL VERSUS INTRAVITREAL INJECTION AS AN ADDITIONAL STRATEGY IN NEOVASCULAR GLAUCOMA TREATMENT

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Purpose: To compare effectiveness of bevacizumab in intracameral versus intravitreal injection as an additional strategy in patients suffering from noevascular glaucoma.
Design: Retrospective case series
Participants: Nine patients diagnosed with secondary neovascular glaucoma due to CRVO (n = 3) and proliferative diabetic retinopathy (n = 6).
Intervention or methods or testing: All patients received 1,25 mg of bevacizumab in intravitreal (group 1, n = 4) and intracameral (group 2, n = 5) injections. Only patients with posterior synechiae, non responding for mydriasis received intracameral injection. After injection both study groups underwent panretinal photocoagulation (PRP) except of 2 cases from 2nd group were krioapplication of peripheral retina was performed.
Main outcome measure: Visual acuity, intraocular pressure (IOP), presence of anterior segment neovascularization were recorded and observed in time.
Results: We observed neovascular regression in all cases the day after injection. After PRP or krioapplication we observed stabilization of IOP value. Glaucoma was controlled only with topical eye drops in both study groups and stable in the follow-up period –average 182 days. There was no peripheral anterior synechiae (PAS) neither in the 1st group nor in the 2nd. Neovasular regression was reported only in one patient with proliferative diabetic retinopathy 2 months after receiving intracameral injection and krioapplication of peripheral retina.
Conclusions: bevacizumab in intracameral as well as in intravitreal injection is a valuable and effective addition in the treatment of neovascular glaucoma. The majority of studies is focused on intravitreal injections of bevacizumab because the cause of ischemia in CRVO and proliferative diabetic retinopathy is primary placed in the posterior segment. However we observed equal effectiveness of intracameral and intravitreal injections in the follow up period but more study is needed on bevacizumab's toxicity to endothelium, trabeculum or lens.
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9.4.5.1. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas associated with disorders of the retina, choroids and vitreous: Neovascular glaucoma

see also P444, P463, P505, P528, P534

P340 TRABECULECTOMY WITH MITOMYCIN C FOR NEOVASCULAR GLAUCOMA: PROGNOSTIC FACTORS FOR SURGICAL FAILURE

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Purpose: To evaluate the prognostic factors for surgical outcomes of trabeculectomy with mitomycin C (MMC) for neovascular glaucoma (NVG).
Design: Retrospective cohort study.
Participants: One hundred one patients (101 eyes).
Methods: We reviewed the medical records of patients with NVG who underwent trabeculectomy with MMC at Kumamoto University Hospital, Japan, between January 1, 1994 and March 31, 2007. If both eyes underwent trabeculectomy with MMC, only the eye that was treated first was included. Eyes with a history of prior trabeculectomy were excluded.
Main outcome measure: The primary endpoint was persistent intraocular pressure > 22 mmHg, deterioration of visual acuity to no light perception, and additional glaucoma procedures. Multivariate analysis was performed using the Cox proportional hazards model.
Results: The mean follow-up period was 29.3 months (range, 0.5 to 142.3 months). The probability of success 1, 2, and 5 years after trabeculectomy was 62.6%, 58.2%, and 51.7%, respectively. The multivariate model showed that younger age (relative risk [RR], 0.96/year $P < 0.0007$) and previous vitrectomy (RR, 1.62; $P = 0.02$) were prognostic factors for surgical failure among all NVG patients. Additionally, an eye with unremoved proliferative membrane and/or unrepaired retinal detachment (RD) after vitrectomy (RR, 1.59; $P = 0.05$) was a probable prognostic factor in a subgroup of 66 eyes with previous vitrectomy, and having a fellow eye with NVG (RR, 1.73; $P < 0.003$) was a significant prognostic factor in 82 eyes with NVG attributable to diabetic retinopathy.
Conclusions: The prognostic factors for surgical failure of trabeculectomy with MMC for NVG were younger age and previous vitrectomy in all NVG patients, and having a fellow eye with NVG in patients with disease caused by diabetic retinopathy. Persistent proliferative membrane and/or RD after vitrectomy might contribute to poorer outcomes of trabeculectomy.
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P341 COURSE OF TREATMENT OF NEOVASCULAR GLAUCOMA WITH INTRAVITREAL BEVACIZUMAB - ONE YEAR FOLLOW-UP

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Purpose: To present our experience with intravitreal bevacizumab in the treatment of neovascular glaucoma.
Design: This is an retrospective interventional case series.
Participants: Twenty-six eyes with neovascular glaucoma (NVG) were treated with intravitreal bevacizumab. In 18 eyes NVG was secondary to proliferative diabetic retinopathy. The other 8 were secondary to central retinal vein occlusion. All eyes had iris and angle neovascularisation and symptomatic elevation of intraocular pressure (IOP).
Methods: Each patient received a single intravitreal injection of 1,25 mg bevacizumab. Additional treatment was performed only if IOP was not well controlled with full topical antiglaucoma therapy. Sixteen patients received panretinal photocoagulation (PRP), and 4 of these required trabeculectomy with mitomycin-C. The other 12 patients received cryoretinopexy and after that combined phacoemulsification and Ahmed Glaucoma Valve implantation. After cataract surgery, these patients received PRP. All patients were followed-up during one year.

Main outcome measure: This method results in imminent, but not permanent regression of iris and angle neovascularisation.
Results: All patients demonstrated rapid regression of iris neovascularisation. Mean time from bevacuzimab injection to regression of the neovascularisation was 4 days. IOP was well controlled in fourteen patients and the other twelve patients received additional treatment. Preoperative visual acuity ranged from hand motion (HM) to 0,075, and postoperative visual acuity ranged from HM to 0.2. Mean IOP before treatment was +44.8 ± 4,5 mmHg. Mean IOP after treatment was 20,9 ± 3,8 mmHg. There were no local side effects, neither systemic complications after intravitreal application of bevacizumab.
Conclusions: Intravitreal bevacizumab may be an important additional treatment for the rapid regression of the neovascularisation in NVG patients. Patients must be monitored after application of bevacizumab, as many may still require glaucoma and/or cataract surgery. Therefore, the approach to the neovascular glaucoma treatment includes cooperation of the glaucoma, vitreoretinal and cataract surgery specialists.
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P342 ROLE OF INJECTION BEVACIZUMAB (AVASTIN) AS AN ADJUNCT IN THE SURGICAL MANAGEMENT OF NEOVASCULAR GLAUCOMA

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Purpose: To evaluate the role of Injection Bevacizumab in the surgical management of neovascular glaucoma.
Design: Prospective, non-randomized, interventional case series.
Participants: Twelve patients.
Methods: Twelve eyes of 12 patients with neovascular glaucoma were included.The causes of neovascular glaucoma were Proliferative Diabetic Retinopathy (7), Central Retinal Vein Obstruction (4) and Uveitis (1). Injection Avastin was considered in patients in whom Panretinal photocoagulation could not be performed preoperatively due to associated ocular conditions like poor pupillary dilatation, corneal edema, cataract or vitreous hemorrhage and in whom immediate surgical intervention was needed due to uncontrolled intraocular pressure (IOP) despite maximal medical treatment. Clinical data included demographics, systemic history, visual acuity, slit lamp examination, applanation tonometry, gonioscopy, fundus and disc examination, date of bevacizumab injection, date of regression of iris/angle neovascularization, number of anti glaucoma medications used, surgical details, complications during surgery, and recurrence of neovascularization. Injection Avastin was given 1.25 mg / 0.05 ml, intravitreally and 0.25 mg / 0.02 ml, intracamerally prior to surgery in all eyes. The surgeries done were Trabeculectomy with mitomycin C (4), Phaco - trabeculectomy with mitomycin C with intraocular lens implantation (6) and tube implants (2). Panretinal photocoagulation was done postoperatively as soon as possible.
Main outcome measures: Clinical outcome assessment included improvement or stabilization of visual acuity, control of intraocular pressure (< 21 mmHg) with or without medication, regression of iris neovascularization (NVI) and identification of complications.
Results: An average of 1.5 injections of Avastin (1.25 mg / 0.05 ml) was given per patient. Marked regression of iris neovascularization was seen in 11 eyes (91.66%). NVI regression was seen within a median of eight days (range 1 to 14 days). The surgery was uneventful in all the patients. None of the patients had bleeding complications intra-operatively or in the early post-operative period. There was a statistically significant ($p = 0.005$) improvement in vision in 9 eyes (75%) from a mean preoperative log MAR visual acuity + SD of 2.08 ± 0.53 to 1.41 ± 0.68. The mean IOP decreased from 43.56 ± 10.30 to 19.00 ± 7.43 mmHg ($p < 0.001$). There was recurrence of NVI with raised IOP in two patients after three months of surgery despite additional laser sittings and were considered as failures.
Conclusions: Injection bevacizumab could be of benefit as a surgical adjuvant in the preoperative preparation of filtering surgery for Neovascular Glaucoma and it may be an advantageous treatment option, especially in eyes with hazy media precluding Panretinal photocoagulation.
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P343 CHANGES OF THE ANTERIOR CHAMBER ANGLE AND THE BIOMECHANICAL PROPERTIES OF THE CORNEA IN PATIENTS WITH SECONDARY NEOVASCULAR GLAUCOMA EXAMINED USING OCT VISANTE AND ORA

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Purpose: To document the changes of the anterior chamber angle and the biomechanical properties of the cornea in patients with secondary neovascular glaucoma (SNVG) examined using OCT Visante and ORA.

Design: Prospective control study.
Participants and controls: We examined the eye with SNVG and compared the findings with the other eye of the patient.
Methods: We examined the anterior segment of the eye in patients with SNVG using OCT Visante and, subsequently, we assessed the findings –the corneal thickness, the anterior chamber depth and the potential angle adhesion. ORA utilizes a patented applanation process to provide a new measurement called corneal hysteresis (CH). Hysteresis is an indicator of the elastic properties of the cornea. The hysteresis measurement enables the calculation of a new intraocular pressure (IOP) measurement called IOPcc (corneal compensated). This measurement is less influenced by corneal properties such as central corneal thickness (CCT). IOPg is Goldmann-correlated IOP measurement.
Main outcome measure: The thickness of the cornea was bigger in the eyes with SNVG than in the other eyes. Hysteresis was lower in the eyes with SNVG in comparison with the healthy eyes.
Results: The thickness of the cornea was bigger in the eyes with SNVG (570 microns) than in the other eyes (550 microns). The depth of the anterior chamber firstly depends on whether the patient is phakic, pseudophakic or aphakic, and secondly on the presence of adhesions in a chamber angle. In the eyes with SNVG and with the adhesions in an angle, the anterior chamber was in all cases shallower (2,22 mm) than in the other eyes (2,39 mm). The anterior chamber angle is in the eyes with SNVG narrower or closed than in the other eyes. Hysteresis was lower on the eyes with SNVG in comparison with the healthy eyes. While CH is in normal eyes around 10 mmHg, in eyes with SNVG was about 3-8 mmHg.
Conclusions: OCT Visante is very helpful in diagnostics and in monitoring the changes of the angle in patients with SNVG. OCT Visante with SNVG is not crucial for the diagnosis. However, it is applicable for a documentation of changes and for taking measures of the thickness of the cornea as well as the depth of the anterior chamber which is directly dependent on the amount of adhesions in an angle. The lowered hysteresis in eyes with SNVG can show undervaluation in measuring IOP. Application of ORA for IOP measuring is more advantageous, because we obtain IOPcc.
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9.4.6. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas associated with inflammation, uveitis

see also P351, P464, P474

P344 CLINICAL PROFILE OF UVEITIS ASSOCIATED WITH SECONDARY GLAUCOMA

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Objective: To study the clinical features associated with the development of secondary glaucoma in patients with uveitis and evaluate the response to medical or surgical treatment.
Design: Prospective observational study.
Participants: Two hundred and seventeen eyes of 150 patients presenting to uvea services at a tertiary care eye centre.
Methods: Two hundred and seventeen eyes of 150 patients with uveitis were evaluated for presence of secondary glaucoma. Patients with secondary glaucoma were started on appropriate antiglaucoma medication, followed up for minimum of 6 months and response to therapy was evaluated.
Main outcome measures: Type of uveitis, disease activity, duration, presence of systemic diseases, IOP, angle configuration, response of IOP to anti-glaucoma treatment.
Results: The population of 150 patients (average age: 32.7 ± 25.4 years; 87 male and 63 female) included 107 eyes (49.3%) with anterior uveitis, 34 eyes (15.7%) with intermediate uveitis, 32 eyes (14.7%) with posterior uveitis and 44 eyes (20.3%) with panuveitis. Of these, 90 eyes (41.5%) had active uveitis at time of presentation while 127 eyes (58.5%) had healed uveitis. Systemic associations were found in 24 of 150 patients (16%) which including 9 cases with pulmonary tuberculosis, 5 cases with HLA-B27 related sacroilitis, 5 cases of Sarcoidosis, 3 cases of juvenile idiopathic arthritis, 1 case each of rheumatoid arthritis and AIDS. Forty-eight eyes (22.1%) were found to have secondary glaucoma (IOP > 22 mmHg) including 20 eyes (41.7%) with anterior, 8 eyes (16.7%) with intermediate and 10 eyes (20.8%) with posterior and panuveitis each. Of these, 24 eyes (50.0%) had gonioscopically open angles while 24 (50.0%) had closed angles (PAS > 180 degrees). Active uveitis was seen in 9 eyes (18.8%) with glaucoma. In the 6-month follow-up period, 38 eyes (79.1%) were controlled on medical treatment alone (initial mean IOP: 26.38 ± 4.6 mmHg; post-treatment IOP: 16.0 ± 2.9 mmHg). Fifteen eyes required a single topical antiglaucoma medication, 13 eyes required 2 topical medications, and 7 eyes required 3 topical medications while 2 eyes were not on any therapy. Laser iridotomy procedure was undertaken in 5 of these eyes for treatment of pupillary block. Nine eyes (18.7%) required a trabeculectomy enhanced with Mitomycin C (0.2 mg/ml) for control of IOP.
Conclusions: Secondary glaucoma was found to have in 22.1% cases of uveitis at presentation. Anatomically, open-angle glaucoma was as frequent as closed angle glaucoma. Nearly 4/5th of patients were controlled on topical anti-glaucoma medications.

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9.4.7. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas associated with ocular trauma

P345 ANGLE RECESSION GLAUCOMA –MANAGEMENT OUTCOMES IN CHITTAGONG, BANGLADESH

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Purpose: To document and describe the patterns of outcomes and management approaches to patients diagnosed with angle recession glaucoma presenting at the Glaucoma Department, Chittagong Eye Infirmary & Training Complex, Bangladesh.
Design: A hospital-based prospective observational case series review.
Participants: Twenty-five patients who were diagnosed with angle recession glaucoma over a one year period from November 1st 2007 to October 31st 2008.
Method: Patient particulars, history and mechanism of trauma were recorded. Ophthalmic examination details (including gonioscopy, intraocular pressure and fundoscopy) and management given were documented. Similar relevant details were recorded for three follow-up periods, on all patients, extending over a total period of 9 months.
Main outcome measure: Significant observations, patterns or associations within the cohort.
Results: Twenty-five patients were included in the study. Twenty-two of the patients were male. The mean age of patients was 34.9 ± 20.84 years (Range: 9-72 yrs). All patients had an angle cleavage of more than 180 degrees, with 68% having a recession of 360 degrees. Fifty-six percent had a history of hyphaema. In 88% of patients, the intraocular pressure (IOP) was controlled and kept at a stable level (< 21 mmHg) over follow-up. Of these, 91% were controlled by conservative treatment (topical anti-glaucoma drugs or observation) and 9% was controlled after cataract surgery. Patients with uncontrolled IOP (12%) were advised for filtration surgery. The mean IOP at time of diagnosis was 29.8 ± 9.7 mmHg (Range: 14-50 mmHg). The mean IOP at last follow-up was 18.4 ± 8.4 mmHg (Range: 10-50 mmHg). Visual Acuity (VA) for 23 patients (92%) either remained stable or improved.
Conclusion: Angle-recession glaucoma can cause further loss of vision in ocular trauma patients who may already have compromised vision due to injury. Control of IOP and preservation of presenting VA was seen in most cases with conservative management with topical medications and sustained follow-up. Patients sustaining blunt ocular trauma, especially those associated with hyphaema, should be advised for future follow up and have gonioscopic evaluation of the angle. All cases had an angle recession more than 180 degrees.
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P346 CLINICAL ANALYSIS OF TRAUMA RELATED OCULAR HYPERTENSION AND GLAUCOMA

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Objective: To analyze the pathogenesis and management of ocular hypertension and glaucoma associated with different types of ocular trauma including one case of iatrogenic ocular trauma.
Design: Retrospective study.
Participants: Thirty-two patients who underwent treatment in the University Hospital Queen Jiovanna-ISUL in Sofia, Bulgaria.
Method: The records of 32 patients who experienced different types of ocular trauma (closed globe injury –18 cases, open globe injury –7, one of which was an iatrogenic type of injury, chemical burns –4, thermal burns –2, and electric trauma –1 case) were reviewed and analyzed.
Main outcome measure: The intraocular pressure (IOP).
Results: Each case is determined according to the clinical findings as hemorrhage related, related to chamber-angle injury, lens related, synechia and proliferation related, inflammation related or with a complex pathogenesis. Each patient received medical treatment based on the clinical findings –23 patients received topical and/or systemic medications (anti-glaucoma agents-B-blockers, CAIs, hyperosmotic agents; anti-inflammatory medications, antifibrinolytics); 2 patients

with pupillary secclusion received laser iridectomy and 7 underwent different type of surgical treatment- anterior chamber paracentesis or washing, lens removal, filtration surgery. In all patients nevrtheless the type of treatment selected, a good control of the intraocular pressure was achieved.
Conclusion: Ocular hypertension and glaucoma associated with ocular trauma have a complex pathogenesis. In some cases the elevated IOP is transient, in others it can be controlled with topical/systemic medications alone but in the more severe cases surgical intervention is often necessary.
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9.4.9. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas associated with elevated epicslerar venous pressure

P347 CENTRAL CORNEAL THICKNESS IN PATIENTS WITH STURGE-WEBER SYNDROME

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Purpose: To compare the mean central corneal thickness (CCT) in patients with Sturge-Weber Syndrome (SWS) with that of the corresponding eye of the age and sex-matched control subjects.
Design: A hospital-based prospective case-control series.
Participants and controls: Ten cases (19 eyes) of SWS and 10 controls (19 eyes) of normal age and sex-matched control subjects.
Method: The mean values of ten consecutive pachymetry measurements of patients with SWS and control subjects were used for analysis. Statistical analysis was performed using the student's t-test.
Main outcome measure: A statistically significant mean difference between the cases and controls.
Results: All patients were of Bangladeshi origin (four male and six female patients). The mean age was 25.8 ± 18 years (Range: 3-50 years). Visual acuity of SWS patients ranged from 6/6 to No Perception of Light. All cases had unilateral occurrence of glaucoma and had a mean IOP of 30 ± 12.3 mmHg and in the fellow (unaffected) eye mean IOP was 14.1 ± 2.13 mmHg. Mean CCT for SWS eyes was 566.47 ± 26.35 µm (Range: 522-622 µm) and for the control group was 533.05 ± 24.20 µm (Range: 485-570 µm). The mean difference of the CCT between cases and controls was statistically significant being 33.68 ± 31.21 µm (95% CI: 18.64 - 48.73 µm) ($p < 0.000$). Mean CCT in only the glaucoma-affected eye of the patients with SWS was 571.66 ± 28.35 µm.
Conclusion: Patients with SWS have significantly thicker corneas in the glaucoma-affected and also fellow eye than the age and sex-matched normal control subjects. The mean difference between the two groups was approximately 34 µm. The thicker cornea in the patients with SWS can have important implications for the diagnosis, treatment and follow-up of these patients who develop secondary glaucoma.
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P348 MEDICAL AND SURGICAL MANAGEMENT OF SECONDARY GLAUCOMA ASSOCIATED WITH STURGE-WEBER SYNDROME IN JUVENILE CASES

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Purpose: To report the efficacy and complications of the medical and surgical treatment of secondary glaucoma in juvenile cases with Sturge-Weber Syndrome (SWS).
Design: The medical records of the 11 consecutive patients with SWS, who had been examined between 2002 and 2008, were reviewed retrospectively.
Participants: Our study consists of 11 eyes of 6 male and 5 female cases with SWS.
Methods: Medical and surgical anti-glaucoma treatments were performed for the cases.
Main outcome measure: Main outcomes measures are post-treatment intraocular pressures (IOP) and postoperative complications.
Results: The mean age of our cases was 11.2 ± 4.4 (range: 4 to 18 years) and the mean intraocular pressure (IOP) of 11 eyes was 32 ± 5.8 mmHg (24-42 mmHg) at the time of the

diagnosis of glaucoma. Glaucoma was controlled under only medical therapy in 3 eyes. But in eight eyes initial or recurrect trabeculectomy with mitomycin C (MMC), in two eyes transscleral diod laser cyclophotocoagulation, in one eye Ahmed valve implantation and in one eye Ex-Press miniature glaucoma device implantation were done in order to control the IOP. Intraoperative choroidal effussion developed in two eyes during trabeculectomy and resolved without surgical therapy.

Conclusion: Trabeculectomy with antifibrotic agents, drainage valve implantation, cyclodestructive procedures and medical treatment are the choices for treatment of secondary glaucoma in SWS.

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9.4.11. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas following intraocular surgery

P349 SECONDARY GLAUCOMA IN INDUSTRIAL BLUNT INJURIES AND ITS VISUAL OUTCOME

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Purpose: Blunt injuries while nailing is common in industrail areas and frequency is often underestimated, but they can be the cause of disabiling functional ocular sequeales. Development of secondary glaucoma and loss of vision noticed in these workers. Through a prospective study to evaluate the severity of eye injuries and investigate each case and to take the preventive measures especially for oculo facial injuries.

Methods: The descriptive study was conducted at ophthalmology department of Al- Ain hospital from September 2006 to December 2008. All the patients presenting with a history of nailing and hit by nail while hammering and followed by ocular trauma were included, age, sex, presentation, associated injuries, ocular structures involved, treatment modalities development of secondary glaucoma analyzed and these patients were followed for 3, 6, 12, months after the injuries, statistical data were analysed.

Result: In 48 patients, 42 cases were a direct hit of the nail on the eyelid (87.50%) and in 6 cases (12.5%) patients were hit by concrete and nail while breaking the concrete. Most were male (97.91%) young adults, most associated injuries were facial lacerations in 42 (87.5%), in 9 (18.75%) cases orbital injuries were noticed. Peri-orbital, corneal, conjunctival lacerations, hyphema, iris, cilliary body injuries and development of secondary glaucoma were main ocular manifestations. Visual loss noticed due to corneal injuries, hyphema, secondary glaucoma, angle recession and posterior central involoment due to blunt injury and glaucomatous visual field loss noticed in 3 case (6.25%).

Conclusion: Among 48 cases with ocular injuries the mainly male majority belongs to the age group < 40 yrs and most of them were employed from other countries for construction work. They were not aware of risk factors, susceptable to ocular injuries. Due to cornea injuries, hyphema, iris and cilliary body injury, and secondary glaucoma, patients had some visual loss. Proper oculofacial care education and awarness of the risk of ocular injuries, pointing out the necessity of wearing a protective helmet which covers the oculofacial region can prevent and minimize incidence of ocular injuries.

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9.4.11.2. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas following intraocular surgery: Glaucomas in aphakia and pseudophakia

P350 PSEUDOPHAKIC GLAUCOMA AFTER SMALL INCISION CATARACT SURGERY IN EYE CAMPS IN RURAL INDIA

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Objective: Glaucoma after cataract surgery is common in the eye camp setting. Important causes are: posterior capsular tear with vitreous loss, retained ophthalmic viscoelastic devices (OVD) and retained lens matter in the capsular fornices and anterior chamber. The objective of this study was to report incidence of glaucoma after cataract surgery in Eye Camps in Rural India.

Design: Retrospective study of all pseudophakic glaucoma patients who were operated in camps in rural India, presenting at our centre.

Participants: Clinical records of all cases of pseudophakic glaucoma presenting at our centre from July 2007 to January 2009 were reviewed.

Method: We evaluated 22 cases (22 eyes) with high intraocular pressure (IOP) following cataract surgery performed in eye camp setting in rural India. Postoperative IOP ranged from 28 to 52 mmHg (Applanation tonometry). Of the 22 cases, 11 cases (11 eyes) may be caused by retained OVD, which was evident as posterior capsule tear. Retained lens matter and resultant inflammation, epithelial and fibrous down growth, was the possible cause in the remaining 10 cases (10 eyes).

Main outcome measure: To find out the possible cause of glaucoma after small incision cataract surgery.

Result: Four cases (4 eyes) underwent trabeculectomy with mitomycin-C application, 2 eyes (2 cases) required removal of lens matter from anterior chamber, the remaining 16 cases (16 eyes) were controlled with anti-glaucoma medication (oral azetazolamide, topical dorzolamde, timolol maleate).
Conclusion: A thorough anterior vitrectomy, combined with removal of lens matter and OVD is necessary to avoid post-operative IOP spike in cataract surgery in the camp setting. Staining of vitreous using triamcinolone acetonide may be helpful to identify transparent vitreous band and to achieve good anterior vitrectomy.
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9.4.11.4. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas following intraocular surgery: Glaucomas associated with corneal surgery

see also P126

P351 INCIDENCE OF RAISED INTRAOCULAR PRESSURE FOLLOWING PENETRATING KERATOPLASTY

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Objective: To study the incidence of raised intraocular pressure in patients undergoing penetrating keratoplasty.
Design: Prospective study.
Participants and control: Fifty consecutive cases of corneal opacity of varied aetiology, with a mean follow-up period of 2 years.
Intervention: PK was done in 50 consecutive cases of corneal opacity of varied etiology.
Main outcome measures: A mean follow-up period of 2 years, to observe the incidence of raised IOP folowing penetrating keratoplasty and the various factors associate with it.
Result: Following PK, 13 (26.0%) of the total sample developed elevated IOP. The mean time from PK to first IOP rise was 4 weeks. Variables which were significantly associated with IOP rise included: aphakia 4 (8.0%), psuedophakia 2 (4.0%), peripheral anterior synechiae 7 (14.0%), steroid-induced glaucoma 7 (14.0%). Only 7 (14.0%) patients required surgical treatment for glaucoma.
Conclusion: Although psuedophakia and aphakia have been associated with rise in IOP in eyes post PK, their significance is low. But peripheral anterior synechiae and steroids are major contributing factors.
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P352 SURGICAL OUTCOMES OF DESCEMET'S STRIPPING ENDOTHELIAL KERATOPLASTY (DSEK) IN PATIENTS WITH PRE-EXISTING GLAUCOMA SURGERY

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Purpose: To report the surgical outcomes of eyes with prior glaucoma drainage devices (GDD) or trabeculectomy that undergo DSAEK for corneal decompensation.
Methods: Retrospective, consecutive chart review of all patients with prior filtering surgery undergoing DSAEK at two surgical centers (Tulane University Hospital and Gorovoy MD Eye Specialists) between July 2004 and November 2008 was preformed. Patients undergoing combined glaucoma and DSAEK surgery (13) were excluded.
Primary outcome measures included: Pre- and post-operative IOP measured at 1 week, 1 month, 2 months, 5 months, and last follow-up after DSAEK; number of pre-operative glaucoma medications; number of postoperative glaucoma medications at last follow up; DSAEK outcome (success *vs* detachment *vs* graft failure); and glaucoma filtering outcome (success *vs* need for further surgical intervention.) Student's t-test3 was used to evaluate for statistically significant differences.
Results: Twenty five patients (21 with GDD and 4 with trabeculectomy) met our study inclusion criteria. Average final post-operative follow up time for patients with GDDs was 15 months (range 1-37 months). Average final post-operative follow up time for patients with trabeculectomy was 26 months (range 5-48 months). There was no statistically significant difference in pre-operative and post-operative IOP in patients with prior GDD or trabeculectomy in the first 2 post-op months in either group (p values = 0.31 *vs* 0.32). 14% (3/22) GDDs failed (mean time to failure 4 months after DSAEK) *vs* 50% (2/4) trabeculectomies failed (mean time to failure 5 months after DSAEK) and required further surgical intervention. No statistical difference was found in pre and post-operative glaucoma medications. Twenty percent (5/25) of patients experienced graft failure, while two patients (8%) had graft dislocation that required re-bubbling of the graft one day post-operation.
Conclusions: DSAEK is associated with increased failure of GDDs and trabeculectomies. DSAEK in the presence of GDD is associated with higher incidence of graft dislocation and graft failure. Further studies are required to confirm these findings.

9.4.15. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Glaucomas in relation to systemic disease

see also P003, P059, P123, P357, P440

P353 STRAIGHT GAZE AND UPGAZE OCULAR PULSE AMPLITUDE AND INTRAOCULAR PRESSURES IN PATIENTS WITH THYROID EYE DISEASE AND GLAUCOMA

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Objective: Patients of thyroid eye disease usually develop compressive optic neuropathy but some patients develop glaucomatous field defects. Some patients have restrictions of extraocular movements due to fibrosis of extraocular muscles. The upgaze intraocular pressure is significantly raised in such patients. Low ocular pulse amplitude has been correlated with field defects and is reduced in patients of low-tension glaucoma. But ocular pulse amplitude is increased in thyroid eye disease.The study was conducted to investigate the role of differences in straight gaze and upgaze ocular pulse amplitude and intraocular pressure in patients with thyroid eye disease and glaucoma.
Design: Observational study.
Participants: Patients with thyroid eye disease and glaucomatous field defects in one eye.
Controls: Patients with thyroid eye disease and no field defects.
Method of testing: Dynamic contour tonometer was used to measure the Ocular pulse amplitude and Intraocular pressure in both groups in straight gaze and upgaze as it is quite reproducible.
Main outcome measures: Difference in intraocular pressure in straight gaze and upgaze and difference in ocular pulse amplitude in straight gaze and upgaze.
Results: Mean difference in intraocular pressure in two gazes was 4.32 ± 1.34 mm in patients with glaucomatous field defects and 2.25 ± 1.44 mm in patients without filed defects, but mean difference in OPA in patients with glaucomatous defects was -1.2 ± 0.7 mm and -0.5 ± 0.3 mm in patients without glaucomatous field defects
Conclusion: The upgaze pressure is significantly higher and upgaze ocular pulse amplitude is significantly lower in patients with thyroid eye disease and glaucoma. Thus during sleep at night the intraocular pressure may be increasing and ocular pulse pressure (measure of perfusion) may be reducing thus causing glaucoma. So all patients of thyroid eye disease should get their intraocular pressures and ocular pulse pressures tested in straight gaze and upgaze to identify patients with eyes at risk of developing glaucoma and patients with significant changes may be observed or prophylactically treated with some drugs that can decrease the intraocular pressures and increase the ocular pulse pressure.
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P354 THE RELATIONSHIP BETWEEN DIABETES MELLITUS AND EXFOLIATION SYNDROME IN A UNITED STATES VA POPULATION: A CASE-CONTROL STUDY

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Objective: Exfoliation Syndrome (ES) has been suggested as a risk factor for cardiovascular and cerebrovascular diseases, although its relationship with diabetes mellitus (DM) remains unclear. Varying outcomes have come from a few studies: from no association to, surprisingly, an inverse correlation. The purpose of our study was to clarify the relationship between DM and ES. For the first time in the analysis, we accounted for glycosylated hemoglobin (HgA1c), body mass index (BMI), and the potentially confounding effect of lens status.
Design: Retrospective, case-control study.
Participants: The study participants were chosen from an electronic database of outpatients seen for comprehensive, dilated eye examinations between January 1, 2004 and November 30, 2007 at the Boston Veterans Administration Healthcare Systems hospitals. ES subjects with or without glaucoma (n = 328) were compared to controls without any type of glaucoma or signs of ES (n = 328).
Methods: All ES subjects were required to have documented ES precipitates on the iris or lens capsule noted by two independent clinicians. Controls were matched based on age, race, and gender. If any subject or control had history of cataract surgery in either eye, documentation of a pre-operative slit lamp examination was required to determine their ES status. BMI was collected on all subjects. Diabetes status was based on chart documentation of diagnosis and/or use of diabetes medicines. If the subject had DM, five HbA1c results were collected.
Main outcome measure: A conditional logistic regression was performed to assess the relationship between DM and ES syndrome while adjusting for BMI and other factors. A secondary analysis (two sample t-test) was performed to compare the HbA1c of the two diabetic groups: those with and those without ES.
Results: DM was present in 96 (29.2%) of the ES subjects and 100 (30.5%) of the control subjects. There was no relationship between DM and ES syndrome (odds ratio 0.93; 95% confidence interval, 0.67-1.32). Furthermore, HbA1c levels were not significantly different between subjects with DM and ES and those without ES (mean HbA1c in DM without ES = 6.8 ± 1.02, DM with ES = 6.97 ± 1.04, p = 0.25).
Conclusion: We found no relationship between the presence

of DM and ES in this predominately male, Caucasian population with a high burden of DM. This contrasts with previous studies which found an inverse correlation between the two conditions. In our subjects with DM, we also found no statistical difference in HbA1c levels in those with ES compared to those without ES. Our study methodology differs from previous studies in that we accounted for BMI, HbA1c, and lens status in the data analysis.

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P355 PREVALENCE OF NOCTURNAL OXYGEN DESATURATION AND SELF-REPORTED SLEEP-DISORDERED BREATHING IN GLAUCOMA

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Purpose: To evaluate the prevalence of nocturnal oxygen desaturation and sleep-disordered breathing symptoms within a glaucoma population.

Patients and Methods: One hundred and twelve subjects (glaucoma = 52, control = 60) aged between 45 and 80 years were recruited for the study. Clinical assessment included overnight ambulatory pulse oximetry monitoring and administration of a self-reported sleep-disordered breathing questionnaire.

Results: There were no differences in age, sex, body mass index, or prevalence of systemic hypertension between the groups. The mean oxygen desaturation index of the glaucoma group (8.6) did not differ significantly from that of the control group (9.6) (P = 0.715). The prevalence of moderate to severe respiratory dysfunction (oxygen desaturation index > 20) in the glaucoma group (17%) was similar to that in the control group (12%) (P = 0.463). The severity of sleep-disordered breathing symptoms was similar between the groups (P = 0.157).

Conclusions: No statistically significant association was found between glaucoma and either nocturnal oxygen desaturation or sleep-disordered breathing. Although this study cannot exclude the possibility of either impaired optic nerve head autoregulation or hypoxic damage occurring secondary to sleep apnea syndrome, the findings do not support the routine use of pulse oximetry in the workup of individuals with glaucoma.

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P356 THE PULSATILE OCULAR BLOOD FLOW (POBF) IN THE POLISH SUBJECTS WITH THE SLEEP APNEA SYNDROME (SAS)

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Purpose: The aim of the study was to determine the correlation between pulsatile ocular blood flow (POBF) and other ophthalmic findings with sleep apnea syndrome (SAS).

Material and Methods: Patients were recruited from those, who underwent polysomnography in the 'Sleep Unit' of the Physiology Department. Sleep apnea syndrome was diagnosed if the apnea-hypopnea index (AHI) was > 5. A total of 26 Caucasian patients, 17 with SAS age and gender matched to 9 controls were included into the study. Comprehensive ophthalmic examination included the pulsatile ocular blood flow (POBF) measurements, disc analysis with HRT II and computerized perimetry as well as the best visual acuity, a slit lamp and indirect ophthalmoscope evaluation of anterior and posterior segments and applanation tonometry. A complete medical history was taken for each patient.

Results: The observed prevalence of glaucoma in SAS patients was 11.76 % (2 of 17). The study revealed that the differences of mean POBF between the SAS patients and the control group were not statistically significant neither in the right nor in the left eye: U- test p > 0.05. No correlations were found between sleep apnea syndrome and mean IOP, mean RNFL thickness and visual field mean defect (MD). The apnea-hypopnea index (AHI) was significantly associated with body-mass index (BMI). However there was no correlation between AHI and cardiovascular diseases nor with diabetes mellitus.

Conclusions: We did not find the correlation between the pulsatile ocular blood flow and the sleep apnea syndrome. Although some previous studies showed the association between IOP, MD, RNFL thickness and the sleep apnea syn-

drome, our study did not confirm that. However, the prevalence of glaucoma among SAS patients in Poland was higher than expected in a regular Caucasian population.

P357 RETINAL NERVE FIBRE LAYER MEASUREMENTS IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME

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Purpose: To study retinal nerve fiber layer (RNFL) thickness in patients with obstructive sleep apnea syndrome (OSAS).
Design: Observational cohort study.
Participants: One hundred and twenty patients with OSAS were analyzed for RNFL thickness and compared with an age-matched control group of 104 subjects.
Methods: Patients with OSAS underwent sleep studies to determined the respiratory disturbance index (RDI) during night sleep and were classified as having moderate (RDI, 20-39), and severe (RDI > 40). The RNFL thickness was assessed by optical coherence tomography (Stratus OCT) using the fast RNFL thickness (3.4) scan acquisition protocol.
Main outcome measure: RNFL thickness and RDI were evaluated.
Results: Compared with the control group, eyes with OSAS showed a thinner RNFL in the 360 degrees average measurement (101.52 ± 11.3 μ, 101.38 ± 11.3 μ for control right eye and left eye respectively, and 97.86 ± 12.03 μ, 96.5 ± 12.13 μ for OSAS in the right eye and left eye respectively, p = 0.02) and in the superior (p = 0.034), inferior (p = 0.03) quadrants in the right eye and superior (p = 0.03), quadrant in the left eye. There are no correlations between the RDI and RNFL measurements on the SAS eyes.
Conclusions: RNFL thickness was not correlated with the severity of OSAS however the thickness of RNFL was reduced in patients with OSAS compared to controls by less than 5 μ (5%). The clinical significance of this change needs to be determined.
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P358 GLAUCOMA AND SYSTEMIC DISEASES

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Purpose: To investigate common systemic diseases and systemic medications in patients with primary open-angle glaucoma, and study important drug interactions between glaucoma medications and systemic medications.
Methods: One hundred eighty patients with primary open-angle glaucoma were prospectively studied. Detailed history was obtained, including the presence of concurrent systemic diseases and the use of glaucoma and systemic medications.
Results: The five most common systemic diseases in this cohort of patients included hypertension, hypercholesterolemia, diabetes, cardiac disease, and thyroid disease. The five most common classes of systemic medications were antihypertensives, anti-hyperlipidemic agents, anti-platelets/anticoagulants, hypoglycemic agents, and psychiatric agents. A list of twenty most commonly prescribed systemic medications was compiled and studied to determine any adverse or beneficial effect of these medications on glaucoma management.
Conclusions: Medical management of glaucoma in elderly patients is challenging due to coexisting systemic diseases and additional medications which are used to treat these conditions. Knowledge of the concomitant systemic diseases and their treatments is critical to the safe management of our glaucoma patients.
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9.4.20. Clinical forms of glaucomas: Glaucomas associated with other ocular and systemic disorders: Other

P359 CHARACTERISTIC ASSOCIATED ORGAN PATHOLOGY IN PATIENTS WITH OPEN-ANGLE GLAUCOMA, PROVIDED SOCIAL AND MEDICAL CARE IN THE PSYCHONEUROLOGICAL NURSING HOME

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Purpose: To optimize medical therapy we conducted a research on accompanying diseases in 30 patients with primary open-angle glaucoma (POAG). Social and medical aid was provided by a psychoneurological nursing home (PNH).
Methods: Prevalence of a glaucoma in PNH patients > 40 years was 6,8%, in patients > 70 years: 9%. The mean age

of patients was 68.4 ± 11.2 years. Of the patients surveyed, 4 were men (13%) and 26 women (87%).

Results: All patients were mentally disabled and divided into 2 groups. Distribution of patients depending on a glaucoma stage was as follows: the suspicion on a glaucoma was defined at 5 people (17%), POAG I stage - was not marked, II stage - at 10 people (33%), III - IV stages - at 14 people (47%), a secondary glaucoma - at 1 people (3%). At 100% of the surveyed persons accompanying mental diseases were marked. The schizophrenia was at 13 people (43%), organic defeats of a brain - at 8 (27%), vascular - at 5 (17%), a chronic alcoholism - at 3 (10%), oligophrenia - 1 (3%). Accompanying organ the pathology was revealed at 29 people (97%). Most often there were diseases of cardiovascular system - 24 people (80%), discirculation encephalopathy - 17 (57%), diseases of digestive system - 13 (43%), a chronic bronchobstructive disease - 12 (40%), skin illnesses - 8 (27%). Among diseases of cardiovascular system in 67% it was defined ischemic disease of the heart (1 case - an infarction), in 17 cases (57%) - arterial hypertension (16 cases - II deg., 1 case - III deg). To all patients at inspection measurement IOP by the Maklakov tonometers (79 measurements) was lead. Pays attention that indemnification IOP (< 27 mmHg) was observed only in 34 cases (43%), increased IOP (27 mmHg and more) were observed in 57%. In 37 cases (47%) the differences between indicators IOP of the right and left eye 4 more mmHg was observed. At the comparative analysis of the received data with indicators of patients with a glaucoma of the district clinic, not having mental diseases, it has been established that was not observed distinctions on age of patients (68,4 ± 11,2 and 69,8 ± 11,0 years accordingly). However at patients PNH met advanced and late stages of a glaucoma is more often (47% and 19% accordingly, p <0,01), at more frequent presence accompanying organ pathologies (97% and 74% accordingly, p < 0,01).

Conclusion: 1. High prevalence OAG at PNH patients is marked is more senior 40 years (in 4,5-6,8 times above, than on the average across Russia); 2. PNH patients had a glaucoma in advanced and a terminal stage (47 %) is more often.

10. DIFFERENTIAL DIAGNOSIS E.G. ANTERIOR AND POSTERIOR ISCHEMIC OPTIC NEUROPATHY

P360 ENDOTHELIAL DYSFUNCTION AND OXIDATIVE STRESS IN PATIENTS SUFFERING FROM ALZHEIMER DISEASE (AD) OR GLAUCOMA: TWO NEURODEGENERATIVE DISEASES WITH COMMON VASCULAR RISK FACTORS? A PILOT STUDY

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Objective: Although primary open-angle glaucoma (POAG), is associated more closely with elevated intraocular pressure (IOP), other risk factors already implicated in the aetiology of this disease include systemic and ocular vascular dysregulation, systemic blood pressure (BP) alterations, endothelial dysfunction and oxidative stress. Most of these factors are also believed to contribute to the pathogenesis of Alzheimer's disease (AD). In addition, glaucomatous optic neuropathy (GON) progresses more severely in patients suffering from AD when compared to glaucoma patients without dementia. Moreover, the defective cerebral perfusion demonstrated by some glaucoma patients is similar to that encountered in AD and the incidence of glaucoma among patients suffering from AD could be as high as 24%. The objective of the present study was to examine: 1) retinal vascular reactivity (as a measure for local ocular endothelial function) in patients suffering from either AD or glaucoma as compared to normal controls; and to determine 2) whether in patients suffering from AD or glaucoma local and/or systemic alterations of the increased oxidative stress could contribute to the observed vascular dysfunction.

Design: Case-controlled study.

Participants: Twenty-six participants were included in the study as following: 15 healthy controls, 6 patients with AD and 5 patients with glaucoma. None of the participants included in the study were on medication or supplements known to affect endothelial function. Glaucoma patients and controls were screened for cognitive deficits using the ACE-R and only included if they score more than 88. AD patients and healthy controls were included only if their ocular examination did not exhibit any signs of glaucoma

Methods: The retinal vascular reactivity was assessed by using the retinal vessel analyser (RVA, IMEDOS GmbH) during baseline and after stimulation with flickering light in three separate steps (F1, F2 and F3). The mean arterial pressure (MAP), intra-ocular pressure (IOP) and body mass index (BMI) were also recorded. All subjects were subjected to a blood analysis to detect the level of circulating glutathione in its reduced (GSH) and oxidized (GSSG) forms.

Results: There were no significant differences in MAP, IOP and BMI between the three groups. The time to reach the maximum vessel diameter during the last flicker (F3) was similar in glaucoma and AD patients (29.40 ± 11.54 and 25.00 ± 13.31 secs respectively, p > 0.05) and statistically significant higher than the values measures observed in the healthy control group (15.06 ± 8.64 secs, p = 0.031 controls *vs* glaucoma; p = 0.04 controls *vs* AD). POAG and AD patients exhibited similar GSH values (POAG 11.50 ± 6.34 and 11.60 ± 6.93 respectively, p > 0.05) that appear lower than those in the healthy controls (17.44 ± 6.96), however they analysis did not reach statistically significance (p > 0.05).

Conclusions: The results suggest a delayed response to the third and last flicker which appears to be similar in both patients with glaucoma and AD compared to healthy controls. Additionally, there seems to be a trend towards reduced systemic levels of GSH in both glaucoma and AD patients compared to healthy controls that did not reach significance due to low numbers. We hypothesise that such deferred response may be an indication of an endothelial dysfunction shared by both patients with glaucoma and AD, which in turn may represent the ocular manifestation of a compromised systemic oxidative mechanism.

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11.1 Medical treatment: General management, indication

see also P054, P570

P361 EFFECTS OF NUMBER OF INTRAOCULAR PRESSURE MEASUREMENTS ON THE CORRELATION OF RESPONSE TO GLAUCOMA MEDICATION BETWEEN FELLOW EYES

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Purpose: To examine the effects of number of intraocular pressure (IOP) measurements on the correlation of response to glaucoma medication between fellow eyes.
Design: Observational case series.
Participants: Seventeen patients with primary open-angle glaucoma.
Methods: Topical latanoprost was applied to the first eye (one-eye trial) and then to both eyes (bilateral treatment). IOP measurements were performed by Goldmann applanation tonometry twice on different days for each of three occasions; at baseline and before and after bilateral treatment. IOP decrease in the first and the second eyes was calculated according to the following formula. Formula 1, IOP decrease (ΔIOP1) = Tpre -Tpost (mmHg); Formula 2, IOP decrease (ΔIOP2) = (Tpre - Tpost) - (Cpre - Cpost) (mmHg), where T and C were IOP of the treated and contralateral eyes, respectively. Pre and post represent IOP measurements performed before and after treatments. IOP data in one-eye trial and bilateral treatment were used for the evaluation of IOP decrease in the first and the second eye, respectively. IOP data closer to the treatment period were adopted when using single IOP measurement, while the mean of IOP data was calculated when using two IOP measurements. The correlation of IOP decrease between fellow eyes was analyzed by linear regression analysis using the Pearson correlation coefficient, r.
Results: No significant correlations of ΔIOP1 between fellow eyes were found regardless the number of IOP measurements (r^2 = 0.026-0.198, p = 0.073-0.54). ΔIOP2 was significantly correlated between fellow eyes using two post-treatment IOP (r^2 = 0.449, p = 0.003 with single pre-treatment IOP; r^2 = 0.601, p < 0.001 with two pre-treatment IOP), but not with single post-treatment IOP (r^2 = 0.165, p = 0.11 with single pre-treatment IOP; r^2 = 0.174, p = 0.096 with two pre-treatment IOP).
Conclusions: Subtraction of fellow-eye IOP fluctuation and using multiple post-treatment IOP measurements may improve the prediction of fellow-eye response to glaucoma medication in one-eye trial.
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P362 FIXED COMBINATION THERAPY AND TREATMENT SCHEMES AMONG THE VARIOUS GLAUCOMA DIAGNOSES. A MULTICENTRIC, CROSS-SECTIONAL GLAUCOMA STUDY IN BUENOS AIRES, ARGENTINA

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Purpose: To assess the number and type of antiglaucomatous medications applied and the rate of use of these medications in the whole population and in each glaucoma diagnosis in outpatients from 4 urban hospitals in Buenos Aires, Argentina.
Design: Multicentric, prospective, non-comparative.
Participants: Seven hundred forty-one consecutive patients under glaucoma care in 4 hospitals in Buenos Aires during September/October 2007.
Methods: Patients underwent an interview and complete glaucoma examination. Data on diagnoses and on medical antiglaucomatous schemes useful for this report were processed.
Main outcome measures: Rate of use of glaucoma medications by diagnosis, number of medications per patient.
Results: One hundred and eighty four patients (24.83%) were untreated at the time of the examination; all of them were either glaucoma suspects or undergoing initial study. Two hundred and seventy two (36.71%) were using only one medication, 285 (38.46%) two or more medications, and of these 43 (5.80%) were under three or more medications. Prostaglandin analogues (PGA) were the most frequently used group in all patients: 303 (40.89%), second place was for fixed combinations with timolol plus a non-PGA: 282 (38.06%), betablockers came thereafter: 137 (18,49%) followed by topic CAIs 41 (6.61%), alpha agonists 38 (5.13%), acetazolamide 28 (3.78%), and pilocarpine 19 (2.56%). The least used treatment was fixed combinations with timolol plus a PGA: 17 (2.29%). As for specific glaucoma diagnoses, PCAG had the highest rate of use of PGAs (56.58%) and

also the highest rate of use of topic CAIs (10.53%) and the lowest of betablockers (14.47%) and pilocarpine: 2 (0.65%). POAG had the lowest rate of use of pilocarpine 2 (0.65%) and of alpha agonists: 11 (3.55%). Pseudoexfoliation glaucoma had the highest rate of use of fixed combinations with timolol plus a non-PG: 56 (46.28%), the highest rate of fixed combinations with a PGA: 5 (4.13%) and the lowest of topic CAIs: 8 (6.61%).

Conclusions: a) Approximately forty percent of the patients had fixed combination therapy in their regime; b) more than one third were on monotherapy and scarcely less than six percent used more than three medications; c) the single most used medication type were PGAs and the least used were fixed combinations with timolol plus a PGA; d) PCAG had the highest rate of use of PGAs and pseudoexfoliation-associated glaucoma had the highest rate of use of fixed combinations.

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P363 FIXED COMBINATIONS IN CLINICAL PRACTICE FOR POSTER

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Purpose: To study the effect of the Bimatoprost & Timolol fixed combination on intraocular pressure in glaucoma patients.

Design: Data was collected over a period of year 2008. Intraocular pressure was checked and recorded from 102 patients and then rechecked and recorded 2 and 6 months after switching their anti glaucoma treatment to Bimatoprost & Timolol fixed combination.

Participants: Patients with primary open-angle glaucoma who were medically treated and were taking one or two individual medications or on combination treatment or were finding it difficult to manage two separate bottles or failure to achieve target intraocular pressure or tachyphylaxis from existing treatment or had visual field deterioration or had optic disc haemorrhage were included. Patients who had laser treatment (ALT, SLT) or surgical procedures, and patients in whom beta blockers were contraindicated and patients with known preservative allergy were excluded. Two out of 102 patients discontinued treatment due to side effects.

Methods: Intraocular pressure was recorded by Goldmann tonometer by same person on all patients.

Results: All patients (102/102) showed a decrease in intraocular pressure when switched to Bimatoprost & Timolol combination therapy. The mean intraocular pressure before switch over was 18.9 mmHg (range 15-27 mmHg). Intraocular pressure decreased an average of 4.0 mmHg mean value of 14.7 mmHg (range 10-17 mmHg) from their existing level at first fllow up in 2 months, and mean value of 13.9 mmHg (range10-18 mmHg).

Conclusions: This combination has been shown to be effective in randomised controlled trials. It offers good amount of reduction in intraocular pressure which has been shown to be essential in managing glaucoma. Future plan: Data recording is continuing and we will follow up the sustainability of intraocular pressure lowering effect of this combination, also, we will study the effect of lowered intraocular pressure on the disease progression and visual field deterioration.

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P364 PATIENT SATISFACTION WITH TOPICAL MEDICATIONS: THE NEW ZEALAND GLAUCOMA EYE DROP SURVEY

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Purpose: Compliance is a major issue in glaucoma management. The reasons for non-compliance with topical ocular hypotensive medication are complex and multifactorial. An important area which has not been investigated thoroughly is patients' satisfaction with eye drops as a method of medication delivery. The purpose of this study was to assess patients' self-reported satisfaction with topical medications used in the treatment of glaucoma and ocular hypertension.

Design: Postal survey.

Participants: Five thousand one hundred patients with glaucoma or ocular hypertension registered with Glaucoma New Zealand.

Main outcome measure: Demographics; medications; frequency, method, and ease of administration; need for assistance; side effects; impact on quality of life; and overall satisfaction.

Results: Fifty-one percent of questionnaires were returned

(n = 2,602). The mean age of respondents was 72.1 ± 10.8 (SD) years. The majority were New Zealand European (94%) and 58% were female. Approximately 14% required assistance to put in eye drops. The majority of patients who self-administered found eye drops 'easy' or 'very easy' to use. However, 29% would prefer a tablet if available. Side effects are frequent, although in the majority these symptoms are only 'a little' or 'slightly' bothersome. Overall, the majority of patients are 'satisfied' or 'very satisfied' with eye drops.

Conclusion: Fourteen percent of patients with glaucoma or ocular hypertension rely on somebody else to administer their eye drops and 29% would prefer to take a tablet. Side effects are present in 80% of patients however the majority of patients are 'satisfied' or 'very satisfied' with eye drops as a method of medication delivery.

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11.3.2. Medical treatment: Adrnergic drugs: Thymoxamine, dapiprazole

P365 TOLERABILITY AND EFFICACY OF PRESERVATIVE-FREE DORZOLAMIDE-TIMOLOL (PRESERVATIVE-FREE COSOPT®) IN PATIENTS WITH OPEN-ANGLE GLAUCOMA OR OCULAR HYPERTENSION

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Background: The present goal in glaucoma therapy and prevention is to slow the rate of retinal ganglion cell loss by reducing intra-ocular pressure (IOP). An effective treatment has to minimize side effects in order to achieve optimal patient compliance. Several currently available topical medications contain preservatives. These medications and/or their preservatives have been associated with a variety of ocular surface disorders. Removal of the preservatives may represent a useful strategy for treating patients with co-existent glaucoma and a history of dry eye or other ocular surface diseases. Validated questionnaires, such as the GSS-SYMP6 scale, may be a useful tool to demonstrate the tolerability of topical ophthalmic medications.

Aim: The primary outcome was to evaluate the changes in the GSS-SYMP6 score in newly diagnosed and untreated open-angle or ocular hypertension patients treated with preservative-free (PF) dorzolamide-timolol for an 8-week period. The secondary outcomes included the effectiveness of PF dorzolamide-timolol on IOP and physician and patient's satisfaction with the treatment.

Methods: This was a Canadian open-label, 8-week, multicenter study in patients with newly diagnosed and untreated OAG or ocular hypertension. Eligible patients had to have an IOP of > 27 mmHg. Based upon entry GSS-SYMP6 score, these patients had to have symptoms consistent with ocular surface disease at study entry or for whom the use of a PF formulation was otherwise advisable as determined by the investigator. Statistical differences were assessed using Student's t-test and a statistical significance set at 5% (two-tailed test).

Results: A total of 183 patients were enrolled in the study of which 178 were eligible for data analysis. The mean (SD) age was 65.6 (12.1) years old, 48.9% were male. There were 91 patients diagnosed with open-angle glaucoma for their worse eye, 61 with ocular hypertension, and 23 with both. There were 124 patients with either glaucoma or ocular hypertension in both eyes. There was no significant change in the mean (SD) GSS-SYMP6 score. The values at baseline, week 4 and week 8 were 73.5 (21.9), 74.6 (19.3), and 75.9 (20.7) respectively. Treatment with PF dorzolamide-timolol resulted in a significant decrease in IOP, from 29.6 mmHg (4.2) at baseline to 18.1 (3.9) at week 8 ($P < 0.001$). The mean percent change in IOP was -38% (14.7) ($P < 0.001$). The physician and patient's global satisfaction score as evaluated by a 5-point Likert scale showed that they were either very satisfied or satisfied in a proportion of 91.2 % and 84.7 % respectively. Eight patients (4.5%) discontinued the study. Three serious adverse events were reported by 3 (1.7%) patients. Two of them (one cardiac disorder and one gastro-intestinal disorder) were considered definitely related to treatment as per the investigator's assessment.

Conclusion: The data obtained with the GSS-SYMP6 score suggest that initiation of treatment with PF dorzolamide-timolol was not associated with a worsening of ocular surface disease symptoms over an 8-week period. This was accompanied by a significant decrease in IOP and a high level of satisfaction by both the treating physician and the patient.

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P366 EVALUATING THE EFFICACY, TOLERABILITY AND SAFETY OF BRIMONIDINE 0.2%/TIMOLOL 0.5% OPHTHALMIC SOLUTION IN CLINICAL PRACTICE

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Objective: Fixed combination glaucoma medications may increase compliance in patients requiring multiple medications for IOP control. A fixed-combination of the alpha-2 adrenergic agonist brimonidine, 0.2% and the beta-adrenergic antagonist timolol, 0.5% (FCBT) has been shown to be more effective than each constituent alone and at least as effective as the two medications used together. This study was designed to evaluate the efficacy and safety of FCBT in patients with glaucoma or ocular hypertension in a clinical setting.
Design: This was a 2-month, multicenter, open-label study in which 399 patients with open-angle glaucoma or ocular hypertension underwent treatment with FCBT.
Participants: Adult patients diagnosed with glaucoma or ocular hypertension who in the judgment of the investigator had inadequate IOP control on their current therapy.
Intervention: FCBT was administered twice daily for two months either as initial, adjunctive, or replacement IOP lowering therapy.
Main outcome measure: The main outcome measures were the mean IOP and patient satisfaction from self-reported questionnaires.
Results: At baseline, physicians rated 74% of 399 patients as having difficulty to control IOP. At 2 months, FCBT therapy reduced mean IOP from 21.0 mmHg at baseline to 16.3 mmHg ($P < .001$) for all groups. Treatment naive patients achieved a 9.3 mmHg IOP reduction from a baseline of 25.5 mmHg ($P < .001$). When existing IOP lowering therapy was replaced with FCBT alone, patients achieved an additional 4.1 mmHg (18.4%) reduction from baseline ($P < .001$). When FCBT was used as adjunctive therapy, patients achieved an additional 4.5 mmHg (19.7%) from baseline ($P < .001$). Overall, the percentage of patients achieving a target pressure ≤18 mmHg increased from 41% at baseline to 76% at 2 months. At study completion, 100% of investigators reported that they would prescribe FCBT in the future and 97% of patients rated the tolerability of FCBT as good or excellent. The most common adverse events were ocular hyperemia in 2.5% (10/399) and burning in 2.3% (9/399) of patients. No serious adverse events related to FCBT treatment were reported.
Conclusions: Overall, FCBT was well-tolerated and patients on FCBT achieved significantly lower IOP than baseline when used as initial, replacement, or adjunctive therapy.
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P367 ADDITIVE EFFECT OF BRIMONIDINE TO PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA TAKING FIXED COMBINATION OF TIMOLOLE MALEATE-DORZOLAMIDE VERSUS FIXED COMBINATION OF TIMOLOL MALEATE-LATANOPROST

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Objective: To evaluate intraocular pressure lowering effect of topical brimonidine 0.2% twice daily in patients with primary open-angle glaucoma (POAG) receiving of fixed combination of timolole maleate-dorzolamide versus fixed combination of timolol maleate-latanoprost.
Design: Randomized comparative clinical study.
Participants: Eighty-four eyes of 84 patients with POAG with IOP out of control while receiving of fixed combination of timolole maleate-dorzolamide (group-1) *vs* fixed combination of timolol maleate-latanoprost (group-2) were treated with brimonidine twice daily adjunctive therapy.
Main outcome measure: Study visits were made at baseline, 1 month, 3 months and 6 months of treatment. Success was defined as 15% or more reduction in IOP from baseline.
Result: At baseline mean IOP was 23.68 ± 4.61 mmHg in group-1 and 22.0 ± 4.23 mmHg in group-2 ($P = 0.099$). The mean reduction from baseline IOP were 5.6 ± 5.6 mmHg and 3.2 ± 5.2 mmHg in group-1 and group-2 respectively at 1 month of the treatment ($P = 0.045$). The mean reduction from baseline IOP were 7.41 ± 6.8 mmHg in group-1, and 4.32 ± 5.2 in group-2 at 3 months of the treatment ($P = 0.019$).
Conclusion: This study suggests that brimonidine provides greater additive IOP lowering effect in patients with POAG receiving fixed combination of timolole maleate dorzolamide.
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P368 NON-IOP-RELATED EFFECT OF BRIMONIDINE ON VISUAL FIELD IN PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA (POAG)-A 12 MONTHS STUDY

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Introduction: Brimonidine tartrate 0.2% (Alphagan™, Allergan) is a potent and highly selective alpha2-adrenergic agonist that lowers intraocular pressure (IOP) by decreasing aqueous production and increasing uveoscleral outflow. Brimonidine has been shown to effectively lower IOP in normotensive, glaucomatous and ocular hypertensive eyes with the potential additional benefit of providing neuroprotection for RGCs in glaucoma patients.
Purpose: to explore possible non-IOP-related effect of Brimonidine on visual field in patients with POAG.
Methods: Sixty patients (120 eyes) with POAG without other ophthalmological or neurological diseases were examined in 12 months prospective clinical study. At the beginning, all patients underwent two visual field examinations (SAP Humphrey 30-2) and after that were divided in two groups. Thirty patients (60 eyes) were treated with timolol 0.5% and 30 patients (60 eyes) were treated with brimonidin 0.2%. Control visual field examinations were performed after 3, 6 and 12 months.
Results: Both examined medications had decreased IOP levels after 6 and 12 months but statisticaly significant difference in IOP levels was not established between examined groups ($p > 0.5$). Higher retinal sensitivity in group of patients treated with brimonidin 0.2% versus group of patients treated with timolol 0.5% (positive effect on mean slope, $p < 0.01$) indicates potential effect of brimonidin 0.2% in reducing visual field deterioration in progressing human glaucomatous eyes.
Conclusions: Our results of 12 months study are encouraging with high probability that will be confirmed after 24 months testing (db/year) visual field progression (GSP/GPA). Positive effect of brimonidin 0.2% on visual field in glaucoma patients could improve investigation of neuroprotective activity in human trials.
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P369 THE EFFECT OF BRIMONIDINE 0.02%/TIMOLOL 0.5% FIXED COMBINATION IN PERIPAPILLARY MICROPERIMETRIC DEFECTS IN OCULAR HYPERTENSIVE AND GLAUCOMATOUS EYES

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Purpose: Glaucoma refers to a group of diseases characterized by sight-threatening optic neuropathy. The importance of lowering IOP in glaucoma and ocular hypertension (OH) is well established. AGIS demonstrated that a low IOP (≤18 mmHg) is associated with reduced progression of visual field defect. Despite IOP control, it is recognized that glaucomatous patients may still experience a loss of mean sensibility of visual field by up to 1.5% per year. As a result additional targets that may preserve visual field such as neuroprotection are being evaluated. The topical alpha-2-agonist, brimonidine , has been extensively studied for its neuroprotective effect and has been postulated to have a mechanism of action that may prevent apoptosis in the nerve fibre layers leading to the prevention of visual field (VF) loss and even a reversal of VF defect. The purpose of our study was to investigate the effect of brimonidine 0.02%/timolol 0.5% fixed combination (BrTFC) on early visual field defects, measured through peripapillary microperimetry (PMP). Peripapillary defects are one of the earliest findings in glaucoma. The PMP technique allows for eccentric fixation monitoring in case of concomitance of macular diseases and thus demonstrates high specificity.
Design: Independent prospective, open label, uncontrolled, pilot clinical trial.
Methods: Thirty newly-diagnosed OH or glaucoma patients who met the inclusion criteria of > 2 areas of mean sensibility of VF with > 2db of PMP defect were enrolled into this pilot study. The patients were treated with BrTFC. The patients were subjected to 4 test parameters at both baseline and 12 weeks: IOP, visual acuity (VA), VF in dB (Humphrey Sita Standard) and mean sensibility using PMP (Nidek - MP1). Our primary objective was to assess change from baseline in mean sensibility of PMP (dB). The secondary objectives were analyses in mean change from baseline in IOP, VA and mean deviation in VF. All analyses were performed using paired data (t Student test).
Results: After 12 weeks of treatment with BrTFC, the mean sensibility of PMP demonstrated a statistically significant improvement of 1.6 dB from baseline ($p = 0.01$). Mean reduction in IOP from baseline was statistically significant from 22.13 mmHg to 18.37 mmHg after 12 weeks of treatment ($p = 0.0001$). No statistically significant difference was observed in either VA or mean deviation in VF.
Conclusions: This pilot study demonstrates that PMP is an effective measure for identifying early glaucomatous damage and accurately assessing minor VF changes within a short timeframe. Our findings also suggest that BrTFC significantly reverts peripapillary VF defects. Further investigation to explore whether other therapies can demonstrate peripapillary VF improvement is warranted.
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11.3.4. Medical treatment: Adrenergic drugs: Betablocker

see also P069, P376, P387, P394, P399

P370 VARIATIONS IN AQUEOUS HUMOR FLOW IN RESPONSE TO TOPICAL BETA-BLOCKER

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Objective or purpose: Glaucoma is an intraocular pressure (IOP)-related optic neuropathy. Topical beta-blockers lower IOP by decreasing aqueous humor flow. Because patients show variability in their IOP responses to this drug class, we designed a pilot study to explore the amount of variation in aqueous humor flow in response to topical timolol.
Design: Prospective, randomized clinical fluorophotometry study.
Participants: Study subjects, without glaucoma or ocular hypertension, were recruited using established inclusion and exclusion criteria in an approved IRBMED protocol.
Methods: Subjects were examined by visual acuity testing, biomicroscopy, gonioscopy, fundoscopy, IOP measurement, pachymetry, and A-scan. For fluorophotometry, 2% topical fluorescein was administered to each eye and allowed to reach steady state distribution. Subjects randomly received 1 drop of timolol 0.5% to their treated eye and 1 drop of artificial tears to their placebo eye. Fluorophotometry scans were performed hourly between 8 a.m. and noon. Data were analyzed using Oldham's correlation method.
Main outcome measure: Aqueous humor flow was calculated from hourly scans in the timolol-treated and placebo-treated eyes.
Results: Thirty subjects were studied with an average age of 35 ± 14 years with 17 men and 13 women. Eight subjects were studied in an inpatient setting, while the remaining 22 were studied in an outpatient clinical setting. The aqueous flow for placebo-treated eyes was 2.5 ± 0.7 µL/min. The percent decrease in flow ranged from 0 to 68 percent. We observed an Oldham's correlation of 0.39 for the relationship of variance of aqueous flow response between placebo and timolol-treated eyes.
Conclusions: As expected, timolol decreased aqueous humor flow, but aqueous flow varied in treatment response according to individual baseline flows. We observed that individuals with higher aqueous flow showed greater response to timolol in comparison to individuals with lower aqueous flow. Future research will entail exploring a possible association between timolol response and beta-adrenergic receptor genotypes.

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P371 RANDOMIZED TRIAL COMPARING, AFTER ONE YEAR OF TREATMENT, THREE FIXED COMBINATIONS OF PROSTAGLANDINS/PROSTAMIDE WITH TIMOLOL MALEATO

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Objectives: To evaluate the advantages and disadvantages of the use of fixed combinations of prostaglandins analogs and prostamide with timolol maleato, in patients diagnosed with open-angle chronic glaucoma or ocular hypertension using before more than one antiglaucoma drug. We put the emphasis in the decreasing of intraocular pressure.
Design: This clinical study, both descriptive and prospective, was carried out on in three groups of out-patients diagnosed with open angle chronic glaucoma or ocular hypertension and already treated with more than one antiglaucoma drug. An initial evaluation of all the patients was made after one month without treatment to evaluate the initial IOP. The pachymetry was also included in this study. Patients were randomly assigned one of the three groups. An evaluation was made monthly until the sixth month and then in the month twelve, using the same masked observer in which the IOP was measured and the patient was asked about possible adverse reactions. The length of the study was twelve months. Differences between initial IOP and pachymetry of the 3 groups were not statistically significant. We also described the characteristics of that population studied.
Results: All these three combinations decrease the IOP to levels without statistical differences. The lowering action of the 3 groups, related to their own initial pressure, expressed in percentage of the initial IOP, is about 32 %.The related symptoms to these three combinations decrease substantially from the beginning of the study to the evaluation at the 12th month. The red eye, which appears at the beginning due to Bimatoprost/timolol, decreased from 45% to 11% at the 12th month. The difference with the patients under other medicines is only statistically significant with the Latanoprost/timolol group. The dark eye rings did not change for the Bimatoprost/timolol group and increase in the others compared to the beginning of the study.

Conclusions: After one year of treatment, the three combinations are good depressors of the IOP; they all achieve important reductions in the IOP, about 32%. We only found difference in the red eye; the patients in the Bimatoprost/timolol group have statistically significant more than the patients under Latanoprost/timolol

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P372 CORRELATION OF THE OCULAR HYPOTENSIVE EFFICACY OF LATANOPROST OR TIMOLOL WITH BASELINE AND CHANGES IN AQUEOUS HUMOR DYNAMICS

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Objectives: Latanoprost (LP) and timolol are two of the most effective and commonly-used drugs in glaucoma therapy. They reduce intraocular pressure (IOP) by different mechanisms. LP improves aqueous humor outflow and timolol reduces aqueous flow. We sought to determine whether baseline or changes in aqueous humor dynamics correlated with the ocular hypotensive efficacy of either drug.
Design: Retrospective analysis of data from a prospective, double-masked, crossover, interventional study.
Participants and/or controls: Thirty volunteers with a diagnosis of ocular hypertension (previous record of IOP > 21 on multiple measurements).
Methods: IOP (9 am and 11:30 am) was determined by pneumatonometry, aqueous flow and outflow facility (C) by fluorophotometry and uveoscleral outflow (Fu) by mathematical calculation using the Goldmann equation and an episcleral venous pressure of 11 mmHg. Measurements were made at baseline (after a 6 week washout of current or study medication, if needed) and at 1 and 6 weeks of treatment with timolol 0.5% twice daily or LP 0.005% once daily in the evening.
Main outcome measure: Scatter plots were evaluated and linear correlations were computed where appropriate, with and without correction for baseline IOP. Significant correlation ($p<0.05$) between the IOP lowering effect and baseline aqueous humor dynamics or changes in aqueous humor dynamics was sought.
Results: The percent IOP reduction produced by LP or timolol after 1 or 6 weeks of treatment was significantly ($p < 0.0001$) correlated with the baseline IOP ($r = 0.62$ to 0.66). The percent drop in IOP with LP at 1 or 6 weeks significantly ($p = 0.001$ and $p = 0.032$, respectively) correlated with baseline Fu ($r = 0.63$ and $r = 0.42$) and at 1 week significantly ($p = 0.007$) inversely correlated with baseline C ($r = -0.51$). At 1 or 6 weeks, the percent IOP reductions produced by LP were significantly ($p = 0.001$) correlated with the rise in C ($r = 0.62$ and $r = 0.38$). Using a multivariate analysis, the correlations between IOP reduction and either C or Fu (with a single exception) became insignificant after correcting for the confounding variable of baseline IOP. Only the positive correlation between IOP reduction and increase in C at 1 week remained significant for LP in the multivariate analysis. At baseline, significant ($p < 0.05$) correlations were found between: 1) higher IOP and lower C ($r = -0.47$); 2) higher IOP and higher Fu ($r = 0.39$). The ocular hypotensive efficacy of timolol did not correlate with the baseline or change in aqueous flow at either 1 or 6 weeks.
Conclusions: Patients with higher baseline IOPs respond better to LP or timolol than patients with lower baseline IOPs. The ocular hypotensive efficacy of timolol is not affected by baseline aqueous flow. The ocular hypotensive efficacy of LP at 1 week of treatment correlated with change in C. No conclusion can be made concerning correlations of LP or timolol on Fu as the results are inconsistent.

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P373 EVALUATION OF MAJOR DEPRESSIVE DISORDER IN PATIENTS RECEIVING CHRONIC TREATMENT WITH TOPICAL β-BLOCKERS

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Purpose: To screen for major depressive disorder (MDD) in patients receiving chronic therapy with topical ß-blockers or prostaglandin analogues for glaucoma.
Design: Cross-sectional study.
Participants: The study population was recruited from a university-based glaucoma follow-up clinic and general ophthalmology outpatient department. It consisted of 162 patients

with confirmed diagnosis of glaucoma and receiving chronic treatment (> 3 months) with antiglaucoma medications (98 on topical ß-Blockers only [Group I] , 64 on prostaglandin analogues only [Group II]) and 150 patients with age related cataract [Group III]. Patients with any other systemic illness or receiving systemic ß-blockers were excluded.
Methods: Administration of Prime MD Today questionnaire (PRIMary care Evaluation of Mental Disorders) based on criteria from American Psychiatric Association's Diagnostic and Statistical Manual IV (DSM- IV).
Main Outcome Measures: Questionnaire scores, demographic data, medical data, ocular diagnosis.
Results: Mean age of the patients in group I, II and II was 52.6 ± 6.3 yrs, 55.2 ± 7.6 yrs and 65.5 ± 8.2 yrs. In group I, 9 patients (9.2%), screened positive for MDD, in group II, 1 patient had MDD (1.5%), while in Group III, 3 patients (2%) were diagnosed to have MDD. None of the affected patients were practicing punctal occlusion following the instillation of medicine. The incidence of MDD in Group I was significantly higher than Group II ($p < 0.05$) and Group III ($p < 0.01$) while there was no significant difference between groups II and III. All patients screened positive for MDD were referred to a psychiatrist for counseling and appropriate therapy.
Conclusions: Nearly 1 out of every 10 patients receiving chronic treatment with topical ß-Blockers was found to be suffering from major depressive disorder. All glaucoma patients on topical ß-Blockers must be screened for MDD and referred for appropriate psychiatric consultation and treatment if indicated.
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P374 COMPARISON OF 24-HR IOP WITH THE TRAVOPROST/TIMOLOL FIXED COMBINATION COMPARED WITH THE LATANOPROST/TIMOLOL FIXED COMBINATION WHEN BOTH ARE DOSED IN THE EVENING IN EXFOLIATIVE GLAUCOMA

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Aim: To compare the 24-hour IOP control obtained with the travoprost/timolol fixed combination (TTFC) compared with the latanoprost/timolol fixed combination (LTFC) when both are administered in the evening in exfoliative glaucoma (XFG).
Methods: One eye of 42 XFG patients was included in this prospective, observer-masked, crossover comparison. Following wash-out, all patients were randomized to received either TTFC or LTFC for 3 months. They were then switched to the opposite therapy for another 3 months. At the end of each period 24-hour pressure monitoring was performed.
Results: In 40 subjects who completed the study, the untreated baseline IOP following washout was 27.7 ± 3.5 mmHg. Both TTFC and LTFC regimens significantly reduced intraocular pressure from baseline at each time-point and for the mean 24-hour pressure curve ($p < 0.001$). When the two fixed combinations were compared directly, TTFC treatment (mean: 18.7 mmHg, 95% confidence interval [CI]: 17.9 to 19.4 mmHg) provided a significantly lower 24-hour pressure than LTFC therapy (19.6 mmHg, 95% CI: 18.8 to 20.4 mmHg; $p < 0.001$). Treatment with TTFC also resulted in lower 24-hour pressure fluctuation (3.4 mmHg, 95% CI: 3.0 to 3.8) than LTFC treatment (4.1 mmHg, 95% CI: 3.6 to 4.5; $p = 0.011$) and lower peak IOP (20.5 *vs* 21.5 mmHg, $p < 0.001$). No statistically significant differences were observed in conjunctival hyperemia and hypertrichosis ($p = 0.29$ and $p = 0.25$).
Conclusion: Both fixed combinations significantly reduce 24-hour IOP in XFG compared with untreated baseline. The TTFC gives rise to statistically better 24-hour IOP control than LTFC when both are administered in the evening.
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P375 TIMOGEL® VS TIMOLOL 0.5% OPHTHALMIC SOLUTION. EFFICACY, SAFETY AND ACCEPTANCE

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Aim: To evaluate the efficacy, safety and tolerability of changing to TIMOGEL® preservative-free once daily from prior timolol 0.5% ophthalmic solution twice daily in OH and POAG patients.
Methods: Seventy-five OH and POAG patients treated with timolol 0.5% bid with IOP ≤21 mmHg were enrolled. They underwent complete ophthalmologic examination, IOP mea-

surements (at through and day-time curve), evaluation of side effects (local and systemic), Schirmer test, break up time, blood pressure, heart rate, ocular diastolic perfusion pressure measurements and acceptance (Comparison of Ophthalmic Medications for Tolerability -COMTOL- questionnaire and VFQ25 questionnaire). Patients were re-evaluated 3 months after the switch to TIMOGEL®. The Pearson Chi-square test was used to test for a statistically significant difference between the two treatments. P values less than 0.05 were considered statistically significant.

Results: At through the mean percentage IOP reduction was 23,6% under Timolol 0.5% and 22,3% after 3 months of TIMOGEL® treatment. No statistical differences in mean IOP values at through and in the day-time curve were observed between the two treatments. Local and systemic side effects were less frequent under TIMOGEL® treatment (HR: $p < 0.05$). Patients demonstrated a significant improvement of Schirmer test and BUT ($p < 0.05$) and a reduction of dryness and foreign body sensation ($p < 0.01$) after switching to TIMOGEL®. Mild and short lasting blurred vision after TIMOGEL® instillation occurred for about 18,5% of patients . 82% of patients were satisfied or very satisfied with TIMOGEL® *vs* 61% with previous treatment ($p < 0.01$). TIMOGEL® was discontinued only in three patients.

Conclusions: TIMOGEL® preservative-free dosed once every morning has a 24-hours hypotensive effect with a better safety profile than TIMOLOL 0.5% bid and it is well accepted by patients. The once-daily dosing improved the acceptance and the compliance.

11.4. Medical treatment: Prostaglandins

see also P069, P371, P372, P374

P376 THE EFFICIENCY OF USAGE PREPARATIONS TRAVOPROST 0,004% AND TRAVOPROST 0,004% + TIMOLOL 0,5% WHILE TREATING PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: The analysis of the efficiency of hypotensive effect of the preparation travoprost 0,004% and travoprost 0,004% + timolol maleate 0,5% in comparison with preparations from other groups in primary open-angle glaucoma patients.

Design: Prospective, randomized, parallel-group clinical trial.

Participants: Ninety-two eyes of 54 glaucoma patients.

Methods: The research has been done among 54 patients (92 eyes) who had a primary open-angle glaucoma with noncompensated IOP, among them 32 - men, 22 - women, age from 30 till 80 years old, on the average 68.7 ± 2.8 years old. Depending on the drug therapy prescribed earlier all patients have been divided into two groups: 1-st group (58 eyes) - the patients who had been taking thimolol maleate 0.5% - 32 eyes (34.7%) before the research or betaxolol hydrochloride 0.25 % - 12 eyes (13%) or brinzolamide 1% - 14 eyes (15.4%); 2-nd group - the patients who had been taking travoprost 0.004% - 22 eyes (23.9%) or latanoprost 0,005% - 6 eyes (6.5%) or latanoprost 0.005% + thimolol maleate 0.5% - 6 eyes (6.5 %). The patients of the first group were prescribed 0.004 % travoprost solution which was taken 1 drop once every evening. The patients of the second group were prescribed combined preparation, including 0.004 % travoprost solution and 0.5 % thimolol solution also taken 1 drop once every evening. The research has lasted for six months. All the patients underwent ophthalmologic examinations: Goldmann applanation tonometry, Pascal contour dynamic tonometry, tonometry with ORA (Ocular Response Analyser).

Main outcome measures: A change of intraocular pressure.

Results: In comparison with the initial IOP parameters 0.004% travoprost and combined preparation, including 0.004% travoprost solution and 0.5% thimolol solution reduced it significantly during all the period of the research. The data received with the help of Pascal contour dynamic tonometry was used as the basic parameter describing actual IOP. In the first group 0,004% travoprost truly ($p < 0.05$) reduced IOP on the average on 4 mmHg in comparison with the initial data (from 22.4 ± 1.1 up to 18.2 ± 1.4 mmHg). In the second group of patients the average IOP reduce came to 6 mmHg in comparison with the initial data (from 23.8 ± 0.53 up to 1704 ± 0.78 mmHg), that is statistically valid ($p < 0.05$).

Conclusion: 0.004 % travoprost and combined preparation, including 0.004% travoprost solution and 0.5% thimolol has the evident permanent and long term hypotensive effect on the patients with primary open-angle glaucoma and can be applied as a choice preparation at POAG monotherapy with noncompensated pressure.

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P377 - withdrawn

P378 COMPARISON OF THE EFFECT OF LATANOPROST AND TRAVOPROST ON 24-HOUR IOP IN NORMAL-TENSION GLAUCOMA

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Purpose: It has been reported that latanoprost (LP) and travoprost (TP) are effective in lowering intraocular pressure (IOP) for 24 hours after administration. TP may be more effective in the 12-hour to 48-hour period after administration. But it is not fully clear, especially in NTG. To compare 24-hour reduction in IOP by LP and TP without Benzalkonium chloride in the right and left eyes of identical patients with normal tension glaucoma (NTG).

Design: Individual randomized open-label parallel study.

Participants: Twenty-one NTG patients.

Method: The subjects were 42 eyes in 21 NTG patients, composed of 10 males and 11 females. Their average age was 53.0 ± 11.8 years old. The inclusion criteria were based on the 24-hour variation in IOP without treatment. The difference in the mean 24-hour IOP in the right and left eyes was less than 1 mmHg, and the difference in IOP in the right and

left eyes at each time point of measurement was 2 mmHg or less. The IOP was measured with the Goldmann applanation tonometer in sitting position at 10, 13, 16, 19, 22, 1, 3, and 7 o'clock under hospitalization. After 24-hour IOP without treatment was examined, LP was randomly assigned to one eye and TP to the other eye in the identical patients. The patients were treated for 8 weeks by LP and TP, then the 24-hour IOP was measured under re-hospitalization.
Main outcome measure: 24-hour IOP variation.
Results: IOP lowered significantly in both LP group and TP group at all time points after the treatment ($p < 0.05$). The mean 24-hour IOP reduction rate was 13.7 ± 8.9% in LP group and 14.7 ± 9.5% in TP group. It shows no significant difference between both groups. Further, there were no significant differences in IOP reduction at all measurement time points.
Conclusions: In NTG, LP and TP had equal effects on 24-hour IOP reduction.
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P379 EFFECT OF TAFLUPROST ON THE INTRAOCULAR PRESSURE IN LATANOPROST LOW-RESPONDER MONKEYS

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Purpose: To investigate the effect of tafluprost on intraocular pressure (IOP) in the ocular normotensive monkeys which dose not well respond to latanoprost. So far, it has been known that IOP lowering effect of PG analogues is different among the individuals. The main outcome of this study is to investigate the effect of tafluprost on IOP in the ocular normotensive monkeys that do not respond to latanoprost well.
Methods: The animals had been trained to IOP measurement before this experiment. IOP was measured using pneumatonometer under conscious. 0.005% latanoprost and saline were topically administrated once a daily (9:00-11:00 a.m.) for 7 days. We defined the monkeys which responded 1 mmHg or less IOP reduction as the latanoprost low-responder. 0.0015% tafluprost and saline were topically administrated once a daily (9:00-11:00 a.m.) for 7 days to latanoprost low-responder monkeys.
Results: These were 11 latanoprost low-responder monkeys. The baseline IOP before latanoprost administration was 16.6 ± 0.8 mmHg (mean ± S.E.M), and maximal IOP reduction (maximal DIOP) was 0.7 ± 0.2 mmHg (Day 1) and 0.6 ± 0.1 mmHg (Day 7), respectively. Topical administration of tafluprost for 7 days decreased IOP in all latanoprost low-responder monkeys. The baseline IOP before tafluprost administration was 16.5 ± 0.8 mmHg, and maximal DIOP was 2.1 ± 0.2 mmHg (Day 1) and 2.9 ± 0.2 mmHg (Day 7), respectively. The IOP reduction of tafluprost was significant compared with that of saline (Student t-test, $p < 0.05$).
Conclusions: Topical administration of tafluprost decreased IOP in latanoprost low-responder monkeys. This result suggests that tafluprost may be effective medicine for latanoprost low-responder.
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P380 IOP REDUCTION PERSISTS AT LEAST SIX MONTHS AFTER A TRANSITION FROM TRAVOPROST TO BAK-FREE TRAVOPROST IN GLAUCOMA PATIENTS AT THE MANHATTAN VA

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Purpose: To evaluate whether BAK-free travoprost 0.004% is effective in maintaining IOP after transitioning from BAK-preserved travoprost 0.004%.
Design: Retrospective chart review.
Participants: Open-angle glaucoma, glaucoma suspect, or ocular hypertensive patients (84) from the eye clinic of the Manhattan VA in New York City.
Methods: Patients were treated with benzalkonium chloride (BAK) preserved travoprost and then subsequently transitioned to BAK-free travoprost. The study included monotherapy and concomitant therapy patients. No other significant ocular interventions or medication changes were permitted during the follow-up period. All analyses were conducted using paired, two-tailed student t-tests.
Main outcome measure: IOP at baseline with 2 follow-up visits
Results: Eighty two of eighty four patients were male with a mean age of 75.6 ± 9.9 years. Patients on travoprost monotherapy (N = 45) had a mean baseline IOP of 14.9 ± 3.5 mmHg. After the transition to BAK-free travoprost, Mean IOP was 14.6 ± 3.3 mmHg ($p = 0.55$) at the first follow-up (mean 69 days). Mean IOP was 14.9 ± 3.1 mmHg ($p = 0.92$) at last follow-up (mean 255 days). The concomitant therapy group (N = 39) had a mean baseline IOP of 14.6 ± 4.1 mmHg on travoprost. Mean IOP after a regimen change to BAK-free travoprost was 14.2 ± 4.1 mmHg ($p = 0.61$) at first follow-up (mean 67 days) and 14.95 ± 3.2 mmHg ($p = 0.56$) at last follow-up (mean 241 days). Statistical analyses of both groups together also showed no significant difference between mean baseline IOP on travoprost or the initial or > 6 month follow-up on BAK-free travoprost ($p = 0.43$ and $p = 0.70$, respectively).
Conclusion: Intraocular pressure remained statistically equivalent for greater than 6 months after switching from

BAK-preserved travoprost to BAK-free travoprost. Our study suggests that BAK is not necessary for persistent IOP-lowering in this population and that patients within the VA system may be safely switched.

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P381 EVALUATION OF TWO 0.005% LATANOPROST OPHTHALMIC FORMULATIONS: A PILOT PRECLINICAL STUDY

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Objective: To evaluate and compare the safety and efficacy of a topical ophthalmic solution of 0.005% latanoprost with and without benzalkonium chloride (BAK) applied on ophthalmologic healthy New Zealand albino rabbits.
Design: This was a single-center, prospective, longitudinal, comparative, double-mask, randomized, preclinical study.
Participants: Thirty New Zealand albino rabbits were controlled under fed/light/ dark conditions and handled according to the guidelines of the Association for Research in Vision and Ophthalmology.
Methods: The study was performed in 30 ophthalmologic healthy New Zealand albino rabbits. Fifteen rabbits received randomly and equitably one drop on both eyes of a 0.005% latanoprost sterile solution with or without BAK (both solutions developed by Laboratorios Sophia, S.A. de C.V., Guadalajara, Mexico) at 20:00 hours, every day, during 15 days. The baseline assessment and the evaluations during the study were performed by one ophthalmologist who did not know what formulation to each subject was applied. The rabbits were assessed the day 0 (baseline examination), 1 (the day the article was assigned and applied for the first time), 7 and 15. The IOP was evaluated in two different hours (08:00 and 16:00 ± 1 h) with Goldmanns applanation tonometer. Safety was assessed using fluorescein and rose bengal corneal stain.
Main outcome measure: Intraocular pressure (IOP).
Results: The IOP reduction from the baseline to the end of study (day 15) evaluated at 08: 00 h was 3.7 mmHg (SD ± 1.09) for the BAK group and 3.7 (SD ± 1.17) for the BAK-free group. The IOP reduction evaluated at 12:00 h was 3.8 (SD ± 1.04) for the BAK group and 3.6 (SD ± 1.22) for the BAK-free group. There was no hyperemia reported in both groups.
Conclusions: In this pilot study, both latanoprost solutions showed equal therapeutic effects in lowering the IOP whether they had or not BAK. These results suggest that the efficacy and safety of latanoprost without BAK has no differences when compared to the one with BAK. Nevertheless, wider studies will be necessary in the future.

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P382 THE COMPARATIVE EFFICACY OF LATANOPOROST AND TRAVOPROST IN CONTROLLING THE DIURNAL CURVE OF IOP IN PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA AND OCULAR HYPERTENTION

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Purpose: The presence of diurnal curve of IOP is an independent risk factor for the progression of glaucoma. The control of diurnal curve of IOP by antiglaucoma medication is an important concern. This study was designed to compare the control of diurnal curve of IOP with latanoprost 0.005% and travoprost 0.004% dosed once daily in patients of POAG and OTN.
Design: This was prospective, randomized, parallel group, observational study.
Participants: Fifty glaucoma patients.
Methods: This study was designed to compare the efficacy of once daily evening administration of latanoprost and travoprost ophthalmic solutions. This study included 50 patients who were randomized into 2 treatment groups of 25 patients each. At baseline and 4 weeks after the therapy masked evaluators measured intraocular pressure (IOP) at 9 am, 1 pm, 4 pm, 8 pm, 12 pm, 3 am, 6 am and 9 am.
Outcome measures: reduction in IOP.
Results: Baseline mean IOP were similar in both the groups. At the end of 4 weeks, IOP was reduced in both the groups significantly as compared to baseline ($P < 0.01$). In travoprost

group, the IOP decreased by 6.1 and 5.9 mmHg at 4 pm and 8 pm. The IOP reduced by 5.6 and 5.2 mmHg at these time points with latanoprost group. The IOP reduction of 8 pm were significantly higher in travoprost group as compare to latanoprost group ($P < 0.01$). At all other time points there was no significant difference in IOP lowering in both the groups.

Conclusions: Both latanoprost and travoprost were equally effective in controlling diurnal curve of IOP in patinsts of POAG and OH. However, travoprost appears to reduce evening mean IOP more effectively than latanoprost.

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P383 A COMPARISON OF INTRAOCULAR PRESSURE LOWERING EFFECT OF LATANOPROST 0.005% WITH TWO DIFFERENT DOSING REGIMEN: ONCE DAILY AND ONCE EVERY OTHER DAY

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Purpose: To compare the IOP-lowering effect of latanoprost 0.005% when prescribed once daily and once every other day in patients with POAG or OHT

Design: Prospective, randomized, cross-over clinical trial.

Participants: Forty eyes of 20 patients with bilateral OHT or early stages of POAG (mean age 62 ± 12.6 years).

Methods: Following a washout period of all medications, each patient started latanoprost once daily (group 1) in one randomly assigned eye and once every other day (group 2) in the other eye (both groups at 9 p.m.). After 1 month, eyes then were crossed over to the opposite dosage of latanoprost and followed again for 1 month. IOP was measured at 9 a.m., 4 p.m., and 9 p.m., at baseline and on two consecutive days at the end of the first and second month of the study. Measured IOPs 36-48 hours after drug application in group 2 were compared with group 1 for statistical analysis.

Main outcome measures: Intraocular pressure at the end of the first and second month of the study.

Results: Mean baseline IOP in the right eye and left eye were 25.6 ± 2.61 and 25.5 ± 2.72 ($p > 0.05\%$) respectively. At the end of the first month of treatment mean IOP measured at 9 a.m., 4 a.m., and 9 p.m., in group 1 and group 2 were 17.3 ± 2.55 and 18.6 ± 1.9 ($p = 0.00$),17.2 ± 2.9 and 18.1 ± 1.5 ($p = 0.06$),16.7 ± 2.2 and 17.8 ± 2.1 ($p = 0.007$). At the end of the second month of the study, IOP measured at those hours in group1 and group 2 were 17.5 ± 2.1 and 18.9 ± 2.45 ($p = 0.002$), 16.7 ± 1.97 and 17.8 ± 3.05 ($p = 0.001$),16.9 ± 1.77 and 17.4 ± 2.39 ($p = 0.009$).

Conclusions: Both once daily and once every other day dosage of latanoprost significantly reduce the IOP, but in every other day dosage this reduction is significantly less pronounced 36-48 hours after drug application.

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P384 THE EFFECTS OF PROSTAGLANDIN ANALOGUES ON INTRACELLULAR CA^{2}+ CONCENTRATIONS IN PROSTANOID FP OR EP-RECEPTOR-DEFICIENT MICE CILIARY ARTERIES

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Purpose: It has been shown that antiglaucomatous prostaglandin (PG) analogues, Latanoprost, Tafluprost and Unoprostone, not only reduce intraocular pressure but also increase ocular blood flow. We reported that these PG analogues decreased intracellular Ca^{2+} concentrations ($[Ca^{2+}]i$) in wild-type (WT) mice ciliary arteries. However, the underlying mechanism is not yet clear. To investigate whether this mechanism is derived from PG receptors (FP or EP receptors), we investigated the effect of these PG analogues on isolated FP-receptor-deficient (FPKO) or EP-receptor-deficient (EPKO) mice ciliary arteries in vitro.

Design: Basic research.

Participants and/or controls: WT, FPKO and EPKO mice were used.

Methods: Under a microscope, vascular ring segments of ciliary arteries were cut from WT, FPKO and EPKO mice to form strips (150-200 μm in width, 1.5 mm in length). These strips were incubated in a solution composed of the Ca^{2+}-sensitive dye fura-2. The effects of various PG analogues on $[Ca^{2+}]i$ were measured using an Aquacosmos System equipped with a Nikon epifluorescence microscope and band-pass filters for wavelengths of 340 and 380 nm. After correction for the individual background fluorescence, the ratio of the fluorescence at both excitation wavelengths (F340/F380) was monitored simultaneously to determine the $[Ca^{2+}]i$.

Main outcome measure: The effects of PG analogues on relative $[Ca^{2+}]i$ change were measured, where the change of $[Ca^{2+}]i$ induced by the high-K solution was defined as 100%.

Results: These three PG analogues significantly decreased $[Ca^{2+}]i$ in WT mice ciliary artery elevated by high-K (LAT: 46 ± 4%, TAF: 55 ± 6%, UNO: 65 ± 7%). In EPKO mice, the decreasing rates were LAT: 49 ± 5%, TAF: 56 ± 4%, UNO: 71 ± 9%, and they were not significantly different from those of WT. In FPKO mice, the rates were LAT: 34 ± 7%, TAF: 63 ± 7%, UNO: 63 ± 7%. The rates of LAT and TAF were significantly different from those of WT mice.
Conclusions: Antiglaucomatous PG analogues decreased $[Ca^{2+}]i$ in WT, EPKO and FPKO mice ciliary arteries. EP or FP receptors seem to play a small role on vascular smooth muscle relaxation induced by PG analogues.
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P385 EFFECT OF DOSE TITRATION OF BIMATOPROST ON THE INCIDENCE OF HYPEREMIA

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Purpose: Bimatoprost ophthalmic solution (0.03%) is a member of a new class of ocular hypotensive drugs called prostamides, which are compounds related to prostaglandins. The most common side effect of these medications is conjunctival hyperemia, which has been reported to occur in approximately 40% of the patients. To determine: 1) if dose titration of bimatoprost therapy reduces the incidence and severity of hyperemia; and 2) if delayed treatment of the fellow eye reduces hyperemia.
Methods: Twenty-four patients with glaucoma or ocular hypertension naive to prostaglandin or prostamide medications were randomly assigned in a double masked fashion to instill bimatoprost following one of the two schedules. Patients in group 1 instilled bimatoprost every day at 10 pm in one randomly selected eye. Patients in group 2 instilled bimatoprost every third day at10 pm in one randomly selected eye for the first three doses and then switched to every other day dosing. On day 30, both groups were asked to use bimatoprost daily at night in both eyes. The contralateral eye in both the groups served as an internal control and patients were instructed to instill an artificial tear solution to maintain patient masking. Study visits were at baseline, days 7, 14, 30, and 37. Hyperemia was graded at each visit on a 5-point scale (0 = none, 0.5 = trace, 1 = mild, 2 = moderate, 3 = severe).
Results: Patients in group 1 showed significant increasing hyperemia in the treated eye on each follow up visit compared to group 2, which was statistically significant (see table). The control eye had no statistically significant increase in hyperemia at any visit through day 30. However, on day 37 visit, both the groups showed increased hyperemia in the control eye. Bimatoprost showed IOP lowering effect at all visits. Comparing baseline hyperemia between Group 1 and Group 2 at each follow-up visit. Baseline *vs* Day 7 (Group 1) 0.28 *vs* 0.56 (p=0.03); (Group 2) 0.40 *vs* 0.53 (p=0.11). Baseline *vs* Day 14 (Group 1) 0.28 *vs* 0.56 (p=0.01); (Group 2) 0.40 *vs* 0.43 (p=0.38). Baseline *vs* Day 30 (Group 1) 0.28 *vs* 0.57 (p=0.01); (Group 2) 0.40 *vs* 0.57 (p=0.12). Baseline *vs* Day 37 (Group 1) 0.28 *vs* 0.50 (p=0.07); (Group 2) 0.40 *vs* 0.54 (p=0.08).
Conclusion: Dose titration is an effective way to reduce hyperemia seen with bimatoprost; delayed treatment of the fellow eye does not help in reducing the hyperemia.

P386 SHORT-TERM COMPARATIVE STUDY OF THREE DIFFERENT FORMULATIONS OF 0.005% LATANOPROST IN HEALTHY VOLUNTEERS

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Objective: To evaluate the safety and efficacy of three 0.005% latanoprost sterile ophthalmic solutions applied on healthy volunteers: cyclodextrins/BAK-containing latanoprost (CBL), cyclodextrins-containing latanoprost without BAK (CL), and refrigerated latanoprost with BAK (RLB).
Design: The present was a single-center, double mask, prospective, longitudinal and comparative clinical study.
Participants: Thirty healthy subjects who achieved the eligibility criteria were admitted.
Methods: The study was performed in 30 ophthalmologic healthy volunteers. They where divided in three groups equally. The three groups received either CBL, CL (both developed by Laboratorios Sophia, S.A. de C.V., Guadalajara, Mexico), and RLB (Pfizer Laboratories) separately in a dose of one drop on both eyes at 20:00 h (± 1 h) during fifteen days. The base line assessment and the evaluations during the study were performed by one and only ophthalmologist who did not know what formulation to each group was applied. The volunteers were assessed the day 0 (baseline examination), 1 (the day the article was assigned and applied for the first time), 7 and 15. The IOP was performed at 08:00 h (± 1 h) with Goldmann's applanation tonometer. Safety was assessed using fluorescein corneal stain with a scale ranging from 0 (none), 1 (mild), 2 (moderate), and 3 (severe).
Main outcome measure: Intraocular pressure (IOP).
Results: The IOP reduction obtained from the baseline to the end of study (day 15) was 3.9 mmHg (SD ± 1.5), 2.7 mmHg (SD ± 1.6), and 2.5 mmHg (SD ± 1.4) for the CBL, RLB, and CL group, respectively. The hyperemia presented in the three groups (scale 0 to 3) had a mean of 0.70, 0.67, and 0.38 for RLB, CL, and CBL group, respectively.
Conclusions: According to the results, the formulation of CL showed an equal effect on IOP reduction when compared with the other two formulations. With regard to the safety, the CL solution maintained a low range of hyperemia as seen with the other two solutions. We can conclude that CL is as effective and safe as CBL and RLB solutions in reducing the IOP. Nonetheless, wider studies will be necessary in the future.

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P387 IMPROVED IOP-LOWERING FOLLOWING THE TRANSITION TO THE TRAVOPROST/TIMOLOL MALEATE FIXED COMBINATION (DUOTRAV) FROM PRIOR MONO- OR TWO-DRUG THERAPY

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Purpose: To evaluate the safety and efficacy of changing the travoprost/timolol fixed combination (DuoTrav Alcon Labs, Fort Worth, TX, TTFC) in patients with ocular hypertension or primary open-angle glaucoma.
Design: Prospective, open label clinical trial with a historical control.
Methods: We changed patients at Visit 1, treated with any prior mono- or adjunctive glaucoma therapy, to TTFC alone dosed each evening. Patients had a safety visit (Visit 2) at 1 month and returned again at Month 3 (Visit 3) to evaluate efficacy and safety on TTFC. The intraocular pressure (IOP) was measured at the same time at Visit 3 as Visit 1 (± 1 hour).
Results: In total, 502 patients were enrolled in this trial and 480 completed Visit 3. The average age was 69.5 ± 11 years and 305 were female and 197 male. For all patients, the average IOP on prior therapy at Visit 1 was 21.8 ± 2.4 mmHg and at Visit 3, 16.4 ± 2.5 mmHg ($P < 0.0001$). The IOP values for TTFC were lower compared to the most common prior treatments including: timolol (16.3 ± 2.4 *vs* 21.8 ± 2.1 mmHg, $n = 146$, $P < 0.0001$), latanoprost (16.8 ± 2.3 *vs* 22.0 ± 2.3 mmHg, $n = 76$, $P < 0.0001$) and travoprost (16.3 ± 2.4 *vs* 22.0 ± 2.3 mmHg, $n = 65$, $P < 0.0001$). For all patients, the most common adverse events on TTFC were burning (n = 17, 3.4%), conjunctival hyperemia (n = 15, 3.0%) and itching (n = 14, 2.8%). In total, 22 patients (4.4%) discontinued before Visit 3, 18 patients for an adverse event (2.8%) and 4 patients for withdrawn consent (n = 4, 0.8%).
Conclusion: This study suggests that patients may be safely changed from prior mono- or adjunctive glaucoma therapy to the travoprost/timolol fixed combination and on average, at least over 3 months, benefit from a further reduction of IOP.

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P388 OBSERVATIONAL STUDY ON EFFICACY AND SAFETY OF A SYSTEMATIC SWITCH FROM LATANOPROST 0,005% AND TIMOLOL 0,5% DOSED CONCOMITANTLY TO THE TRAVOPROST 0.004%/TIMOLOL 0.5% FIXED COMBINATION. A 6 MONTH STUDY

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Purpose: 1. To assess the efficacy and safety of systematically switching a large number of glaucoma patients from Latanoprost 0,005 and Timolol 0,5% to the fixed combination Travoprost 0.004%/Timolol 0.5% (TTFC); 2: To record effects on BUT.
Design: Open-label, multicenter, prospective, observational, 6-month study.
Patients and Methods: Three hundred-nine patients on concomitant Latanoprost 0.005% and Timolol 0.5% were systematically switched to TTFC.
Main Outcome Measures: Control of intraocular pressure (IOP), rate of patients reaching IOP < 18 mmHg, rate of discontinuation, BUT changes, tolerability. IOP was measured at baseline (while on concomitant therapy), and at 1 and 6 months after switching to TTFC. BUT was assessed at baseline and 6 month visits. Adverse effects were recorded at 1 and 6 months.

Results: IOP significantly decreased (from 18,3 mmHg to 16,6 mmHg) after regimen substitution ($p < 0,0001$). Many patients reached an IOP < 18 mmHg ($p < 0,0001$). BUT significantly improved after switching (from 8,4 sec. to 9,2 sec., $p < 0,0001$). Few patients reported adverse events (AEs, 8.7%): the rate of discontinuation due to AEs was very low (4,5%).
Conclusion: TTFC is a useful therapeutic option due to its strong IOP-lowering efficacy with once-daily dosing. In this study, glaucoma patients who underwent a regimen modification to TTFC obtained: 1. further reductions in IOP probably due to improved compliance and subjectively perceived convenience; 2. improved ocular surface status linked to the once-daily monotherapy. The high switch rate of 94,5% beyond the 6 months follow-up visit indicates a good tolerability profile of the TTFC.
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P389 EFFECTS OF VARYING CONCENTRATIONS OF BENZALKONIUM CHLORIDE (BAK) ALONE AND IN MARKETED TOPICAL OPHTHALMIC FORMULATIONS ON CULTURED HUMAN CONJUNCTIVAL EPITHELIAL CELLS

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Purpose: To investigate the effect of varying concentrations of BAK alone and in marketed topical ophthalmic formulations on cultured conjunctival epithelial cells.
Design: BAK concentrations of 0.001%, 0.005%, 0.01%, 0.015%, 0.02%, and 0.05% as well as marketed formulations of topical synthetic prostaglandins were examined for cytotoxicity in a human conjunctival cell line.
Controls: Balanced salt solution (BSS, Alcon) was used as a live' control and a fixative solution containing 70% methanol and 0.2% saponin in phosphate-buffered saline was used as a dead' control.
Methods: Human conjunctival epithelial cells (1-5c-4), obtained from American Type Culture Collection (ATCC), were plated onto 0.1% gelatin coated 96-well trays and cultured at 37°C and 5% CO_2. Cells were assayed upon reaching confluence; media was aspirated and replaced with 100 µL of test solution. Cells were incubated at 37°C and 5% CO_2 for 25 minutes. The LIVE/DEAD® Viability/Cytotoxicity Kit (Invitrogen) was used to determine the percentage of dead and live cells via ethidium homodimer (Eth-1) and calcein fluorescence, respectively.
Results: The percent live cells (mean ± SD) after being treated with BAK concentrations of 0.001%, 0.005%, 0.01%, 0.015%, 0.02%, and 0.05% were 109% ± 14%, 112% ± 14%, 56% ±15%, 28% ± 6%, 16% ± 3%, and 3% ±1%, respectively (n = 9). The BAK containing prostaglandins behaved similarly to their respective BAK concentration.
Conclusions: BAK, while being a very common preservative, demonstrated significant cytotoxicity in cultured conjunctival cells in a strong dose-response mediated manner. Ocular surface side effects have previously been demonstrated with chronic, long-term exposure to IOP lowering medications containing BAK. Similar toxicity was observed in marketed formulations of BAK containing prostaglandins that was observed in the isolated BAK concentration. Chronic topical ophthalmic preparations, such as glaucoma medications, may better serve patients should an alternative preservative be implemented or use of lesser concentrations of BAK.
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P390 EFFECTS OF PRESERVATIVE-FREE TAFLUPROST IN VIVO ON RABBIT OCULAR SURFACE AND IN VITRO ON IOBA CONJUNCTIVAL CELLS

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Purpose: Most of the commercially available formulations of prostaglandin (PG) F2 alpha analogs used for the treatment of glaucoma contain the preservative benzalkonium chloride (BAK), which has shown pro-inflammatory, pro-necrotic, pro-apoptotic and pro-oxidative effects on conjunctiva in vivo and in vitro. Our purpose was to study the effects of the preservative-free (PF) formulation of tafluprost, a new PG analog, on both human conjunctival cells in vitro and rabbit eyes in vivo.
Methods: Cells from the IOBA-NHC immortalized epithelial cell line from normal human conjunctiva were exposed for 30 minutes to 1/10 dilutions of BAK-containing commercially available solutions of latanoprost, travoprost, bimatoprost, their respective concentrations of BAK (0.02%, 0.015%, and

0.005%), and preservative-free tafluprost solution. Membrane integrity/cellular viability, apoptosis and oxidative stress were assessed using microplate cytofluorometry and flow cytometry. Standard immunofluorescence was performed to study cell morphologic patterns under the same conditions. At the same time, adult male New Zealand albino rabbits received 50 µl of either: phosphate-buffered saline (PBS); PF-tafluprost 0.0015%; latanoprost 0.005%; or benzalkonium chloride (BAK) 0.02%; all solutions were applied at 5-min intervals for a total of 15 times. The ocular surface toxicity was investigated using slit lamp biomicroscopy examination, flow cytometry (FCM) on conjunctival impression cytology (CIC) for CD45 and tumor necrosis factor-receptor 1 (TNFR1), and corneal in vivo confocal microscopy (IVCM). Standard immunohistology also assessed inflammatory/apoptotic cells.

Results: Preservative-free tafluprost resulted in significantly high membrane integrity, low oxidative stress and low pro-apoptotic effects on conjunctival cells in vitro. Immunofluorescence showed that cell shrinkage increased in a BAK-concentration dependent manner, with a low shrinkage being observed with preservative-free tafluprost. In rabbits, clinical observation and IVCM images showed lower ocular surface toxicity with tafluprost and PBS compared with latanoprost and BAK. FCM showed a higher expression of CD45 and TNFR1 in latanoprost- or BAK-instilled groups, compared with PF-tafluprost and PBS groups. Latanoprost induced fewer positive cells for inflammatory marker expressions in CIC specimens compared with BAK-alone, both of which were higher than with PF-tafluprost or PBS. Immunohistology showed the same tendency of toxic ranking.

Conclusion: These results suggest that the preservative-free formulation of tafluprost, a new prostaglandin analog, has low pro-apoptotic, pro-necrotic and pro-oxidative effects on conjunctival cells in vitro, and that rabbit corneoconjunctival surfaces presented a better tolerance when treated with PF-tafluprost compared with commercially available latanoprost or BAK solution.5,6

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P391 COMPARISON OF INTRAOCULAR PRESSURE LOWERING EFFECT OF EVERY NIGHT VERSUS EVERY OTHER NIGHT DOSING OF BIMATOPROST 0.03%

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Purpose: To compare intraocular pressure (IOP) reduction profiles of Bimatoprost 0.03% administered every other night (QOD-HS) compared to every night (QHS) in patients with primary open-angle glaucoma (POAG) and pseudoexfoliation glaucoma (PXFG).

Design: A retrospective chart review.

Participants: Thirty six eyes of 24 consecutive patients (32 eyes with POAG and 4 with PXFG), who were switched from QHS to QOD-HS Bimatoprost, due to intolerance or inadequate control of IOP, between May 2005 and May 2008.

Methods: IOP in the morning (AM) and afternoon (PM) of the next day after administration (day 1) and the day after (day 2) on QOD-HS regimen was compared to IOP in the AM and PM when they were on QHS regimen, 4-6 weeks after switching to QOD-HS.

Main Outcome Measure: IOP.

Results: Mean IOPs on QHS Bimatoprost were 15.9 ± 3.5 mmHg in the AM and 15.9 ± 2.8 mmHg in the PM, while mean IOPs on QOD-HS were 14 ± 2.3 mmHg (AM) and 14.3 ± 2.6 mmHg (PM) on day 1, and 14.8 ± 3.1mmHg (AM) and 14.9 ± 2.5 mmHg (PM) on day 2 after administration. The mean diurnal IOP on QHS Bimatoprost was 15.9 ± 2.8 mmHg, while on QOD-HS it was 14.2 ± 2.3 mmHg day 1 and 14.9 ± 2.5 mmHg day 2 after administration. IOP in the AM after QOD-HS therapy was lower than the IOP in the AM after QHS by 1.9 ± 2.9 mmHg ($P = 0.0004$), and on day 2 was lower in the AM by (1.1 ± 3.4 mmHg at $P = 0.05$). PM IOP on QOD-HS regimen was lower than PM IOP on QHS by (1.6 ± 3.4 mmHg at $p = 0.009$) in the day 1 and in the PM of the day 2 IOP was lower by (0.94 ± 3.44 at $p = 0.1$). Mean diurnal IOP on QOD-HS regimen was lower than mean diurnal IOP on QHS by (1.76 ± 2.73 mmHg, $p = 0.0004$) on QOD-HS day 1 and by (1.03 ± 3.05 mmHg, $p < 0.05$) on day 2. According to IOP reduction, there was a statistically significant difference between QHS and QOD-HS in favor of QOD-HS for at least 36 hours after administration, while IOP reduction in the PM of day 2 after administration of QOD-HS Bimatoprost was equal to IOP reduction in the PM on QHS regimen. Difference between IOP fluctuation on QHS and QOD-HS day 1 and day 2 respectively were not significant ($p = 0.827$ and 0.936).

Conclusion: Every other night dosing of Bimatoprost was effective in controlling IOP in this select group of patients with POAG and PXFG who had uncontrolled IOP, or side effects on Bimatoprost 0.03% QHS regimen, and may be considered as an alternative to every day treatment.

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P392 EFFECT OF TRANSITIONING FROM TOPICAL ADMINISTRATION OF LATANOPROST TO BENZALKONIUM CHLORIDE-FREE TRAVOPROST ON SUPERFICIAL PUNCTATE KERATOPATHY

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Purpose: To investigate the effect of a transition from topical administration of latanoprost (LAT) to benzalkonium chloride-

free travoprost (TRV) on superficial punctate keratopathy (SPK).
Design: Prospective, observational case series.
Participants: Forty-five subjects (mean age, 68.4 ± 9.2 yrs; 15 males and 30 females) diagnosed with open-angle glaucoma or ocular hypertension using topical LAT for one month or longer who showed reproducible SPK.
Methods: Patients were collected at four institutions, where the follow-up included corneal findings, intraocular pressure, and adverse events before and after the transition from LAT to TRV. Each record was masked by using independent case cards. During the follow-up period, concomitant drugs were continued. The cornea was divided into five zones and the fluorescein staining intensity in each zone was scored on a five-point scale from 0 to 4 using the NEI classification; the mean value for the intensity was regarded as the severity of SPK. Analyses were performed independently of the facilities from which the cases were collected.
Main outcome measure: SPK scores based on the NEI classification.
Results: The mean pre-transition SPK score was 1.4 ± 0.6. Significant reductions in the mean SPK scores were observed at 2 weeks (0.7 ± 0.5, $p < 0.0001$), 1 month (0.6 ± 0.4, $p < 0.0001$), and 3 months (0.7 ± 0.5, $p < 0.0001$) after the transition. There were no elevations in intraocular pressure after the transition to TRV. The most frequent adverse events were irritating sensation (24.4%) and hyperemia (33.3%).
Conclusion: SPK observed during topical administration of LAT was significantly reduced by transitioning to TRV.
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P393 THE EFFECT OF NSAID ON INTRAOCULAR PRESSURE (IOP) REDUCTION AND CONJUNCTIVAL HYPEREMIA BY 0.004% TRAVOPROST IN NORMAL ADULTS
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Purpose: To evaluate the effect of NSAID on intraocular pressure (IOP) reduction and conjunctival hyperemia by 0.004% travoprost in normal adults.
Methods: This study was prospective, randomized, double-masked crossover controlled study with 30 ophthalmologically normal subjects. Topical NSAID (dicrofenac sodium) was applied in randomly selected one of two eyes (treated eye) and placebo in the other contralateral eye (control eye) 3 times a day for 2days. Travoprost 0.004%was applied once in both eyes on the 2nd day morning. Conjunctival hyperemia was evaluated in a blind manner by anterior segment photographs at 1, 2, 3, 6, and 12 hours after travoprost application and classified into 6 grades. The IOP at 6, and 12 hours were compared with the IOP in the same time of the 1st day.
Results: Thirty subjects (mean age 37.7 ± 7.2 years) completed this study. The IOP at 0, 6 and 12 hours were 15.0 ± 2.3, 10.6 ± 2.1 and 9.5 ± 2.0 mmHg (mean ± S.D.) in treated eyes, and 15.0 ± 2.3, 13.9 ± 2.8, and 13.0 ± 2.3 mmHg in control eyes, respectively. The mean IOP reduction rates at 6 and 12 hours were 24.2 ± 13.5% and 26.5 ± 12.2% in treated eyes. There is no significant difference in IOP between treated and control eyes. The mean conjunctival hyperemia scores in treated eyes were 1.52, 1.45, 1.86, 2.41, 2.55, and 3.55 at 0, 1, 2, 3, 6, and 12 hours after travoprost application. Those in control eyes were 1.48, 1.41, 2.03, 2.72, 3.21, and 3.52 at 1, 2, 3, 6, and 12 hours. The conjunctival hyperemia in treated eyes were significantly less than that in control eyes at 3 and 6hours ($P < 0.05$).
Conclusions: NSAID pretreatment did not influence IOP reduction by travoprost, but conjunctival hyperemia transiently reduced. Secondly produced prostaglandins may be involved in the conjunctival hyperemia induced by prostaglandin-analogues
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P394 REAL LIFE EXPERIENCE STUDY OF THE SAFETY AND EFFICACY OF TRAVOPROST 0.004% / TIMOLOL 0.5% FIXED COMBINATION OPHTHALMIC SOLUTION IN INTRAOCULAR PRESSURE CONTROL.
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Objective: To evaluate the safety and efficacy of Timolol 0.5% / Travoprost 0.004% combination (Duotrav) as observed with primary open-angle glaucoma (POAG), ocular hypertension (OHT) and normal-tension glaucoma (NTG).
Design: Non-randomised prospective interventional study.
Participants: Fifty-six eyes of 28 glaucoma patients.
Methods: Patients with POAG with uncontrolled IOP on other medication and no contraindication to beta blockers were switched to Duotrav in 56 eyes of 28 patients. The drop in intraocular pressure was the primary outcome measured.
Main outcome: Adequate intraocular pressure control.
Results: Switch to Duotrav provided an additional intraocular pressure reduction of 1.1 mmHg (5.6%) to 4.4 mmHg (18.3%) was achieved at three months. The most significant drop was seen in patients who were initially on bimatoprost (18.3%) and travoprost (18.2%). It was effective in lowering the intraocular pressure to clinically significant levels in POAG, NTG and OHT (mean additional drop < 18 mmHg in POAG, NTG and 18.3 mmHg in OHT).
Conclusion: Duotrav was well tolerated with few side effects and produced clinically significant additional IOP reduction when switched from other anti-glaucoma drugs in patients with uncontrolled glaucoma. It also helped achieve IOP of < 18 mm in glaucoma patients.
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P395 PERIORBITAL CHANGES INDUCED BY UNILATERAL TOPICAL THERAPY WITH BIMATOPROST 0.03% IN PRIMARY OPEN-ANGLE GLAUCOMA PATIENTS AND ITS REVERSIBILITY

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Purpose: To describe periorbital changes as a side effect of topical therapy with bimatoprost 0.03%.
Design: Case series.
Participants: A clinical review of 14 nonconsecutive patients (6 females and 8 males) with primary open-angle glaucoma treated daily with unilateral topical bimatoprost 0.03%.
Methods: Documentation with digital photography and Hertel exophthalmometry was done.
Main outcome measure: Periorbital skin changes.
Results: Eyes treated with bimatoprost 0.03%, significant deepening of the upper eyelid sulcus, periorbital fat atrophy, loss of the lower eyelid fullness, and involution of dermatochalasis, with dark discoloration of the lid and periorbial skin and apparent enophthalmos, compared to the fellow untreated eye. These unilateral changes were not present prior to starting bimatoprost. Exophthalmometry didn't reveal any significant difference between treated and untreated eyes. These changes appeared as early as 2 months after commencing bimatoprost treatment, and were partially reversible 4 months after discontinuation of the medication in 2 patients. Four patients self reported these changes as asymmetric appearance of their eyes, troublesome enough to switch them to other medications.
Conclusions: Unilateral bimatoprost use can lead to periorbital changes that can be bothersome to the patients, due to asymmetric appearance of the eyes. Those changes seem to be at least partially reversible on stopping the medication.
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P396 PROSTAGLANDINS IN EUROPEANS WITH ANGLE-CLOSURE GLAUCOMA

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Purpose: Angle-closure glaucoma (ACG) is one of the most important causes of world blindness. Recent studies showed the efficacy of prostaglandins in treatment of this disease. But most of them were performed in Asian subjects. So the objective of our study was to evaluate efficacy and safety of monotherapy by latanoprost in comparance with travoprost in European patients with chronic ACG.
Design: Three-months, open-label, prospective, randomized, comparative study.
Participants: Sixty patients (112 eyes) with chronic ACG after laser iridectomy were enrolled in the study. Female 36 (60%) and male 24 (40%). Mean age 67 ± 8,03 (from 55 to 78).
Intervention: Previous treatment was cancelled in all patients. After 'wash-out' period all of them were randomized into 2 groups and switched to latanoprost or travoprost monotherapy at 8 p.m. once daily. Biomicroscopy and IOP measurements with Goldmann tonometer were performed at the same time during each visit: before treatment, in 2 weeks and in 1, 2, 3 months after beginning. Visometry and perimetry were performed before treatment, in 1 and 3 months after beginning.
Main outcome measures: Efficacy was determined by reduction in IOP and decrease of scotomas' number from baseline; tolerability was assessed by reports of adverse events.
Results: After 3 months of prostaglandin treatment, the mean IOP reduction were 19,68% in latanoprost and 20,89% in travoprost group ($p < 0,05$). The decrease of scotomas' number was 38,5% in latanoprost ($p > 0,05$) and 48,82% in travoprost group ($p < 0,03$). Patients withdrawal because of heavy hyperemia and burning after first instilation of study drug: 4 (6 eyes) in travoprost and 1 (2 eyes) in latanoprost group. Number of eyes with conjunctival hyperemia was significantly higher in travoprost group than in latanoprost in 2 weeks and 2 months after treatment beginning ($p < 0,03$).
Conclusion: Significant decrease of IOP was seen after 2 weeks of prostaglandine monotherapy (without difference between groups) and IOP-level was stable during all treatment period. Decrease of scotomas' number was significant just in travoprost group. No serious ocular or systemic adverse event was reported. Side effects in both groups were mostly presented by light conjunctival hyperemia.
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P397 HYPEREMIA REDUCTION AFTER ADMINISTRATION OF FIXED COMBINATION OF BIMATOPROST AND TIMOLOL MALEATE IN PATIENTS ON PROSTAGLANDIN OR PROSTAMIDE MONOTHERAPY

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Objective: To evaluate hyperemic and IOP reduction in patients who switch from prostaglandin or prostamide to a fixed combination of prostamide with timolol maleate.
Design: Multicentre longitudinal non-controlled, non-randomized open trial.
Participants: One hundred twenty-nine patients were selected; 52 were on travaprost, 47 on bimatoprost and 26 on latanoprost. For all patients included, monotherapy was not enough for adequate IOP control and they should have no beta-blocker contradiction history.
Intervention: Patients were treated with a fixed combination of bimatoprost and timolol maleate. Hyperemia was evaluated using a referential table and IOP was measured at 8:00, 12:00 and 16:00 h before and after three months of treatment.
Main outcome: IOP and hyperemia was compared in two intervals: pre-treatment and after three months. The mean of three measures of IOP during the day was considered for analysis. Two-way ANOVA (repeated measurement considered) was used for analysis.
Results: Hyperemia and IOP were reduced for all three groups with the same pattern for both eyes. Bimatoprost group had the highest hyperemic level before treatment comparing with latanoprost and travaprost group and had the greatest reduction after treatment ($p < 0,01$). Mean hyperemia level was: Travaprost before: 1.59 (± 0,85) and after: 0.88 (± 0.67); Bimatoprost before: 1.91 (± 0.70) and after 0.48 (± 0.53); Latanoprost before: 1.26 (± 0.58) and after 0.79 (± 0.81) for the right eye. Travaprost before: 1.52 (± 0.88) and after: 0.81 (± 0.67); Bimatoprost before: 1.77 (± 0.82) and after 0.45 (± 0.53); Latanoprost before: 1.28 (± 0.55) and after 0.66 (± 0.65) for the left eye. Regarding IOP, all three groups had a significant reduction ($p < 0,001$) but bimatoprost group had a lower IOP before treatment comparing with travaprost and latanoprost group: Travaprost before: 18.27 mmHg (± 3.65) and after: 13.64 mmHg (± 3.15); Bimatoprost before: 15.87 mmHg (± 3.37) and after 12.5 mmHg (± 2.85); Latanoprost before: 18.29 mmHg (± 4.25) and after 13.74 mmHg (± 3.46) for the right eye. Travaprost before: 17.96 mmHg (± 3.83) and after: 13.95 mmHg (± 3.49); Bimatoprost before: 16.23 mmHg (± 3.50) and after 12.91 mmHg (± 3.53); Latanoprost before: 17.74 mmHg (± 3.86) and after 13.50 mmHg (± 3.27) for the left eye.
Conclusion: A significant hyperemic reduction was found after switching from a monotherapy with prostaglanding or prostamide to a fixed combination of prostamide and beta-blocker. IOP reduction was significant after the intervention for all three groups.

P398 EARLY ANTERIOR CHAMBER AND ANGLE CHANGES WITH PROSTAGLANDIN ANALOGS

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Purpose: To determine the anterior chamber and angle parameters change after prostoglandin analogs treatment in primary open-angle glaucoma patients.
Methods: Prospectively anterior chamber depth (ACD), anterior chamber volume ACV and anterior chamber angle /ACA) results were compared with Corneal Topography unit before and after prostaglandine analogs (latanoprost, bimatoprost and travaprost randomized) treatment at 1, 3 and 6 months with Paired-t test. Recently diagnosed 19 glaucoma patients (36 eyes) without any previous glaucoma medication history, were included.
Results: The mean age was 63,2 years, The difference of ACD, ACV and ACA between premedication and 1-month results were statistically nonsignificant. P-values were respectively; 0.1, 0.2, 0.3. The comparision of both ACD and ACA premedication and 3. month results were statistically significant ($p = 0.02$ for both)
Conclusion: Anterior chamber parameters can be effected and angle changes can be occured as a result of presumed ciliary body edema by Prostoglandin analogs. But larger series with longer follow-ups are needed.
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P399 EFFICACY AND SAFETY OF A FIXED-COMBINATION OF BIMATOPROST AND TIMOLOL IN THE TREATMENT OF PATIENTS WITH POAG OR OH, A 3 MONTH REPORT

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Purpose: To study the efficacy and safety of a fixed-combination of bimatoprost and timolol (Ganforti ™) one drop in the morning for treatment of POAG or ocular hypertension in a 3 month multicenter study in Mexico.
Design: The design was prospective, multicenter, open-label, clinical phase IV study.
Participants: Two hundred thirty-seven patients with POAG or OH were tested.
Methods: Two hundred thirty-seven patients who were nave to treatment or after washout, were given Ganforti ™ drops at waking. Measurements were taken at trough (8 am) and peak (10 am) at baseline, at 1 week, and at month 1, 2 and 3. IOP was the main variable, and VFs were taken at baseline and at 3 months. Safety was evaluated at slit lamp for adverse effects and interrogation for side effects. Statistical analysis was done by Anova, Wilcoxon and Bonferroni's post-hoc test.
Main outcome measure: IOP at peak and trough at 3 months of treatment.
Results: Two hundred thirty-seven patients were included, and followed up for 3 months, of which 237 patients finished the study. Four patients were withdrawn from the study because of allergy (2), local discomfort (2) or systemic side effects (1, low blood pressure and bradycardia), and one abandoned treatment. Mean IOP at baseline (after washout of up to 4 weeks) started as a mean of 21.16 mmHg and ended at the 3 month end of study, at 15.22 mmHg at peak hour (10 am), a drop of 5.94 mmHg or 28.8% (range: 12.5-17.9 mmHg). As for response rate, 79% of patients had a 20% IOP drop or more. The subgroup of 54 patients who had originally been on beta blockers had a larger IOP drop (6.11 mmHg) *vs* the ones who had been originally on prostaglandins (6.06 mmHg). Adverse events were 7 patients or 3%: Side effects were local in 4 cases, which necessitated termination of study, one severe allergy and one intense conjunctival hyperemia and lid swelling. One case had low blood pressure and bradycardia, and was also removed from study. When asked about patient satisfaction, 90% of patients responded they were satisfied with treatment.
Conclusions: Once-daily treatment with Ganforti ™ was effective in lowering IOP 28.8% or 5-94 mmHg in patients with POAG or ocular hypertension in this 3 month study. We found a 3% of adverse effects that necessitated removal of patients from study protocol.
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P400 COMPARISON OF THE EFFECTS OF BIMATOPROST AND A FIXED COMBINATION OF LATANOPROST AND TIMOLOL ON 24-HOUR BLOOD PRESSURE AND OCULAR PERFUSION PRESSURE

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Purpose: To compare the effect of bimatoprost and the fixed combination of latanoprost and timolol (LTFC) on 24-hour systolic (SBP) and diastolic (DBP) holter blood pressure and on 24-hour ocular perfusion pressure (OPP) in glaucoma patients.
Design: Randomized, double-masked, multicentre clinical trial.
Participants: Two hundred patients with glaucoma.
Methods: Included were patients who were controlled (IOP < 21 mmHg) on the unfixed combination of latanoprost and timolol for at least 3 months prior to the baseline visit or patients on monotherapy either with latanoprost or timolol who were eligible for dual therapy not being fully controlled on monotherapy. The latter group of patients underwent a 6 weeks wash-in phase with the unfixed combination of latanoprost and timolol before baseline IOP determination and inclusion into the study. Supine and sitting position IOPs were recorded at 8 p.m., midnight, 5 a.m., 8 a.m., noon and 4 p.m. at baseline, week-6 and week-12 visits; a 24-hour blood pressure curve was obtained with holter (measurements every 15 minutes) at baseline and between week 6 and 12. Comparisons between treatments and within the 2 treatment groups with baseline were carried out with ANOVA. Rates of diastolic OPP < 55, < 45, < 35 mmHg in the 2 groups were calculated and compared using Fisher's test.
Results: Mean baseline SBP and DBP were 136.5 ± 18.3 *vs* 134.2 ± 20.1 mmHg ($p = 0.1$) and 79.1 ± 10.2 *vs* 78.2 ± 10.1 mmHg ($p = 0.4$) in the bimatoprost and LTFC groups respectively. At week 12, mean SBP was significantly lower in the group treated with LTFC ($p = 0.03$), while no significant difference in mean DBP was found between the 2 groups. Analysis of diastolic OPP found no significant difference between the 2 groups, and proportions of patients with at least one value of the 24-hour curve below 55, 45 and 35 mmHg were 75%, 46%, 26% and 76%, 47%, 28% in the bimatoprost and LTFC groups respectively ($p = 0.1$).
Conclusions: Similar mean DBPs and diastolic OPPs were found after both bimatoprost and the LTFC. Mean SBP was significantly lower after the LTFC. In this study, the percentage of 'dippers' was considerably higher than the one described in previous studies on the role of perfusion pressure in glaucoma.

P401 EFFICACY OF BIMATOPROST 0.03% IN REDUCING THE INTRAOCULAR PRESSURE IN PATIENTS WITH 360 DEGREE SYNECHIAL ANGLE-CLOSURE GLAUCOMA: A PRELIMINARY STUDY

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Purpose: To evaluate the efficacy and safety of Bimatoprost 0.03% in lowering intraocular pressure (IOP) in patients with 360 degree synechial angle-closure glaucoma.
Design: This was a prospective, non-randomized, non-comparative, selective analysis, single-centre pilot study.
Participants: Twenty Indian chronic angle-closure glaucoma (CACG) patients having 360 degree peripheral anterior synechiae (PAS), an IOP greater than 21 mmHg and with no visual potential in the study eye were recruited.
Methods: All participants underwent a detailed eye examination that included assessment of visual acuity, slit-lamp biomicroscopy, applanation tonometry and gonioscopy. Following YAG peripheral iridotomy and reconfirmation of complete angle closure by indentation gonioscopy, dilated fundus examination including disc evaluation was carried out, baseline IOP was measured and once-daily evening dose of Bimatoprost 0.03% administered for 8 weeks. Study visits were scheduled at day 1, weeks 1, 4 and 8 of therapy. At each study visit, IOP was recorded in triplicate at 8:00 AM, 10:00 AM and 4:00 PM.
Main outcome measure: The primary efficacy outcome measure was percentage change in IOP from baseline to 8 weeks of therapy.
Results: The mean age at presentation was 56.5 ± 8.23 years. The pre-treatment mean baseline IOP was 43.22 ± 5.8 mmHg. Post-treatment mean IOP at day 1, weeks 1, 4 and 8 were 27.43 ± 9.72, 29.72 ± 10.55, 28.96 ± 9.25 and 28.03 ± 9.88 respectively. The mean percentage reduction in IOP from baseline to 8 weeks of Bimatoprost therapy was 33.42% (43.22 ± 5.18 to 28.53 ± 9.95 mmHg, P = 0.0000). The most commonly reported adverse event was conjunctival hyperaemia (35%).
Conclusion: In this unique preliminary study, Bimatoprost 0.03% treatment resulted in a statistically significant reduction in IOP in primary CACG patients with 360 degree PAS. Thus it can be inferred that Bimatoprost 0.03% is a safe and efficacious treatment modality in this subgroup of CACG patients. The study results suggest that Bimatoprost 0.03% does not require an open ciliary face for reducing IOP.
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P402 INTRAOCULAR PRESSURE LOWERING EFFICACY AND SAFETY OF TRAVOPROST 0.004% AS A REPLACING THERAPY IN PATIENTS WITH OPEN-ANGLE GLAUCOMA OR OCULAR HYPERTENSION

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Aim: To evaluate the intraocular pressure lowering efficacy of travoprost 0.004% monotherapy in patients previously treated with other topical ocular hypertensive medications, and in previously untreated patients.
Participants and Methods: This open-label, 12-week study in 1651 adult patients with ocular hypertension or open-angle glaucoma who were untreated or required a change in therapy (due to either inadequate efficacy or safety issues) as judged by the investigator was conducted at six sites in China. Previously treated patients were instructed to discontinue their prior medications at the first visit. All the patients were dosed with travoprost 0.004% once-daily at 8 pm in both eyes for 12 weeks. Efficacy and safety evaluations were conducted at weeks 4 and 12. IOP measurements were performed at the same time of the follow-up visits.
Results: Mean IOP reductions from baseline in untreated and treated patients with different prior medications at weeks 12 were: latanoprost, 4.3 mmHg (± 4.6); beta-blocker, 6.3 mmHg (± 4.0); alpha-agonist, 7.5 mmHg (± 4.3); topical CAI, 8.0 mmHg (± 4.9). All mean IOP changes from baseline were statistically significant ($p < 0.001$). No treatment-related serious adverse events were reported in this study.
Conclusion: In patients treated with other ocular hypertensive medications or untreated, the IOP reduction with travoprost was significant. The results of this study demonstrate the potential benefit of using travoprost as a replacement therapy in order to ensure adequate IOP control. Travoprost administered once daily was safe and well tolerated in patients with glaucoma or ocular hypertension.

11.7. Medical treatment: Treatment of bloodflow

P403 SYSTEMIC HYPERTENSION - RISK FACTOR FOR PROGRESSION IN PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: In a recent years it has been hypothesized that primary open-angle glaucoma (POAG) is particularly characterized by vascular dysregulation. In this study we wish to evaluate and to analyse the evolution to primitive open-angle glaucoma and vascular factor present (systemic hyperten-

sion), to make correlations to the stages of arterial hypertension, the treatment of the systemic disease and progression rate of visual field (VF) like marker to functional impact in glaucoma disease.
Method: The study involved 109 (50 female; 59 male) patients diagnosed and treated during 14 months, ages between 55 and 70 years. All patients involved are POAG and Systemic Hypertension, classified according to the European Society of Cardiology guidelines 2007. The cases are divided in three groups (A, B and C) after the stage of systemic hypertension and the cardiovascular risks factors. To diagnose glaucoma we used a complete protocol of ocular examination: visual acuity, biomicroscopy, gonioscopy, intraocular pressure (IOP), optic nerve evaluation, computerized perimetry (mean defect (MD), pattern defect (PD)). General examination protocol included a complete metabolic and cardiovascular screening. Each group of patients received different antihypertensive therapy depending on the level of systolic blood pressure, diastolic blood pressure and the global cardiovascular factors involved: angiotensin-converting enzyme inhibitors (ACE): 39 patients, beta blockers: 35 patients, thiazide diuretics: 35 patients. IOP the most important factor to glaucoma progression are maintained to optimal values with same ocular lipid hypotensor-prostaglandin analogues Travoprost.
Results: The level of SBP/DBP was stabilized with antihypertensive drugs but it is necessary to mention that after the first evaluation (three months) a subgroup of 19 patients was identified who needed an augmentation of antihypertensive therapy. they received a similar combination The study shows the patients with POAG and Systemic Hypertension who are received a antihypertensive medication(beta blockers, diuretics or ACE inhibitors) what sustained constant values of systolic and diastolic blood pressure have a evolution constant of parameters VF (MD, PD).The groups with great variations of blood pressure especially diastolic blood pressure and additional cardiovascular risks factors who needs a supplementary antihypertensive therapy have accelerate progression rate of VF with same good level of IOP.
Conclusions: The role of vascular factor in glaucoma progression determine a therapy for each patient with cardiovascular factor .The systemic disease treatment are a important place in glaucoma progression because a constant values of blood pressure and a good cardiac debit generate a proper perfusion pressure of the optic nerve head with influence on the evolution a glaucoma disease.
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11.14. Medical treatment: Investigational drugs; pharmacological experiments

P404 ADAPTIVE DESIGN IN OPHTHALMOLOGY CLINICAL TRIALS: AN EFFECTIVE APPROACH FOR DRUG DEVELOPMENT

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Purpose: In 2004, the FDA released the critical path initiative challenging industry to develop drugs cheaper, faster and better. Adaptive designs were identified as one means to achieve these goals. Most clinical trials are conducted in a rigid protocol with key design parameters determined at preplanning stage and held constant thereafter, leading to increased chance of missed endpoints, unnecessary use of ineffective treatment arms, wasted resources and subject enrollment and prolonged development time. Increased sensitivity to inefficiencies in clinical trials has prompted adaptive mechanisms which allow key design parameters to be modified in a pre-defined manner according to data accumulating as the clinical trial is on-going.
Design: We employed study simulations that analyzed accumulating data to modify study design features according to prospectively defined plans. In this simulation study operational characteristics were compared between different designs in a dose-finding exploratory clinical trial of IOP effects in an ocular hypertensive population.
Testing: Methodology compared conventional parallel design with innovative adaptive features that allowed for sample size re-estimation, allocation of patients to more effective doses and early stopping rules for both efficacy and futility. Decision rules for these adaptations were pre-specified, to be based on observed data at interim analysis.
Results: Simulations demonstrated the adaptive approach outperformed the fixed parallel design. Given the same sample size, adaptive patient allocation resulted in more patients being allocated to effective doses, and fewer patients allocated to ineffective dose levels. The adaptive design provided not only greater power for detecting the treatment effect of IOP for effective doses, but also provided treatment estimates with greater precision.
Conclusions: The use of adaptive designs is an efficient approach for facilitating Ophthalmology clinical trials, especially so within 'learning' phase of development - Phase II. The application of adaptive design to trials in Ophthalmology can create a new paradigm in which clinicians conduct clinical trials with greater efficiency and flexibility without compromising study validity or integrity.
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P405 OCULAR HYPOTENSIVE EFFECT OF SYSTEMIC AND TOPICAL INSULIN

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Purpose: Studies have shown that insulin has no effect on intraocular pressure (IOP). However, in wake of recent renaissance of early insulin intervention in type-2 diabetes, unexpected ocular findings from follow-ups of patients starting insulin therapy have justified a reassessment. Therefore, the present study aims at investigating the effect of insulin on IOP.
Design: Observational experimental study.
Participants: Twenty-one type-2 diabetes patients and 48 female albino rabbits.
Methods: Type-2 diabetes patients, with no diabetic retinopathy and without therapy that could affect IOP, were periodically examined starting from 3 weeks before the initiation of SC insulin therapy. Animal studies on 48 female albino rabbits were done to investigate the tolerability of ocular insulin administration and insulin effect on IOP. Controls and negative controls received denaturated insulin and balanced salt solution (BSS) respectively. Examinations included body mass index (BMI) determinations (humans), and measurements of IOP (humans: Goldmann applanation tonometer; rabbits: Tonopen AVIA, Reichert), blood glucose level at time of IOP measurement (Optium-Xceed, Abbott), and central corneal thickness (CCT) (SP 100, Tomey).
Main outcome measure: Intraocular pressure, central corneal thickness, and blood glucose concentration.
Results: Twenty-one patients have completed > 6 months of follow-up on insulin therapy. There were no statistically significant differences in IOP compared to baseline in first month of insulin therapy. Though statistically significant differences were prominent by the end of third month with Insulin IOP lowering effect being inversely correlated to the BMI (31.26 ± 4.0, 12.74 ± 8.6, and 9.81 ± 5.91% lower IOP, for BMI groups of ≦ 25.0, >25.0-30.0, and > 30.0 kg/m^2 respectively). In rabbits, 6 daily instillations of 8 µ of insulin (Humulin 70/30, Lilly) on corneal surface was the most tolerated and effective protocol in lowering IOP. In treated eyes of this protocol, IOP was statistically significant lower than baseline at days 26-32 and from day 34 on, being 35.23 ± 4.7% less at 2 months after initiation of insulin (7.24 ± 5.08 and 5.14 ± 4.28% for the denaturated insulin and BSS respectively). In both humans and rabbits, the ocular hypotensive effect of insulin was not correlated with blood glucose concentrations or CCT measurements.
Conclusions: The association between IOP and insulin resistance was reported previously, and several studies have attempted to elucidate the correlation of CCT with ocular and systemic factors. However, this is the first report to suggest an ocular hypotensive effect of insulin, not correlated to changes in blood glucose or CCT. More studies are needed due to the small sample size of this observational study and more preclinical studies should be done to address formulation challenges. Clinical studies are invited to address the effect of insulin on IOP in non-diabetic subjects.
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11.15. Medical treatment: Other drugs in relation to glaucoma

P406 CIDOFOVIR INTRAVITREAL INJECTION FOR ABSOLUTE PAINFUL GLAUCOMA

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Objective and purpose: Absolute painful glaucoma (APG) is still one of the significant causes of inability to work in Armenia. Many cases with untreated or uncontrolled glaucoma in their final stage are found in all regions of the country. Difficulties with medications purchase, price and problems with the application and failure to remember to take medication or sometimes refractory conditions make patients unhappy with their disease. Severe pain, tearing, redness and other symptoms in non-seeing eyes push the patients and doctors to remove the organ and keep cosmetic form with expensive implants and prosthesis. During many centuries enucleation or evisceration of the globe was the only method to 'treat' APG .
Design: Patients with different forms of APG with intraocular pressure (IOP) ~45,6 mmHg at the Malayan's Eye Center, Yerevan, Armenia. No visual acuity or light perception.
Participants and control: Twenty-six patients suffering from APG underwent treatment of one intravitreal Cidofovir (vistide) injection 0,01 cc from pars plana at 2-3 mm from the limbus during eight months in 2008 (under at list two antiglaucoma medications three to six days before IOP at the date of injection was 41,7 mmHg). Only two patients needed a second injection after two weeks (0,01 cc). Antibiotics four times per day and Dexamethasone 0,1% every two hours prescribed. Antiglaucoma medication was stopped later.
Intervention and methods: Biomicroscopy and IOP measurements were done before, one week, one month, three months and six months after the injection. Ophthalmoscopy and ultrasound exams, before treatment and one month after. Control group: 14 eyes with APG who during 2008 had a transscleral diode photocoagulation with the same level of basic IOP.
Main outcome measure: The average IOP for one week after the injection was 23,4 mmHg (with meds). One month later: mild pain in 25% of cases, IOP ~11,3 mmHg (no antiglaucoma medication), ultrasound and ophthalmoscopy (in clear cornea and lens) showed macular edema and choroidal detachment, biomicroscopy - corneal gentle folds in 11% of cases. Three months and six months showed almost the same: IOP is ~10,1 mmHg, subatrophy of the globe was in two cases (7,7%). Control group IOP was 26,7 mmHg with one (6Pts) or two anti-glaucoma medications (8 Pts).
Results: For 100% of cases we got IOP stabilization and lowering without any meds, no pain. Two patients with shrinking eyes got soft prosthesis over the cornea. For six patients, complaining of the changing color of the eye we successfully did tattoo of cornea .No patients with repeated removing of the eye or other procedure.
Conclusion: 0,01 cc Cidofovir intravitreal injection in APG shows great results. All previous methods were organ destroying and psychologically hard or not completely effec-

tive for IOP decreasing. Leaving the eye as an organ, stopping of all boring medication after long period of pain and discomfort in non seeing eyes made the quality of life for patient much better. Being antiviral medication Cidofovir was incomparably effective in APG with viral keratitis (2 cases). Compare with diode laser cyclophotocoagulation, which is relatively best procedure for APG, this injection has obvious privileges!

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P407 IN-VITRO EFFECTS OF BEVACIZUMAB ON CULTURED HUMAN TRABECULAR MESHWORK CELLS

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Purpose: To investigate the effects of neutralizing antibodies and antibody fragments targeted against vascular endothelial growth factor (VEGF) on primary cultures of human trabecular meshwork (TM) cells.

Design: We tested the anti-VEGF agents ranibizumab and bevacizumab (Genentech, South San Francisco, CA, USA). Ranibizumab is a Fab antibody fragment approved by the FDA in 2006 for the treatment of wet age-related macular degeneration. While not FDA approved for use in the eye, studies have shown that bevacizumab, a monoclonal anti-VEGF antibody, is effective at decreasing neovascularization in both the retina and anterior segment of the eye.

Controls: Human immunoglobins (IgG) and the vehicle components of bevacizumab and ranibizumab were used as controls.

Methods: Cell toxicity assays were performed using the MTT assay in confluent cultures of TM cells. Proliferative effects of anti-VEGF agents were determined by measuring BrdU uptake in sub-confluent cultures of cells.

Results: Twenty-four-hour treatment with 4 mg/ml bevacizumab reduced TM survival to 34.4 ± 12.4% as compared to control TM cells treated with 4 mg/ml human IgG (mean ± SD). 4 mg/ml bevacizumab also reduced TM cell proliferation to 62.7 ± 9.2% of control TM cells. No significant effects were noted with lower concentrations of bevacizumab, bevacizumab vehicle components, or with ranibizumab.

Conclusions: Our data are the first to reveal that high concentrations of bevacizumab are harmful to TM cells in vitro. No such effect was noted with human IgG controls or ranibizumab. Further studies are needed to better understand the mechanism of the cytotoxic effect of high concentrations of bevacizumab and whether smaller concentrations may have a similar effect after longer periods of exposure.

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P408 SELECTIVE LASER TRABECULOPLASTY: NSAIDS VS STEROIDS IN POST-OPERATIVE MANAGEMENT

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Purpose: To compare the effectiveness of a topical non-steroidal anti-inflammatory eye drop, diclofenac sodium 0.1% ophthalmic solution to a topical steroid, prednisolone acetate 1%, in patients who have undergone selective laser trabeculoplasty (SLT).

Design: This is a randomized, multi-center, prospective, double-blind, active-control study.

Participants: Patients with glaucoma who have undergone SLT.

Methods: A total of 73 participants were randomized to either the NSAID or the steroid treatment group. Study visits took place at baseline and post-operatively at one hour, seven days, one month, three months and six months. The primary outcomes of the study are intraocular pressure (IOP) and inflammation control in the NSAID compared to the steroid group at six months. The comparisons of these parameters at other time points as well as patient comfort throughout the duration of the study were considered secondary outcomes.

Main outcome: The main outcomes are IOP and inflammation control at six months.

Results: Pre- and post-operative IOP means for the NSAID group were significantly different at 24.07 mmHg and 17.25 mmHg respectively ($p < 0.001$). Similarly, pre- and post-operative means for the steroid group were significantly different at 24.23 mmHg and 17.50 mmHg ($p < 0.001$). There was no significant difference in IOP pre-operatively ($p = 0.770$) or post-operatively ($p = 0.238$) between groups. There was no significant difference between groups regarding post-operative inflammation (all p values > 0.080), with the exception of increased anterior chamber flare at one hour following SLT in the steroid group ($p = 0.030$). Patient comfort was not found to differ between treatment groups (all p values > 0.143).

Conclusion: Both topical NSAIDs and steroids can be considered equally successful treatment options for the management of IOP control and inflammation following selective laser trabeculoplasty. Patient comfort is satisfactory with both therapies.

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11.17. Medical treatment: Cooperation with medical therapy, *e.g.*, persistency, compliance, adherence

P409 GLAUCOMA WORKSHOP: A TOOL TO IMPROVE THE COMPLIANCE AND PATIENT-DOCTOR RELATION

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Objective: To explain the design of the workshop. To improve the treatment compliance in the patients of our service. To explain this method for our colleagues to apply it.
Design: Prospective exploratory, descriptive and observational study.
Participants: Population of the Hospital Italiano de Buenos Aires, and their relatives.
Materials and Methods: We invited patients with glaucoma and their relatives through the hospital web, posters and during the consults. Every last Thursday of the months free classes were given in a special room at the hospital during one hour. An ophthalmologist, specialist in glaucoma gave a power point class explaining the ethiology, epidemiology, classification, treatment and blindness prevention. We also taught them how to apply the drops themselves with the physiological solution. They were given a survey to fill in with their e-mail address. It consisted of 21 multiple choice questions. A trained psychologist gave counseling. We finalized these sessions with an open dialogue.
Main outcome measure: an excel file was used to collect the data. Percentages of answers were calculated for each item in each question. Age and sex were analyzed in a separate file and the working activity was considered as an independent variable
Results: Thirty-six patients: 20 female, 16 male, average age 65. Sixty-four percent answered a healthy person must check the IOP once a year; 47% answered they do not realize by themselves if the IOP is high; 55% answered the glaucoma may appear at any age; 75% said it could last all their life; 77% knew it may cause blindness; 58% knew it runs in families; 33% had parents with glaucoma; 39% admitted forgetting to apply the drops; 16% had difficulty with the hours; 50% thought it useful to associate applying the drops with another activity. The majority thinks the follow-up given by the doctor could be helpful if the drops would have less side effects, cost less money and the medical insurances provide them.
Conclusions: The compliance is important in the treatment of glaucoma. Patients have to understand they must use the drops every day, learn how they work and not to quit the treatment due to boredom, lack of interest or even depression. The workshop is a helpful tool for this and to minimize the negative impact of this chronic disease.

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P410 LONG TERM EVOLUTION OF AUTOMATIC VISUAL FIELD PERIMETRY ANALYSIS (VF) IN TREATED GOOD COMPLIANCE CHRONIC OPEN-ANGLE GLAUCOMA (COAG)

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Purpose: To evaluate the evolution of VF through the lineal regression (LR) of the media deviation (MD) in COAG after 5 years observation, its relation with ocular pressure, central corneal thick (CCT), disc excavation.
Design: Retrospective no comparative interventional case series.
Participants: Forty-eight eyes (36 patients) with COAG with well control and compliance to treatment. The diagnosis of COAG was based in disc pathologic excavation and VF defect over 2 Db of MD with more than 2 Db of SMD.
Methods: All patients were examined, treated and controlled by the authors. The VF (Humphrey), CCT (Heidelberg), Goldman aplanation ocular pressure (GAP), were made with the same instruments. All patients were examined with Haag-Streit biomicroscopy , Goldman gonioscopy, GAP diurnal curve of two days (6 Po), VF, binocular ophthalmoscopy, repeated 2 to 4 times per year. VF was repeated according to evolution (media 2/year) and with a minimum of 5 visual fields and minimum of two years of control (2 to 8 years, media 58 months). Age of patients went from 48 to 81 years (media 65). Treatment was submitted according to the follow schema: Medical topic treatment once or twice per day with 1 to 3 drugs (2 drugs in associated drops). Drugs used according to the response in each case (98%:): prostaglandins, timolol, brinsolamide, brimonidine, Argon laser trabeculoplasty (54%), Filtering surgery (16%).
Main outcome measures and Results: GAP media: 16.08 mmHg, GAP corrected according CCT: 16.40. Averages - CCT: 537 (455-637). - VF per patient: 9. - Observation time: 58 months. - VF lost at initial time: 7.1 DB. - Lineal regression lost of visual field: 0.20 DB/year.
Conclusions: In ours patients, with an strict control and monitoring its in short period of months visual field, optic disc, and ocular pressure and submitted to treatment schema described, the loose of DM/year was limited to 0.20 DB. As the media age of the patients was 65 years old its means that the projection lost at 75 will be 2.0 DB and 4.0 at 85.

As the Media of the DM at the beginning of the study was -7.1 DB, at 75 years old it will be -9.1 and -11.1 at 85. Unless it was not possible to stop the damage, its remains between limits that permit a quite normal life.
As drugs and surgery are very important, the education, frequently medical control, according to the severity of the glaucoma, is one of the most important facts in the conservation of the glaucoma patient's vision.

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P411 GLAUCOMA AWARENESS – ESSENTIAL FOR COMPLIANCE IN GLAUCOMA

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Aim: To evaluate the factors responsible for non compliance in the management of glaucoma.
Material and Method: Glaucoma-suspect patients in rural areas around Lucknow were asked to visit the base hospital at the Department of Ophthalmology, CSM Medical University (erstwhile King George's Medical College), Lucknow - India. The suspicion was based on presence of ≥ 2 risk factors which included intraocular pressure (IOP) > 18 mmHg, cup disc ratio ≥ 0.5 or a difference of more than 2 in both eyes or family history of glaucoma.
Results: Three hundred forty-two patients of suspected glaucoma were asked to report to the base hospital. Only 170 were having glaucoma out of 238 who turned up for detailed evaluation and automated visual fields. Of these 43.5% (74/170) were irregular in follow-up. They argued that they had no money to travel or buy medicine (73%), have to depend on others to buy medicine (66%), forgetfulness to instill the anti-glaucoma medications (58%) it is ophthalmologist's vested interest (53%) to ask them to come at regular intervals and felt awkward in using eye drops at functions. One hundred-four [30.41% (104/342)] never visited the based hospital. Some of the reasons for not visiting were: no headache (64%), having good vision (56%), hospital being at far off (45%), had no money to travel to hospital (57%), other work being more important (64%), and they considered that it was ophthalmologist's vested interest (37.5%) to call them to the hospital.
Conclusion: Patient education and information (awareness) is required to eradicate old beliefs and myths regarding glaucoma, which are essential for its management.

P412 HEALTH LITERACY AND OTHER BARRIERS TO FOLLOW-UP AFTER INITIAL DIAGNOSIS OF GLAUCOMA IN A SOUTH-INDIAN POPULATION

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Purpose: To determine the association of health-literacy and other social and demographic factors with the probability of return for follow-up in newly identified glaucoma patients in South India.
Methods: We are conducting an ongoing prospective cohort study of Tamil-speaking individuals enrolled at the time of newly diagnosed glaucoma at Aravind Eye Hospital in Madurai, India. Tamil translations of two validated literacy assessments are used to evaluate health-literacy: 'Rapid Assessment of Adult Literacy in Medicine' (REALM) and 'Test of Functional Health Literacy in Adults' (TOFHLA). An additional oral questionnaire is administered to assess age, gender, level of education, socioeconomic status, marital status, distance and mode of transportation used to attend clinic appointments, and need for an escort. Glaucoma therapy is initiated on the date of enrollment, and follow-up is scheduled approximately 1 week to 2 months later at the physician's discretion. We analyzed data of subjects who have had follow-up of at least 2 weeks longer than their initial scheduled follow-up appointment. This analysis evaluated factors associated with failure to return for initial follow-up examination.
Results: To date, 106 subjects have had sufficient follow-up to assess factors associated with failure to return for follow-up. In univariate analysis, REALM score with literacy grade 3 or below was associated with a lower probability of returning for follow-up (57.8% *vs* 83.3%, p = 0.006). Subjects who failed to return also had fewer dependents than those who returned for follow-up (mean: 0.47 *vs* 1.03 dependents, p = 0.03). Multivariate logistic regression analysis identified these factors as being independently associated with a higher risk of failure to return for follow-up; REALM score literacy grade 3 or below (odds ratio (OR) = 4.06, p = 0.008), and fewer dependents (OR = 1.82 for each smaller number of dependents, p = 0.04). After adjusting for literacy and number of dependents, male gender also was associated with a higher risk of failure to return for follow-up, but the difference did not reach statistical significance (OR = 2.72, p = 0.06).
Conclusion: In this population, illiteracy is a significant risk factor for failure to return after initial diagnosis of glaucoma, particularly among men. In addition, the added responsibility of dependents may increase adherence to recommended follow-up. Future analysis with a larger sample size will more clearly delineate factors associated with the probability of returning for initial follow-up, as well as for subsequent follow-up appointments.

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P413 MONITORING REAL GLAUCOMA PATIENTS' COMPLIANCE IN A FOLLOW-UP PERIOD OF SIX MONTHS

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Purpose: To record the real patient's compliance obtained by TDA; to collect differences, if any, by age, sex, concomitant systemic therapies, years from diagnosis, years from actual therapy, intraocular pressure level at baseline, and visual field defect.
Design: Observational, prospective, six-months study.
Methods: Fifty-six sequential POAG patients on Travoprost or Travoprost/timolol fixed combination monotherapy were submitted to 4 visits: baseline (B), month 1 (M1), month 3 (M3), and month 6 (M6). At M1, M3, and M6 the patient's adherence was verified on TDA records and classified as follows: very good (> 91%), good (between 80% and 90%), inadequate (< 80%). A complete ophthalmic examination was conducted at each visit, the self-reported and the physician-presumed compliance was recorded. The Shapiro-Wilk's test was used to test the normal distribution of quantitative variables. The chi-squared statistics or Fisher's exact test were applied to compare qualitative variables.
Results: Thirty-three percent of patients recorded very good adherence in all the visits. The adherence showed a slight ($p = 0.77$) decrease from M1 to M6. Adherence was statistically influenced by age ($p = 0.0068$; median age of 67 versus 72 years); and years from therapy (patients with a diagnosis < 5 years or > 10 years were less complaints, $p = 0.019$). Schooling level, systemic co-morbidities and therapies, time since last therapy change, visual field severity did not statistically interfere with recorded adherence ($p = 0.437$, $p = 0.494$, $p = 0.1106$, $p = 0.953$, $p = 0.89$, respectively). The physician was able to detect all the 17 patients with very good adherence, and correctly judged as inadequately complaints 11 subjects ($p = 0.011$). Most patients (74%) asked to use the TDA again.
Conclusion: Physicians often judge as very complaints many of their glaucoma patients: data based on TDA records pointed out that only a minority of them is really adherent. The real patients' adherence is very important in the management of glaucoma disease and enables physicians to make treatment decisions based on objective adherence data. Our data suggested we have to take care mainly of elderly, male, years from diagnosis and number of systemic therapies.
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P414 ADHERENCE IMPROVEMENT IN DUTCH GLAUCOMA PATIENTS

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Objective: To study adherence with topical glaucoma medication with an electronic monitoring device (Travatan Dosing Aid, DA) and to study if adherence can be improved with the additional use of a drop guider and/or additional patient education.
Design: Randomized clinical trial with a 2 x 2 factorial design.
Participants: Eight hundred-two patients with ocular hypertension or primary open-angle glaucoma from 18 Dutch eye clinics, starting treatment with travoprost or the fixed combination travoprost/timolol.
Methods: Participating patients were randomised to one of four groups: 1. Use of the DA; 2. Use of the DA with drop guider; 3. Use of the DA together with patient education on glaucoma; and 4. Use of the DA and drop guider together with patient education on glaucoma. Study visits were scheduled at baseline, at 3 and at 6 months after inclusion in the study. At each visit, patients underwent a routine eye examination. At least one visual field was made during follow-up. At each study visit, patients were asked to fill in questionnaires concerning knowledge of glaucoma and its treatment, attitude towards eye drops, perceived self-efficacy and barriers to application of drops. At the follow-up visit after 3 months patients were given feedback on the data generated by the DA, and the patients from group 3 and 4 received further education on glaucoma. Patient satisfaction with the DA was recorded at each follow-up visit.
Main outcome measures: The intraocular pressure (IOP) of participants. The registration of adherence by the DA and comparison of these data with self reported adherence of participating patients. Patient satisfaction with the DA.
Results: Preliminary data of 468 patients from all groups who had a complete follow-up of 6 months (final results will be available by June 2009) are available. From these patients, 122 (26%) dropped out or withdrew from the study. Mean age of the remaining 346 participants was 65 ± 13.2 years, 56% were male. Mean IOP decreased from 19.8 ± 6.7 mmHg at baseline to 16.1 ± 4.3 mmHg after 6 months of follow-up. The

mean adherence rate was 0.92 ± 0.13 ranging from 0.1 to 1. Two hundred-ten (61%) patients missed 0-1 doses per month. Self reported adherence (0-1 missed doses per month) improved from 57% to 86%. A majority of patients (85%) was (very) satisfied with the DA.

Conclusions: The DA data show a fairly high level of adherence of patients participating in this study. In the upcoming final analysis, the differences between the 4 study groups will be elucidated. Although patients overestimated their medication use, self reported adherence was improved during the study.

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P415 RELATIONSHIP OF PERSONALITY TRAITS WITH ELECTRONICALLY MONITORED ADHERENCE PATTERNS WITH TOPICAL GLAUCOMA MEDICATION

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Objective or purpose: To assess the relationship of adherence patterns to topical glaucoma medication with personality traits determined from Meyer-Briggs Type indicator (MBTI).

Design: Prospective, observational cohort study.

Participants and/or controls: Fifty-one patients with newly-diagnosed open-angle glaucoma prescribed with a topical prostaglandin analogue in 1 or both eyes at a tertiary glaucoma center between August 2007 and September 2008.

Intervention or methods or testing: Patients underwent a subjective and the MBTI questionnaire before being asked to use the Travatan Dosing Aid (DA; Alcon, Fort Worth, TX, USA) to administer travoprost as prescribed. All devices were checked 1 month beforehand for reliability. Devices were collected at 1 month of follow up and data involving drop usage was downloaded using provided software. Self reported and electronically monitored adherence was graded into 5 groups and analyzed.

Main outcome measure: Assessment of the relationship between adherence and patterns of drop usage with personality traits as determined by MBTI questionnaire.

Results: A total of 78 patients consented to participate. Twenty-seven (34%) withdrew before study completion or suffered from device errors. Of the data from 51 patients who successfully completed 1 month of electronic monitoring, the overall adherence rate was 0.50 ± 0.24 (range: 0.04 ~ 1.0). The overall pattern of adherence rapidly declined after initial prescription but increased just before the clinical visit (43.24%). Only eleven patients (21.5%) abided with at least 80% of their regimen while 19.6% took less than 50% of their dosing schedule. The agreement between self reported and objective adherence was poor ($y = 0.4143 x + 3.0571$, $R^2 = 0.1796$). When analyzed for personality traits, patients with Sensing dichotomy over iNtuition showed a significant discrepancy between self reported and objective adherence.

Conclusions: Patients reported far higher subjective adherence than electronic monitoring led to believe. Only 21.5% of patients were adherent for at least 80% of their prescribed regimen. Patients with Sensing dichotomy were more likely to deviate from their self-reported adherence.

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P416 SCREENING OF FIRST-DEGREE RELATIVES OF PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA (POAG)

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Purpose: Due to its low prevalence in the general population, screening for POAG may have a low predictive value of a positive test. Screening of high-risk groups may yield better results. If having a first-degree relative with glaucoma is a risk factor for developing the disease, a detection campaign focused in the relatives of glaucoma patients would have more probabilities of detection. The purpose of this study was to perform a glaucoma detection campaign among first-degree relatives of glaucoma patients. The results were compared with a control group of a detection campaign performed among patients attending the ophthalmology service of our institution for the first time.

Methods: First-degree relatives of patients with POAG were included. A control group of subjects older than 55 y/o was also screened. Subjects underwent a complete ophthalmic examination. Glaucoma was defined using the definition of the International Society for Geographical and Epidemiological Ophthalmology.

Results: 26.2% of 61 family members of 35 glaucoma

patients, and 6% of 50 controls were diagnosed with glaucoma. Difference between groups was statistically significant (p = 0.0052). Odds ratio was 5.5 (IC 95%: 1.5-20.4).
Conclusions: Glaucoma detection was more effective when family members were screened when compared with the control group. In this study the probability of getting glaucoma with a family member affected was greater than the control group.

11.20. Medical treatment: Other

see also P043, P418

P417 TOPICAL MITOMYCIN-C VERSUS SUBCONJUNCTIVAL 5-FLUOROURACIL INJECTION FOR MANAGEMENT OF EARLY BLEB FAILURE

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Purpose: To compare the efficacy and safety of topical Mitomycin-C (MMC) versus 5-Fluourouracil (5-FU) injection in the management of early bleb failure after Trabeculectomy or combined phacoemulsification and posterior chamber intraocular lens with Trabeculectomy (PE-Trabx).
Design: Randomized clinical trial.
Participants and/or controls: Thirty-seven eyes of 37 patients with signs of early bleb failure.
Methods: Enrolled eyes were randomly allocated to MMC 0.02% eye drops four times a day for 2 to 4 weeks or subconjunctival injections of 5-FU (5 mg).
Main outcome measures: Intraocular pressure (IOP), and bleb morphology according to the Indiana Bleb Appearance Grading Scale. Other outcome measures included best corrected visual acuity (BCVA), number of glaucoma medications, complications and success rate. Success was defined as 5 < IOP < 22 mmHg without medications.
Results: Thirty-seven eyes with early bleb failure were randomly allocated to MMC (19 eyes) or 5-FU (18 eyes). The 5-FU treated eyes received a mean dose of 19.4 ± 7.03 mg (range 5-65mg) with a mean of 2.8 injections.
Baseline characteristic including age, sex, type of glaucoma, and number of previous surgeries were comparable in the study groups. However, there were more instances of PE-Trabx in the MMC group as compared to the 5FU group (11 eyes (57.9%) versus 3 eyes (16.7%), P = 0.01). Patients were followed for a mean period of 7.24 ± 3.9 (median = 6) versus 6.58 ± 3.35 (median = 6.5) months in the MMC and 5-FU groups respectively (p = 0.589).
Mean preoperative IOP was 20.5 ± 8.85 in the MMC group and 25.82 ± 11.35 in the 5-FU group (p = 0.12), which was decreased to 12.89 ± 4.99 and 11.22 ± 4.33 respectively at last follow up (p = 0.285). There were no significant difference in bleb extent (p = 0.153), height (p = 0.15) and vascularity (p = 0.267) between the study groups. Similarly, BCVA (p = 0.495) and number of glaucoma medications (p = 0.932) were comparable at last follow up. The most common complication of MMC was punctate epithelial keratopathy observed in 5 eyes (26.3%). The most common complication related to 5-FU injections was filamentary keratitis in 7 eyes (38.9%). Success was achieved in 14 eyes (73.7%) in the MMC group and 14 eyes (77.8 %) in the 5-FU group (P = 0.237, Fisher's Exact Test).
Conclusion: Postoperative application of MMC 0.02% drops can be considered as an alternative to subconjunctival injection of 5-FU for treatment of early bleb failure following trabeculectomy or PE-Trabx.
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P418 THE PROBABILITY, THE SEVERITY AND THE RELATED FACTORS OF DRUG-INDUCED KERATOPATHY WITH ANTI-GLAUCOMA MEDICATIONS

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Purpose: To evaluate the probability, the severity and the related factors of drug-induced keratopathy in the eyes using anti-glaucoma eye drops.
Design: A cross-sectional study.
Participants: Seven hundred forty-nine eyes from 427 patients, who had used one or more anti-glaucoma eye drops, were examined in Niigata University Medical and Dental Hospital or the related facilities.
Methods: Superficial punctuate keratitis (SPK) and its severity, gender, age, type of glaucoma, and kinds of eye drops were recorded. The degree of SPK was judged according to an AD (A: area, D: density) classification by Miyata et al. (2003). The severity score (SS) was calculated by the numbers of A times D from an AD classification.
Main outcome measure: SPK was positive in 382 (51.0%) of 749 eyes. While 254 eyes (33.9%) were classified into A1D1 (SS 1), 34 eyes (4.6%) associated severe SPK with SS 4 or more. The number of eye drops and the total dosing frequency per day were different between SPK positive and negative groups statistical significantly. The higher the number of eye drops, the more often and the severer SPK was combined. In eyes using 3 or more eye drops, there was a statistical significant difference between younger (≦ 70 yr-old) and older (> 71 yr-old) age groups. Considerable difference was detected by each type of glaucoma.
Results: Drug-induced keratopathy is often observed in the eyes using recent anti-glaucomatous eye-drops. The number of eye drops, the total frequency per day, age and type of glaucoma might relate to this condition.
Conclusions: We have to consider not only the effect for intraocular pressure but also the incidence and the severity of drug-induced keratopathy as a frequent side effect in glaucoma medication.
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P419 SIDE EFFECTS OF EYE DROPS V COMPLIANCE: PATIENTS' PERSPECTIVES

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Purpose: The aim was to look at patients' views on the side effects of eye drops for glaucoma and to determine the least tolerated side-effects and factors affecting compliance.
Design: This was a qualitative study using an anonymised, validated questionnaire.
Participants: Adult glaucoma patients on topical medication who attended the ophthalmic outpatient clinic.
Methods: Patients taking eye drops were prospectively and consecutively identified by nurses carrying out visual acuities in the outpatient clinic and recruited in to the study. A validated questionnaire was given to patients to be filled in anonymously. The questionnaire included basic demographic information. Patients were then asked questions on the following side effects of eye-drops: darker eye colour, longer thicker lashes, dark circles around the eyes, burning or stinging, itching and redness. These questions included whether they had experienced any of the aforementioned side effects, tolerance to each side effect and which side effect/s would cause patients to stop or commence a particular eye drop.
Main outcome measure: The least tolerated side-effect/s and those that affect compliance.
Results: One hundred twenty-eight out of 137 questionnaires were returned (93%). Seventy-nine percent of the patients had experienced side effects of eye drops. The most common side effect was burning/stinging, experienced by 63 patients (49%). The least tolerated side effect was burning/stinging, with 31% (95% CI 22.8%, 39.2%) wanting to stop their drop if they experienced this side effect. Eighty-three percent of the patients would be willing to commence an eye drop with the side effects of darker eye colour and longer lashes. Only 44 patients (38%, 95% CI 29.1%, 46.9%) would commence an eye drop if it caused burning and stinging. Twenty (16%, 9.57%, 22.43%) patients admitted to having stopped a drop due to side effects. Ninety-six (75%, 95% CI 67.5%, 82.5%) patients said they would change their eye for one with fewer side-effects.
Conclusions: The majority of patients have experienced side effects of eye drops. Painful side effects are less well tolerated than cosmetic side effects. Patients will continue to take an eye drop despite side effects if they feel it is of benefit to their eye condition. It is important for the ophthalmologist to discuss the importance of eye drops in treating glaucoma as well as the side effects to aid with compliance.
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12.1. Surgical treatment: General management, indication

see also P333

P420 CORNEAL DAMAGE FOLLOWING APPROPRIATE LASER IRIDOTOMY IS NEGLIGIBLE

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Purpose: To explore the problem of bullous keratopathy after laser iridotomy (LI), a commonly reported post-operative complication in Japan, the condition of corneal endothelium and the extent of peripheral anterior synechia (PAS) before and after LI were examined. The total energy and the device of laser treatment were referred as well.
Design: Cross-sectional study.
Participants and/or controls: Two hundred-nine eyes of 110 patients including 102 PACS, 94 PAC, 11 PACG and 2 APAC eyes, which received LI were examined pre/post-operatively. Mean period after LI was 3.7 ± 2.5 (1 ~ 10) years. The device of laser treatment was argon + Nd: YAG in 68 eyes, argon only in 137 eyes and Nd:YAG only in 4 eyes.
Methods: The diagnosis (PACS/PAC/PACG/APAC), intraocular pressure (IOP), corneal edema (±), corneal endothelial cell density, corneal guttata (±) and PAS index was recorded pre/post-operatively. The condition of laser exposure and the device (argon + Nd: YAG/argon/Nd:YAG) were also noted.
Main outcome measure: The mean endothelial cell density was 2654.8 ± 383.6/ mm^2 pre-LI, and 2654.8 ± 383.6/ mm^2 post-LI (P = 0.301, not significant). Corneal decompensation was not observed throughout this study. PAS index increased after LI in 10 eyes (4.8%). Plateau iris configuration was clearly observed in 14 eyes (6.7%). The endothelial cell density decreased more than 20% in 7 eyes (3.3%), including 2 eyes with corneal guttata and 5 eyes receiving argon laser treatment only.
Results: In this study, the mean endothelial cell density did not change before and after LI. So far as appropriate LI with low energy by Nd:YAG laser was performed on ordinary eyes, serious corneal damage was not observed. Endothelial cell loss was found in eyes with higher risk such as corneal guttata, and those having excessive laser exposure with argon laser alone. On the other hand, PAS did not develop in 199 eyes (95.2%) suggesting the efficacy of LI in preventing angle-closure glaucoma.
Conclusions: Bullous keratopathy after LI is one of the topics of ophthalmic laser treatment in Japan, and quite a few ophthalmologists prefer cataract surgery to LI for PACS and PAC eyes. Further long-term prospective study in large population is required to determine, whether LI or lensectomy should be the first-choice treatment in managing the eyes with angle-closure.

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P421 - withdrawn

12.2. Surgical treatment: Laser iridotomy

see also P061, P225, P233, P325

P422 THE PRELIMINARY STUDY FOR TREATMENT PATTERN OF PRIMARY ANGLE-CLOSURE GLAUCOMA AT THE BASIC LEVEL IN CHINA

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Objective: To screen appropriate therapies of primary angle-closure glaucoma (PACG) through systematic review and investigate new treatment patterns of PACG at the basic level in China.
Design: Systematic review, controlled trial, RCT, cost-effectiveness analysis.
Participants Studies: PACG patients.
Methods and Main outcome measures: Studies published in the English language were identified (1966 to 2006) from MEDLINE, EMBASE, and the Cochrane Collaborations, as well as studies published in the Chinese language of Chinese Periodical Full text Database (1979 to 2006). The effective, simple and economical treatment options were chosen and their efficacy and safety would be investigated by two clinical trials, the efficacy of laser iridoplasty (LPIp) using in different phase of acute angle closure glaucoma (AACG) and Laser peripheral iridotomy (LPIt) versus LPIt plus LPIp in treatment of chronic angle closure glaucoma (CACG). The eligible AACG patients received one of two treatment options based on presenting time: LPIp for those presenting from 8 am to 5 pm (106 eyes of 106 patients) and the conventional medical therapy for those presenting from 5 pm to 8 am (74 eyes of 74 patients). The CACG patients were randomized to receive one of two treatment options: LPIt (77eyes of 77 patients) or LPIt plus LPIp (81 eyes of 81 patients). Cost-effectiveness analysis was made based on the above results.
Results: According to SR, LPIp was a potential first-line alternative to conventional medication in acute attack. The AACG study indicated that LPIp was an effective intervention in reducing IOP levels in acute attack eyes. The success rate was similar (85.8% *vs* 86.5%). The trabeculectomy rate was 22.6% in the LPIp group and 18.9% in the medical group at 1-year follow-up without statistical significance. The CACG study indicated that there were no significant differences between the LPIt group and the LPIt plus LPIp group in IOP level, visual function and requirement for surgical therapy at one year follow-up. The trabeculectomy rate was 18.2% in the in the LPIt group and 22.2% in the LPIt plus LPIp group. The LPIt plus LPIp combination opened more synechial closure than pure LPIt. During follow-up, the PAS of the LPIt plus LPIp group progressed from 2.0 clocks (median) to 2.5 clocks (median) at 1 year. Cost-effectiveness analysis showed that the cost incurred to achieve an IOP control was RMB 2754 under the conventional treatment pattern and RMB 1817 under the new pattern.
Conclusions: The new treatment pattern – LPIt as the main part – decreases trabeculectomy rate and saves medical costs considerably. It is cost-effective and applicable to the basic level in China.
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12.4. Surgical treatment: Laser trabeculoplasty and other laser treatment of the angle

see also P525

P423 DIODE LASER TRABECULOPLASTY IN OPEN-ANGLE GLAUCOMA: 50-µ VS. 100-µ SPOT SIZE

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Objective: Evaluation of diode laser trabeculoplsaty (DLT) in lowering IOP in patients with both primary open-angle glaucoma (POAG) and exfoliation glaucoma (XFG), using a different size of laser spot.
Design: A six-month, open-labeled, controlled, prospective study.
Participants: Sixty-two eyes (POAG = 33, XFG = 29) have been enrolled in two homogenous groups.
Methods: In each group DLT was performed with different laser spot size: 50µ and 100µ. The wavelength of 532 nm, 0.1 second single emission with the power of 600-1200 mW was applied on the 180 degrees of trabeculum. The follow-up examinations after DLT were done on days 7, 30, 90 and 180.
Results: Two patients were excluded, and only 1 out of 60 eyes failed to show IOP decrease after DLT until day 180 of the follow-up. There were no statistically significant differences of the baseline IOP: 23.58 ± 2.89 mmHg for the 50-µ

group and 22.51 ± 2.57 mmHg for the 100-µ group (p > 0.1). In the 50-µ group, IOP on day 7 was 24% reduced from the baseline, on day 30 there was 30.8% decrease from the baseline, on day 90 there was 31.4% decrease from the baseline and on day 180 there was 29.8% decrease from the baseline (p < 0.001). In the 100-µ group, IOP on day 7 was 26.5% reduced from the baseline, on day 30 there was 34.6% decrease from the baseline, on day 90 there was 35.7% decrease from the baseline and on day 180 there was 39% decrease from the baseline (p < 0.001).

Conclusions: This study suggests that the DLT is more effective by using a 100 µ-laser spot. Comparing with 50 µ DLT, a 100 µ also shows more cosistent IOP reduction during six months period. There is no statistical difference in the IOP reduction between 50-µ and 100-µ treatment in the first 30 days following DLT.

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P424 SELECTIVE LASER TRABECULOPLASTY AS INITIAL AND ADJUNCTIVE TREATMENT IN OPEN-ANGLE GLAUCOMA

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Purpose: To evaluate the efficacy and safety of selective laser trabeculoplasty (SLT) as initial and adjunctive treatment in open-angle glaucoma.

Design: Prospective clinical study.

Participants: One hundred-fourteen eyes of 74 patients underwent SLT.

Methods: 360-degrees SLT was performed by a single surgeon using a Latina goniolens. While 32 eyes (28%) were treated as initial therapy, 82 eyes (72%) were already on an average of 3 medications. Intraocular pressure (IOP) was measured at basal examination, at 1, 3, 6, 9 and 12 months. Topical steroids or nonsteroidal antiinflammatory agents were not prescribed after SLT.

Main outcome measures: IOP was the main outcome measure. Success was defined as IOP reduction of at least 3 mmHg or at least 20% reduction from baseline.

Results: The mean basal IOP was 22.5 ± 5.2 mmHg. The mean IOP values at 1, 3, 6, 9 and 12 months were 17.5 ± 4.2, 16.7 ±4.0, 16.4 ± 3.8 m, 16.5 ± 3.4 and 17.2 ± 3.4 mmHg in order. IOP decreased by 21.4%, 24.2%, 25.5%, 26.1% and 23.9% from baseline during the same examination periods. The percentage of eyes with at least 3 mmHg IOP reduction was 74%, 82% , 83%, 88% and 86%. and the percentage of at least 20% IOP reduction was 52%, 61%, 70%, 67% and 64% at 1, 3, 6 , 9 and 12 months, respectively. Basal IOP correlated with reduction of IOP (p = 0.000 and r = 0.451). Previous argon laser trabeculoplasty; prostoglandin analogue use and pseudophakia did not determine the rate of IOP reduction. Success was mainly determined by basal IOP as shown by logistic regression analysis. No permanent adverse effects were encountered and postlaser IOP spikes were transient

Conclusions: SLT over a circumference of 360 degrees is efficient and safe in the treatment of glaucoma as initial or adjunctive treatment.

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P425 SELECTIVE LASER TRABECULOPLASTY FOR THE TREATMENT OF PSEUDOEXFOLIATIVE GLAUCOMA

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Purpose: To evaluate the efficacy and safety of selective laser trabeculoplasty (SLT) for the treatment of pseudoexfoliative glaucoma.

Design: Prospective clinical study.

Participants: Twenty eyes of 16 pseudoexfoliative glaucoma patients with a mean age of 62.2 underwent SLT.

Methods: 360 degrees SLT was performed by a single surgeon using a 532 nm Nd YAG laser with the aid of a Latina goniolens. While 5 eyes (25%) were treated as initial therapy, 15 eyes (75%) were already on an average of 2 medications at the time of SLT. Intraocular pressure (IOP) was measured at basal examination, at 1, 3, 6, 9 and 12 months. Topical steroids or nonsteroidal antiinflammatory agents were not prescribed after SLT.

Main outcome measures: IOP was the main outcome measure Success was defined as IOP reduction of at least 3 mmHg or at least 20% reduction from baseline

Results: The mean basal IOP was 22.7±6.4 mmHg. The mean IOP values at 1, 3, 6, 9 and 12 months were 17.7 ± 5.9, 17.3 ± 5.6, 16.5 ± 5.8, 16.1 ± 3.6 and 17.8 ± 3.8 mmHg

in order. IOP decreased by 21.6%, 23.4%; 27.3 %, 25.4 % and 22.7% from baseline during the same examination periods. The percentage of eyes with at least 3 mmHg IOP reduction was 75%, 85% , 85%, 50% and 40% and the percentage of at least 20% IOP reduction was 45%, 60%, 65%, 35% and 30% at 1, 3, 6 , 9 and 12 months, respectively. Postlaser IOP spikes were controllable and transient. Permanent adverse effects were not encountered.

Conclusions: 360-degrees SLT is efficient and safe in the treatment of pseudoexfoliative glaucoma as initial or adjunctive treatment. The efficacy seems to wane slowly after 6 months.

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P426 ELT: EXCIMER LASER TRABECULOSTOMY CLINICAL UPDATE, 2009

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Purpose: To report Excimer Laser Trabeculostomy (ELT) long term clinical safety and efficacy results in three groups.

Design: Non-randomized clinical trial, one site: Detmold, Germany.

Participants: Thirty-two eyes of 32 phakic patients (group 1) and 15 eyes of 15 pseudophakic patients (group 2), with open-angle glaucoma, pseudoexfoliative glaucoma, or ocular hypertension underwent ELT surgery alone. 33 eyes of 33 phakic patients underwent combined ELT with cataract surgery (group 3).

Methods: Eighty glaucoma patients, having failed maximal medical therapy, were considered as surgical candidates. ELT was performed using a 308 nm xenon-chloride Excimer Laser on one eye per patient. In the combined ELT/cataract surgery group, phacoemulsification was performed first, followed by ELT. Patients were followed 1 day, 1 month, 3 months, 6 months, 1 year, 2 years, and 3 years postoperatively.

Main outcome measures: Postoperative intraocular pressure (IOP) and glaucoma medication reduction.

Results: In group 1, mean preoperative IOP was 25.44 (± 6.37) mmHg with an average of 2.44 (± 1.27) topical medications. Mean post-operative IOP was 16.17 (± 3.57) at 3 years. Mean IOP-lowering medications were reduced to 0.21 (± 0.40) at three years. In group 2, mean preoperative IOP was 26.73 (± 6.360) mmHg with an average of 2.93 (± 1.33) topical medications. Mean post-operative IOP was 14.10 (± 3.87) at three years. Mean IOP-lowering medications were reduced to 0.67 (± 0.62) at 3 years. In group 3, mean preoperative IOP was 21.03 (± 4.36) mmHg with an average of 1.47 (± 0.72) topical medications. Mean post-operative IOP was 13.16 (± 1.46) at three years. Mean IOP-lowering medications were reduced to 0.45 (± 0.60) at three years.

Conclusions: ELT is a promising novel technique for the treatment of open-angle glaucoma, safely and effectively lowering IOP and reducing medication requirements with a very low complication rate.

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P427 SELECTIVE LASER TRABECULOPLASTY: ALTERNATIVE APPROACH TO GLAUCOMA

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Objective: Argon-laser trabeculoplasty (ALT) has been used for decrease of intraocular pressure (IOP) over 20 years. This method is an alternative to medications and surgical operation for patients with uncontrolled glaucoma. Selective laser trabeculoplasty (SLT) is an improvement of standard ALT. The SLT technique excludes thermal injury of trabecular meshwork and gives a possibility of repeated procedure.

Design: The aim of our report is to define the efficiency of SLT at glaucoma and eye hypertensia.

Participants: We have had 21 eyes under our supervision. Average age of the patients was 56.0 years. Average initial IOP reached 23.43 mmHg. All patients displayed visual acuity of 20/20: a) in 66.67% without correction; b) in 23.81% of cases with correction; c) in 9.52% with correction 20/20, however the field sight was tubular (narrowing to a fixing point). The most typical changes in terms of field of vision were nasal steps (from 5º to 15º), scotomas in Bjerrum area and enlargement of the blind spot. Optic nerve head excavation ranged from 5/10-9/10. Medicinal therapy (for all patients) included beta-blockers, carboanhidrase inhibitors and prostaglandins. In 9.52% of cases filtrational surgery was performed followed by medicinal treatment. Eyes with diabetic angiopathy comprised 9.52%.

Intervention or methods or testing: Selective laser trabeculoplasty was performed with diode laser 532 nm, on 90º trabecular areas of the corner of the anterior chamber. We observed the patients during 14 months.
Main outcome measure: The SLT success was defined by the following criteria: 1) IOP decrease from the initial level, 2) full cancellation of instillations, 3) condition of optic nerve head, the field of vision and visual functions accordingly.
Results: IOP has decreased by 22.3 % from the base level, average value came down to 18.2 mmHg. In all cases we managed to achieve full cancellation of instillation. No single case of negative dynamics in optic nerve head condition, field of vision and visual functions was observed during the supervision. In 33.33 % of cases reduction of optic nerve excavation was noted.
Conclusions: The results received allow us to conclude that SLT is an effective and suitable alternative method of glaucoma and eye hypertensia treatment. When applied on a limited area (on 90º) the procedure enables its repeated use in case if necessity. The SLT appeared to be also effective on eyes after surgical intervention.
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P428 18-MONTH RESULTS OF SELECTIVE LASER TRABECULOPLAST IN PRIMARY OPEN-ANGLE GLAUCOMA AND OCULAR HYPERTENSION. EGYPTIAN STUDY
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Purpose: To investigate the efficacy and safety of selective laser trabeculoplasty in primary open-angle glaucoma and ocular hypertension in Egyptian population. Treatment was considered as primary, adjunctive, or replacement therapy.
Design: A prospective intervention clinical study.
Participants: One hundred-seventeen eyes were enrolled in the study. Female/Male: 55/45. The mean age was 53.2 years. The mean intraocular pressure (IOP) was 19.44 mmHg under a mean of 1.49 anti-glaucoma therapy.
Methods: The treatment protocol consists of 360-degrees laser application to the trabecular meshwork, starting with 0.4 mJ and increasing the power as needed. Topical steroids were then applied for three days. Antiglaucoma therapy was then adjusted according to patient's response.
Main outcome measure: Mean IOP reduction, mean medications reduction, and complications.
Results: The mean IOP was 14.29, 14.54, 14.8, and 15.97 mmHg at 1, 6, 12, and 18 months respectively. The mean anti-glaucoma medications were reduced to 0.48 at 18 months. The whole results were statistically significant. No serious complications were reported.
Conclusions: Selective laser trabeculoplasty was effective in reducing the intraocular pressure and antiglaucoma medications, the effect decreases over with time. Treatment was of particular value when surgery was of a high- risk.
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P429 ONE YEAR AFTER TREATMENT BY SELECTIVE LASER TRABECULOPLASTY
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Purpose: To evaluate efficacy of selective laser trabeculoplasty (SLT) in glaucoma patients.
Design: Retrospective study.
Participants: In this study 110 eyes of 58 patients have been evaluated, 24 men and 34 women. The age ranged between 24 years and 80 years (mean, 63,8 ± 10,5 y). 98 eyes of them were with primary open-angle glaucoma, 10 eyes with pseudoexfoliative glaucoma, 2 eyes with pigmentary glaucoma.
Intervention: The SLT spots were burnt in the extent of 180º circumferentially in the anterior chamber angle (1,1 mJ, 90 spots, 400 µm). Existing glaucoma medication has not been changed in any patient. The reason for SLT were: 1. a deficient decrease of intraocular pressure (IOP) with current glaucoma medication and 2. an intolerance of glaucoma medication.
Results: Our patients were followed-up 1 day, 1 week, 1, 3, 6 and 12 months after the treatment. The mean IOP before SLT was 16,6 ± 3,1 mmHg. After one day IOP decreased about 3,4 ± 2,9 mmHg, respectively about 19,0 ± 14,2%. After one week IOP diminished about 1,6 ± 2,5 mmHg, respectively about 8,8 ± 13,9%. After one month IOP decreased about 2,3 ± 2,6 mmHg, respectively about 12,6 ± 13,5%. After three months IOP lowered about 2,4 ± 2,9 mmHg, respectively about 13,0 ± 15,0%. After six months IOP diminished about 2,5 ± 2,8 mmHg, respectively about 13,7 ± 15,0%. After 12 months IOP decreased about 2,2 ± 2,6 mmHg, respective about 12,1 ± 14,6%. In one eye with high myopia considerable elevation of IOP was found and trabeculectomy was necessary.
Conclusion: SLT is a safe and effective method that reduced the IOP in glaucoma patients. A good effect on the decrease of IOP (12,1 ± 14,6%) lasts one year after SLT in our group. Only in high-myopia eyes we did not havegood experiences

with SLT. The target pressure hae been achieved in 57,27% patients one year after SLT.

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P430 SLT FOR EXFOLIATIVE GLAUCOMAS AND PRIMARY OPEN-ANGLE GLAUCOMAS EIGHT-YEAR FOLLOW-UP

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Purpose: Selective laser trabeculoplasty (SLT) is a technique developed for treatment of the trabecular meshwork in patients with glaucoma. The purpose of this study is to establish the efficacy of SLT for exfoliative glaucoma (EG) and primary open-angle glaucoma (POAG)

Method: We assessed to 8-years efficacy of SLT a randomised treatment of glaucoma. Trabecular meshwork of 42 eyes (25 patients) was treated with Q-switched frequency-doubled Na-YAG laser with a wave-length of 532 nm. The eyes were divided into groups. Group 1: 20 eyes with EG, group 2: 22 eyes with POAG. Approximately 105 laser spots were applied over 360 degrees of the the trabecular meshwork.

Results: The mean preoperative intraocular pressure (IOP) in group 1 was 25,3 ± 1,1 mmHg and in group 2 25,5 ± 1,2 mmHg. A stastically significant decrease of IOP ($p < 0,05$) was observed after SLT by an average in group 1 of -5,5 mmHg and in group 2 -5,7 mmHg. Mean percentage reduction was EG-22,1% and POAG-22,4 %.

Conclusion: Our results show SLT is an effective method for EG and POAG treatment in reducting IPO treated eyes. SLT decreases IOP somewhat for at least 8 years without increase in topical glaucoma treatment.

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P431 IS THE BASELINE INTRAOCULAR PRESSURE PREDICTIVE OF SLT RESPONSE IN OCULAR HYPERTENSION COMPARED TO PRIMARY OPEN-ANGLE GLAUCOMA?

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Purpose: To determine if the baseline intraocular pressure (IOP) before selective laser trabeculoplasty (SLT) predicts the long-term success of SLT in patients with ocular hypertension (OHT) compared to primary open-angle glaucoma (POAG).

Design: A retrospective, chart review.

Participants: Consecutive patients, who underwent SLT as primary treatment for OHT and POAG, with baseline IOP > 22 mmHg, between 2002 and 2005, and completed at least 30 months follow-up was performed. Patients were excluded if they required additional glaucoma medications, laser, or ocular surgery during the follow-up period.

Methods: SLT success was defined as a 20% or greater decrease in IOP from the baseline. Pearson's correlation analysis was performed to correlate the baseline IOP to the percentage of IOP reduction at 3, 6, 12, 18 and 30 months after SLT.

Main outcome measure: Intraocular pressure.

Results: Sixty-two eyes of 37 patients were identified (26 with OHT and 36 with POAG). The baseline IOP for the OHT group was 26.4 ± 2.5 mmHg (range, 22-32 mmHg), while the baseline IOP for the POAG group was 24.8 ± 2.1 mmHg (range, 22-31 mmHg), with no significant difference between mean baseline IOP in the 2 groups ($p = 0.286$). The success rate in OHT group was 81% at 12 months 85% at 30 months, while the success rate in POAG group was 79.4% at 12 months 76.5% at 30 months. There was no statistically significant difference between success rate in OHT and POAG at 12 months and 30 months ($p = 0.984$ and 0.509 respectively). For OHT patients, the Pearson's r value between the baseline IOP and percentage of IOP reduction following SLT at 3 month was 0.394 ($p = 0.047$), at 9 month it was 0.080 ($p = 0.698$), at 18 month it was 0.219 ($p = 0.283$), and at 30 month it was 0.198 ($p = 0.333$). While for POAG patients, r-value at 3 month was 0.651 ($p < 0.0001$), at 9 month it was 0.547 ($p = 0.00012$), at 18 month it was 0.335 ($p = 0.052$), and at 30 months it was 0.306 ($p = 0.079$).

Conclusions: The success rate of SLT, up to 30 months, is the same in OHT and POAG patients. In OHT patients, we found no significant correlation between baseline IOP and the percentage of IOP reduction following SLT, while in POAG patients with matched baseline IOP, baseline IOP moderately predicted the IOP response at up to 12 months after SLT. These findings suggest that, baseline IOP should not be used as a predictive factor for SLT success in OHT; on the other hand baseline IOP is a good predictor of SLT success in POAG patients up to 12 months.

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P432 SELECTIVE LASER TRABECULOPLASTY IN PSEUDOEXFOLIATION GLAUCOMA

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Purpose: Selective laser trabeculoplasty (SLT) is a new method to reduce intraocular pressure in glaucoma associated with pigmentation of trabecular meshwork. This pigmentation is often obtained in pseudoexfoliation glaucoma (PEG). The purpose was to evaluate the long-term results, safety and efficacy of SLT in the patients with PEG.
Design: Prospective clinical trial.
Participants: SLT has been performed in 64 eyes with PEG. The comparison group consisted of 48 eyes with PEG, treated only with medications (timolol twice daily).
Methods: Intraocular pressure (IOP) has been measured in 24 hours, 1 week, 1, 6 and 12 months after SLT.
Results: IOP was reduced significantly (10,2 mmHg from baseline) in 24 hours after SLT. In one week the mean IOP reduction from baseline was 4,6 mmHg, in 1 month 2,3 mmHg, in six months 5,3 mmHg and in 12 months after SLT 6,8 mmHg. As SLT has been performed as a first-line treatment in 10 eyes, no low-tension medications were needed to control IOP in one year follow up in these eyes. The mean IOP reduction from baseline was more significant in SLT treated PEG patients (20%) then in comparison group (15%).
Conclusions: SLT is an effective method for IOP reduction in pseudoexfoliation glaucoma.
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P433 INTRAOCULAR PRESSURE CONTROL AFTER LASER TRABECULOPLASTY IN NIGERIANS

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Objective: To evaluate intraocular pressure control in Nigerians after trabeculoplasty.
Design: Retrospective study of 57 eyes of 42 patients that had laser trabeculoplasty for intraocular pressure control in primary open-angle glaucoma, between November 2004 and August 2005, at the Eye Foundation Hospital, Lagos. The highest intraocular pressure pre Laser and the intraocular pressure at one month, 6, 12, 18, 24, 30, and 36 months post laser were retrieved from the case-notes. The number of medications the patients used before and after laser trabeculoplasty and the vision by Snellen's chart, pre and post laser treatment were also retrieved from the case-notes.
Method: Pilocarpine 2% was used to constrict the pupil. Frequency-doubled Nd:YAG 532 Green laser eyelite, with spot size 50 um. Duration: 0.2 sec. Power: 250-400 mW. 3600 starting at 12 clock hour, and moving the lens clockwise. Blanching or air bubble on the trabecular meshwork was noticed.
Main outcome measure: Intraocular pressures post-trabeculoplasty
Result: Thirteen females with mean age of 62.1 yrs, standard deviation 7.37, 44 males with mean age of 65.1, standard deviation 11.3. Males were significantly older than females with P = 0.006. Mean post laser intraocular pressure at 1 month is 12.56 mmHg, at 6 months 11.78 mmHg, at 12 months 12.1 mmHg, at 18 months 13.01 mmHg, at 24 months 11.38 mmHg, at 30 months 12.54 mmHg, and at 36 months 11.67 mmHg. Percentage reduction in intraocular pressure at 1 month is 38.4% (± 20.59), at 6 months 40.3% (± 17.03), at 12 months 40% (± 16.75), at 18 months 41.4% (± 16.17), at 24 months 48.5% (± 12.81), at 30 months 48.2% (± 18.75), and at 36 months 42.9% (± 20.29). P value 0.0002. Significant visual acuity improvement was noticed following trabeculoplasty (P = 0.0001). Seventeen eyes, 24.5%, were maintained on their previous medications. Twenty-four eyes, 42.1%, had their medications reduced. Eleven eyes, 19.3%, had their medications increased. Three eyes, 5.3%, had no medications before and after laser trabeculoplasty.
Conclusion: Sustained good intraocular ocular pressure control can be achieved with laser trabeculoplasty in selected cases therefore it can be used as adjunctive treatment in selected cases in Nigerians.
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P434 HIGHER ENERGY MAY IMPROVE SUCCESS WITH SELECTIVE LASER TRABECULOPLASTY (SLT) IN PATIENTS WITH PREVIOUS FAILURE IN THE FIRST EYE

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Purpose: To determine factors associated with SLT success in patients with previous failure in the first eye.
Design: Retrospective comparative case series.
Participants and controls: Patients who underwent SLT in both eyes were followed for at least 6 months, and in whom SLT had failed in the first eye.

Methods: Medical records of the patients who underwent SLT in the last 5 years were reviewed. Logistic regression analysis was conducted to find predictors of SLT success in the second eyes. Factors used in the analysis include age, race, sex, history of diabetes, hypertension, or hypercholesterolemia, type of glaucoma, cup disc ratio, baseline intraocular pressure, number of antiglaucoma medications and various SLT parameters, etc. Failure was defined as an intraocular pressure decrease of less than 3 mmHg from the baseline during follow-up. Success was defined as a lowering > 3 mmHg following SLT.
Main outcome measure: Factors associated with SLT success in the second eye in patients with SLT failure in the first eye.
Results: Three hundred thirty SLT procedures were identified. Forty-one patients had SLT in both eyes; 25 met entry criteria. Out of 25 patients who had failed SLT in the first eye, SLT was successful in the second eye in 7 patients (28%), and failed in the second eye in the remaining 18 patients (72%) during mean of 17.6 months of follow-up (range; 6.0-55.3 months). Logistic regression analysis revealed statistically significant decrease in the risk of SLT failure in the second eye with higher SLT energy (odds ratio, 0.023; 95% confidence interval 0.001-0.753; p = .034). Mean SLT energy was 0.89 ± 0.24 mJ in the group of SLT failure in both eyes and 1.19 ± 0.34 mJ in the group of SLT failure in the first eye-success in the second eye.
Conclusions: If there is a poor response to SLT in one eye, the chance of success in the contralateral eye is low. Based on our results, higher energy may be helpful to obtain better outcomes when applying a SLT to the contralateral eye.
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P435 COMPARISON OF SLT (SELECTIVE LASER TRABECULOPLASTY) EFFICACY IN PATIENTS WITH OPEN -ANGLE AND ANGLE-CLOSURE GLAUCOMA

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Purpose: To compare efficacy of 180 degrees selective laser trabeculoplasty (SLT) in lowering intraocular pressure between open-angle and angle-closure glaucoma patients.
Design: Retrospective study.
Participants: Open-angle and angle-closure glaucoma patients.
Method: Medical records of patients who underwent 180 degree selective laser trabeculoplasty (SLT) from June 2005 to Jan 2008 at King Chulalongkorn Memorial hospital, Bangkok, Thailand, were reviewed. Intraocular pressure (IOP) and number of glaucoma medications were assessed at baseline, 4 weeks and 12 weeks after SLT. Main outcome was IOP reduction from baseline and each follow up visit between open-angle glaucoma (OAG) and angle-closure glaucoma (ACG) patients.
Main outcome measure: IOP after SLT treatment.
Results: There were 39 AOG and 20 ACG patients enrolled into the study. Mean (SD) age of OAG and ACG patients were 63.13 (11.89) and 66.00 (9.12) years. Mean (SD) IOP at baseline in OAG and ACG groups were 18.47 (4.72) and 19.48 (3.78) mmHg, respectively. At four weeks after SLT, mean (SD) IOP of OAG and ACG groups were 15.92 (3.36) and 18.05 (4.21) mmHg, respectively. At 12 weeks after SLT, mean (SD) IOP of OAG was 15.12 (2.81) mmHg, whereas ACG was 16.93 (3.56) mmHg. SLT can significantly decrease IOP in both OAG and ACG groups at 12 weeks after laser ($p < 0.01$). The efficacy of SLT in IOP reduction was not different between OAG and ACG groups at both 4 weeks and 12 weeks after laser treatment ($p > 0.05$). The number of glaucoma medications used between baseline and 12-week post laser in both groups were not different.
Conclusions: Selective laser trabeculoplasty can reduce intraocular pressure in both open-angle and angle-closure glaucoma. No statistically significant difference of SLT efficacy was shown between both groups.
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P436 SELECTIVE LASER TRABECULOPLASTY AS ADJUNCTIVE TREATMENT FOR OPEN-ANGLE GLAUCOMA IN INDIAN EYES

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Objective: To study the safety and efficacy of selective laser trabeculoplasty (SLT) as adjunctive treatment of open-angle glaucoma (OAG) in Indian eyes.
Design: Non-randomized, prospective, interventional study.

Participants: Forty eyes of 22 Indian patients with open-angle glaucoma who underwent selective laser trabeculoplasty were included in the study.
Methods: Fifty laser spots were placed over 180 degree of the trabecular meshwork.
Main outcome measures: Pre-laser and post-laser IOP was noted at 2 weeks,1,3 and 6 months following SLT. IOP spikes and any complications were recorded. Reduction in number of topical medications to achieve target IOP was noticed.
Results: Mean pre-treatment IOP was 24.8 mmHg. Mean IOP at 6 months following treatment was 17.3 mmHg. Mean decrease in IOP was 6.2 mmHg. Seventy percent of the patients had an IOP decrease of more than 15%. Eighteen percent of the eyes showed no change in IOP. Sixteen percent of patients had a reduction of topical medication by one drop. Six patients had a transient spike in IOP (6-9 mmHg), which settled within 24-72 hours. No other significant complications were noted.
Conclusion: SLT was found to be efficacious and safe as adjunctive therapy in reducing IOP in OAG in Indian eyes. Long-term prospective randomised studies with a larger sample size, are required to provide stronger evidence.
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12.8. Surgical treatment: Filtering surgery

see also P303, P340, P455, P458, P529

P437 NEW APPROACH TO TRABECULECTOMY PRESERVES EPISCLERAL TISSUE

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Purpose: Utilizing a posterior limbal conjunctival flap to address the recurrent complication of scarring in filtering blebs and minimizing the use of mitomycin on the under surface of the scleral flap and scleral bed.
Method: A 5-mm conjunctival incision is made 8 mm from the limbus. A second incision is made into the Tenon's capsule. Tenon's and episcleral tissue are separated from the sclera to a point 4 mm from the limbus. A 3-mm horizontal incision, half the thickness of the sclera, is made and a scleral tunnel is then created up to the limbus. Radial incisions on either side of the tunnel are created from inside out by tilting the crescent knife. Mitomycin is then applied to the under surface of the flap and the scleral bed. Anterior chamber is then entered with a 2.75-mm keratome and a trabeculectomy is performed followed by a peripheral iridectomy. The scleral flap is loosely sutured with two sutures. Tenon's capsule and conjunctiva are individually sutured. Postoperative care includes antibiotic and steroid eye drops.
Results: Surgical outcomes from 25 eyes with a pre-op IOP ranging from 33 to 56 (average 44.5) resulted in post-operative IOPs ranging from 8 to 18 (average 13).
Conclusions: No damage to episcleral tissue (no button-holing). No scarring at the filter from limbus to 4-mm posteriorly, nasally and temporally. No failing bleb. No needling required. Episcleral tissue is preserved, improving filtration. No need to excise Tenon's tissue in thick vascular tenons (as in African Americans, young patients, etc.). Patients with thin episcleral tissue have diffuse blebs and decreased incidence of cystic blebs. Decrease incidence of fibrous tissue stimulating effect and therefore bleb failure in pseudophakic patients.
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P438 THE RELATIONSHIP BETWEEN THE SUCCESS OF GLAUCOMA SURGERY AND GLAUCOMA TYPE, EARLY POSTOPERATIVE COMPLICATIONS AND DURATION OF PREOPERATIVE TOPICAL MEDICATIONS

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Objective and Purpose: To investigate the relationship between the success of filtration surgery and the type of glaucoma, early postoperative complications and duration of preoperative use of topical medications.
Design: Retrospective review of medical records.
Participants: One hundred eyes of 92 patients who underwent surgery for glaucoma without antimetabolites.
Testing: Analyses were performed using an electronic database organized in the SPSS (version 11.5) statistical package (chi square and Fisher's test).
Main outcome: The following parameters were taken: age, gender, type of glaucoma, c/d ratio, IOP before surgery, visual acuity, duration of medicament therapy before surgery (without therapy to with therapy; without therapy to with 1-30 mo, more than 30 mo therapy), early postoperative complications, IOP two years after surgery, number of medications on the last visit. All patients were divided in two groups according to surgery success, which was determined by the IOP on their last visit (two years after surgery). The IOP below 18 mmHg with or without medications was considered as success. All patients were examined and had surgery by the same ophthalmologists (two of the authors).

Results: The average age of patients was 70,34 ± 0,81 (51-84). There were 43 men's and 57 women's eyes. The duration of use of topical medications was 27,50 ± 3,13 months (0-118). The average value for IOP before surgery was 32,95 ± 9,88, mmHg (20-70). The average postoperative IOP was 13,33 ± 4,55 (2-28). There were 29 (25,4%) patients with diagnosed simplex glaucoma, 34 (29,8%) with capsular glaucoma, 34 (29,8%) with chronic angular glaucoma and 3 (2,6%) with acute angular glaucoma. There were 60,7% patients without postoperative complications, 14,6% had hyphaema, 9,0% had shallow anterior chamber, 15,7% had shallow anterior chamber and choroidal detachment. The success rate of surgery for capsular glaucoma was statistically significant worst ($p = 0,036$) comparing to other glaucoma types. There was no statistic significance between neither any complication nor the type of complications and success of surgery ($p = 0,699$, $p = 0,695$), or between the type of glaucoma and the presence of complications ($\chi^2 = 1,15$, $p > 0,05$). There was no statistical significance between the groups according to duration of preoperative use of topical medications ($p = 0,109$). Neither other parameters showed any statistical significance concerning final outcome (age, gender, c/d ratio, preoperative IOP, visual acuity).
Conclusions: Although surgery techniques for glaucoma improve from day to day, trabeculectomy stays the golden standard. Different factors can take part in final results. Regarding to our results, the early postoperative complications and duration of preoperative use of topical medications did not interfere with final IOP. But, considering the type of glaucoma and final results, we can conclude that the results of surgery for capsular glaucoma were statistically significant worst compared to other types of glaucoma.
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12.8.1. Surgical treatment: Filtering surgery: Without tube implant

P439 UTILIZING RELEASABLE SUTURE DURING TRABECULECTOMY IN PRIMARY ANGLE-CLOSURE GLAUCOMA

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Objective: To observe whether the releasable suture could prevent the post-operative complications of trabeculectomy such as shallow anterior chamber and maintain a longer period of lower intraocular pressure (IOP) in patients with primary angle-closure glaucoma (POAG).
Design: Case-control study.
Participants: The study examined 32 eyes of experimental group and 28 eyes of control study. Sixty patients with POAG were included.
Methods: Sixty eyes of sixty patients with POAG during the trabeculectomy were randomly subgrouped into an experimental group (using releasable suture [RS]) and a control group (without releasable suture [WRS]). The RS group had 32 eyes from 32 patients, and the control group had 28 eyes from 28 patients. There were 10 male patients in each group; there were 22 female patients in the RS group and 18 in the control group. Pre-operation the IOP in RS was 49.61 ± 15.86 mmHg (24~80 mmHg) and in control group 46.96 ± 15.24 mmHg (24~80 mmHg). The standard trabeculectomy was performed and 0.3 mg/ml MMC was placed about 40~60° circumference around sclera flap and under the Tenon's capsule for 1~2.5 minutes depending on the thickness of the Tenon's capsule in each patient. Except for the use of 10-0 nylon releasable suture to close the sclera flaps during the operation in the RS group, the other procedures were the same in two groups. Each group followed-up at 1 day, 1 week, 2 weeks, 1 month, 3 months, six months and 1 year post-operatively.
Main outcome measure: The IOP in RS group was 18.25 ± 11.02 mmHg (2~55 mmHg) and in WRS group 11.36 ± 4.96 mmHg (2~22 mmHg) at first day after operation. The visual acuity (Snellen chart) before and at the first day after operation was 0.45 ± 0.20 (0.01~0.8) and 0.31 ± 0.17 (0.01~0.8) ($P = 0.000$) in RS group, whereas was 0.39 ± 0.27 (0.01~1.0) and 0.36 ± 0.23 (0.01~0.8) ($P = 0.487$) in WRS group respectively.
Results: In the early stage of post-operation, the shallow anterior chamber rate was not significantly different in the two groups ($P > 0.05$). The difference in IOP between the two groups was significant ($P = 0.003$). However, the foreign body sensation of the operated eye in the RS group was significantly higher than in WRS group ($P = 0.003$) two weeks after operation. But there was no difference in either IOP or visual acuity between the two groups 2 weeks, 1 month, 3 months, 6 months and 1 year post-operatively.
Conclusion: Using releasable suture during trabeculectomy does not reduce early post-operative complications such as the rate of the shallow anterior chamber or control the long-term IOP. It could reduce the early post-operative complications and control the long period IOP that using short period low dose MMC and injecing little amount of normal saline (or BSS) into anterior chamber after closure the sclera flap to reform the depth of the anterior chamber and to check the strength of the suture tightness during the trabeculectomy in primary angle-closure glaucoma.
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P440 - withdrawn

P441 EFFICACY OF TRABECULECTOMY IN PRIMARY OPEN-ANGLE GLAUCOMA - THE INFLUENCE OF THE DEFINITION OF SUCCESS

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Objective: To compare different methods of presenting the results of a clinical research in glaucoma.
Design: Retrospective analysis (chart review).
Participants: Patients with primary open-angle glaucoma that have been subject to trabeculectomy in our clinic between 2001-2006.
Methods: We have noted the intraocular pressure and the number of antiglaucoma drugs preoperatively and at all control visits.
Main outcome measure: The influence of the definition of success (postoperative IOP reduction with 20,30 or 40%, postoperative IOP under 21,18,15 or 12 mmHg, with or without adjunctive anti glaucoma medication) on the results yielded by a glaucoma research.
Results: Sixty-five eyes were included in the study. The mean follow-up was 14.38 ± 13.77 months, and the mean number of visits 4 ± 1.58. Complete success (IOP reduction without medication) at 1 year varied between 38.4% (20% reduction of IOP) and 34.6 % (40% reduction of IOP). Qualified success (IOP reduction with medication) at 1 year varied between 76.9% (20% reduction of IOP) and 53.8 % (40% reduction of IOP). We have also analyzed the Kaplan Meier survival curves for IOP reduction under different thresholds, with and without medication, and different types of scatter plots for presenting the results of a study.
Conclusions: The definition of success can influence to a great extent the communicated results of any glaucoma research. It is strongly recommended to use at least two types of graphic presentation: the scatter plot and the Kaplan Meier survival analysis.
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P442 EARLY OUTCOMES OF SAFE SURGERY TRABECULECTOMIES IN A SOCIO-ECONOMICALLY DEPRIVED POPULATION

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Aims: Advances in trabeculectomy techniques over the past decade have prolonged bleb survival rates through the modulation of bleb function and appearance. The safe surgery trabeculectomy (SST) technique has improved the safety profile of what is regarded as the gold standard of glaucoma surgery. An association between social deprivation and high-risk glaucoma has been well established. We report on the short-term outcomes (within 3 months) of SST in a socio-economically deprived population.
Design: Retrospective consecutive case series.
Participants: Forty-two eyes of 38 patients in a socio-economically deprived population of Birmingham, UK. Six patients were Afro-Caribbean and 5 were of Asian origin.
Methods: Trabeculectomy was performed using fornix-based conjunctival flap, standard trabeculectomy punch, releasable scleral flap sutures and antimetabolite treatment. A relatively tight regime of topical steroids, bleb needling and subconjunctival injections was used post-operatively in order to reduce subtenon fibrosis and bleb failure. The follow-up time was 3 months.
Main outcome measure: The main outcome measure of success was defined by 2 criteria (A) final intraocular pressure (IOP) less than two-thirds the pre-operative IOP; or (B) final IOP ≤ 16 mmHg.
Outcomes: Of the 42 eyes, 50.5% had advanced glaucoma and 43% moderate glaucomatous changes. The mean number of pre-operative topical medications was 2.71 ± 0.93 and the mean cup: disc ratio was 0.81. The mean absolute fall in IOP at 3 months was 11.44 mmHg (51.2% - $P < 0.0001$). Success was 77.8% for criterion A, and 97.2% for criterion B. 65% underwent removal of releasable sutures ≤ 4 weeks, whilst 37.5% required up to 3 subconjunctival injections. Only 12.5% required bleb needling revision. Eight eyes had an IOP of ≤ 5 mmHg at > 2 weeks, of which 5 resolved after one visit. Three eyes developed a choroidal detachment. There were no cases of blebitis and all patients required no antiglaucomatous medication at 3 months.
Conclusions: Early outcomes of SST appear to show precise IOP control with minimal complications. Despite a significant proportion of advanced glaucoma within our high-risk population, a mean fall in IOP of over 50% was achieved at 3 months. Our results show that an early and aggressive post-operative regime should be implemented in high-risk patients in order to optimise IOP control and maintain bleb function.
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P443 TRABECULECTOMY IN PATIENTS WITH PRIMARY ANGLE-CLOSURE

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Purpose: To analyze the results of trabeculectomy in patients with primary angle closure.
Design: A retrospective and non-comparative case series.
Participants: Selected patients with primary angle closure in Taiwan from 2001 to 2004.
Methods: A retrospective case series was performed in Taiwan from 2001 to 2004 to evaluate the outcomes of trabeculectomy in eyes with acute primary angle-closure attack (APAC) and those with chronic primary angle-closure glaucoma (CPAC).
Main outcome measure: Final intraocular pressure (IOP), changes of visual acuity, and the incidence of complications.
Results: Fifty-two eyes of 52 patients were reviewed. The mean follow-up period was 32 months (26-42 months). In terms of no visual acuity change before and after surgery, there were significant differences between CPAC and APAC group ($P = 0.02$, Fisher's exact test). In terms of final IOP control, trabeculectomy outcome was significantly worse in patients in APAC group than those in CPAC group ($P < 0.01$, Fisher's exact test). Moreover, the complication of bleb encapsulation appeared more frequently in APAC group than in CPAC group ($P = 0.02$, Fisher's exact test).
Conclusions: Compared with chronic angle-closure glaucoma, trabeculectomy may not be the first choice for patients of acute angle closure because of worse visual acuity, more failure rate, more complications, and less surgical survival.
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P444 THREE YEARS FOLLOW-UP OF INTRAVITREAL TRIAMCINOLONE AS ADJUNCTIVE THERAPY IN TRABECULECTOMY FOR NEOVASCULAR GLAUCOMA

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Purpose: To report the peroperative use and clinical outcome of intravitreal triamcinolone acetonide (IVTA) as adjunctive therapy in eyes with refractory neovascular glaucoma (NVG) undergoing trabeculectomy with mitomycin-C.
Design: Interventional case series.
Participants and Method: Nineteen eyes of 18 consecutive patients with refractory NVG were recruited. All patients received IVTA 4 mg in 0.1 ml at the end of trabeculectomy with mitomycin-C performed by a single surgeon.
Main outcome measure: The main outcome measures were intraocular pressure (IOP), number of glaucoma medications used after surgery and regression of rubeosis.
Results: Eleven of the 19 eyes had successful outcome; intraocular pressure ≦ 18 mmHg with or without adjunctive medical therapy (mean IOP 10.1 ± 4.4 mmHg, mean follow up was 36 ± 3.3 months). Rubeosis regression was visible in all eyes.
Conclusion: This study suggests that peroperative IVTA used in the manner described may augment the success of trabeculectomy with mitomycin-C in patients with NVG.
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P445 COMBINED VISCOCANALOSTOMY-TRABECULECTOMY (VISCO-TRAB) FOR MANAGEMENT OF FAR-ADVANCED GLAUCOMA: A PROSPECTIVE COMPARATIVE STUDY

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Purpose: To compare efficacy and safety of combined viscocanalostomy-trabeculectomy to trabeculectomy alone for management of far-advanced glaucoma.
Design: A prospective comparative study.
Participants: Patients with bilateral far-advanced glaucoma (severe to near total loss of neuroretinal tissue and tubular field defect).
Intervention: All right eyes had combined viscocanalostomy-trabeculectomy (Visco-Trab) and all left eyes had trabeculectomy. The interval between the two surgeries did not exceed 6 months. Visco-Trab surgery constituted subconjunctival mitomycin, 4x4 mm lamellar scleral flap, deep scleral flap dissection until Schlemm's canal (SC) was unroofed, viscoelastic injection into SC, penetrating trabeculectomy anterior to SC, peripheral iridectomy, and flap closure by at least 4 sutures. Patients were followed after 1 & 3 days, 1 & 2 weeks, 1 month and every 3 months until last follow-up. A minimal of 6 months follow-up was required to be included in the analysis.
Main outcome measures: Control of IOP to 14 mmHg or less with no devastating complications or loss of more than 2 lines of best corrected visual acuity were the criteria of success in each group.
Results: The study included 20 patients aged 64.0 ± 14.7 years. Eleven eyes had POAG and 7 eyes had combined phacoemulsfication. None of the eyes had lost more than two lines of Snellen's acuity. Mean IOP was consistently lower, though non-statistically significant, in the Visco-Trab group than in the Trab group at all follow-up intervals. Mean follow-up was 14.9 and 13.7 months, respectively. Complete suc-

cess of IOP control < 14 mmHg at last follow-up was seen in 15 (75%) eyes in Visco-Trab group compared to 11 (55%) eyes in Trab group whereas failure was seen in 2 eyes in Visco-Trab group compared to 5 eyes in the Trab group. Immediate postoperative pressure elevation and hypotony-related complications were reported more commonly after trabeculectomy than after visco-trab surgery. Cumulative probability of failure in both groups was shown in the Kaplan-Meier analysis chart.

Conclusion: Combined viscocanalostomy-trabeculectomy is effective in reducing IOP to the target level for eyes with far-advanced glaucoma as compared to trabeculectomy with less eventful early postoperative course.

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P446 EFFECTS OF A MODIFIED, PURPOSELY TENTED TRABECULECTOMY OVER CONVENTIONAL TRABECULECTOMY IN GLAUCOMA PATIENTS

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Aim: To compare the effects of a modified, purposely tented trabeculectomy over conventional trabeculectomy without releasable sutures in lowering intraocular pressure (IOP) in primary glaucomas.

Materials and Methods: Fifty-three patients of age 55 to 77 were included in a retrospective non-randomized clinical study. Twenty-six of them underwent conventional trabeculectomy and 27 underwent modified tented trabeculectomy with a reverse frown incision. In the modified technique, suturing is done in such a way that a tenting is made purposefully. First the sides of the scleral flap were sutured where they are open and the posterior edges of the scleral flap are brought medially and sutured to the centre of the curved incision, so that a tent is formed. IOP and complications were compared in the 2 groups. IOP was measured on 2nd post-operative day, at one month and the final follow up was between 6 and 24 months.

Results: The preoperative IOP did not significantly differ between the 2 groups. (29.34 ± 10.90 and 25.62 ± 7.88 in the conventional and tented group respectively). Post-operatively on the 2nd day IOP was significantly lower in the tented group than in the conventional group ($p = 0.0001$). IOP more than 18 mmHg at final follow-up was found in 10 of the conventional group and 1 in the tented group ($p = 0.002$).

Conclusion: Making a tent purposely for aqueous drainage ensures that there is continuous flow of aqueous in one direction and consequently fibrosis is prevented due to the antifibrotic effect of the aqueous itself rather than by the use of antifibrotic agents. A larger area of drainage is obtained because of the reverse frown incision employed in the modified trabeculectomy. This study statistically proves that tented trabeculectomy is a more effective way to control IOP than a conventional trabeculectomy with out releasable suture.

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P447 SUTURELESS TRABECULECTOMY – LONG-TERM RESULTS

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Purpose: To evaluate long term results of trabeculectomy procedure, which is reasonably effective, without any suture (sutureless trabeculectomy) in cases of primary open-angle glaucoma.

Design: Ninety-one eyes of 63 patients between the age of 53-67 years having primary open-angle glaucoma, where IOP was very high on first presentation or could not be adequately controlled due to noncompliance for various reasons, were subjected to modification of standard trabeculectomy procedure.

Method: After making fornix-based conjunctival flap, partial thickness corneoscleral tunnel (5 mm x 3 mm) was made at 12 o'clock limbus. Then inner scleral window of about 1.5 mm x 1.5 mm was made in the floor of the corneoscleral

tunnel. One corneal stab incision was made at 10 o'clock limbus. Then PBI was done through inner scleral window. BSS was injected in AC through 10 o'clock corneal stab wound to make sure that some amount of fluid would escape through the main corneoscleral tunnel. Conjunctiva was adequately closed with diathermy. AC was formed partly by BSS and partly by air. Postoperative management included regular antibiotics, anti-inflammatories with maintaining AC depth and IOP.

Observations: AC was well formed in 64 (70.33%) eyes within 3 days, whereas it took 6-13 days to form in 18 (19.78%) eyes. But in 9 eyes (9.89%), IOP was found slightly elevated (avg. 23 mmHg) after 5-7 days, where digital massage was effective to form the bleb and to lower IOP. Bleb was slightly raised and well functioning in 69 (75.82%) eyes, whereas it was flat and partially functioning in remaining 22 (24.18%) eyes. In 6 eyes (6.59%) it became cystic over a period of time.

Results: Cases have been followed-up for 1.9 years to 4.1 years (mean 2.7 years). When patients were examined last, 59 eyes (64.84%) had IOP within normal limits without any medication. Thirteen eyes (14.29%) required one drug to control IOP. Eleven eyes (12.09%) required two drugs to control IOP. Eight eyes (8.79%) required surgical intervention after one year. Seven eyes (7.69%) had ciliochoroidal detachment and equal numbers of eyes had corneal edema. Cataract enhancement was noticed in 14 (15.38%) eyes. Vision could be stabilized at preoperative level in 67 (76.63%) eyes. In 10 (10.99%) eyes, vision dropped by one line, where no obvious reason could be found. While it was gradually deteriorating in 14 (15.38%) eyes due to cataractous changes.

Conclusion: This modification of trabeculectomy (sutureless) was effective modality to control IOP in 59 eyes (64.84%) with primary open angle glaucoma without any medication. In 24 eyes (26.37%) it required one or two drugs to control IOP, which otherwise remained uncontrolled before sutureless trabeculectomy. There were no complications related to sutures.

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P448 FACTORS ASSOCIATED WITH VISUAL OUTCOME FOLLOWING TRABECULECTOMY

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Purpose: To evaluate factors influencing the visual outcome in early postoperative period after standard trabeculectomy with mitomycin C (MMC).

Design: Prospective non-comparative study.

Participants: Thirty-three eyes from 31 glaucoma patients underwent standard trabeculectomy with MMC at the Department of Ophthalmology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand.

Methods: Standard trabeculetomy with intraoperative MMC was performed on all participants' eyes. Possible factors associated with visual outcome were recorded pre-operatively and within 2 months post-operatively. The data collection included demographic characteristic, visual acuity (VA) (LogMar), intraocular pressure (IOP) by Goldmann applanation tonometer, anterior chamber depth (ACD), autorefraction, vertical and horizontal keratometry (KV and KH), central corneal thickness (CCT) and axial length.

Main outcome measure: Pre-and post-operative data was compared. Correlation and regression analysis between post-operative VA and all factors was analysed.

Results: Twenty-one eyes with primary open angle glaucoma and 10 eyes with primary angle-closure glaucoma were enrolled (mean age 58 years). Twenty- five eyes with completed data were included in statistic analysis. Visual acuity was improved post-operatively compared to preoperative VA, but not significantly changed ($p = 0.27$). Post-operatively, IOP and axial length were significantly decreased ($p < 0.01$) whereas cylindrical refraction was significantly increased ($p = 0.02$). ACD, CCT and keratometry were not significantly changed after trabeculectomy. Post-operative VA was significantly correlated with pre-operative VA ($p < 0.01$), KH ($p = 0.04$) and post-operative KV ($p < 0.01$). After regression analysis, post-operative KV was the only predictive factor associated with post-operative VA.

Conclusion: Significant factors associated with visual outcome after standard trabeculectomy with MMC included preoperative VA, horizontal keratometry and post-operative vertical keratometry. Post-operative KV was the only predictive factor correlated for post-operative VA.

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P449 LONG-TERM EFFICACY AND SAFETY OF A MODIFIED CAIRNS TRABECULECTOMY

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Objectives and purpose: To evaluate the long-term efficacy and safety of a modified Cairns trabeculectomy as described by Peng Khaw.

Design: Retrospective analysis of 1009 eyes of 782 consecutive patients who underwent a modified Cairns trabeculectomy with a change in the method of application of Mitomycin C, for advanced glaucoma with a minimum follow-up of 12 months and a mean of 27.3.

Participants: One thousand-nine eyes of 782 patients over 18 years of age, with advanced glaucoma, defined as a vertical cup/disc (cd) ratio of 0.9 or more, with a mean deviation 12 decibels on Humphreys Visual field and an absolute defect (0 db) in the central 5 degrees (Hodapps Classification); or with visual acuity less than 3/60 where visual fields were not possible. And not controlled on medical treatment, were included in the study.
Interventions and Methods: Eyes were evaluated preoperatively for, corrected visual acuity, Humphrey visual fields (24-2 SITA), intraocular pressure (IOP). All eyes underwent a MMC-augmented, fornix-based, modified Cairns trabeculectomy, where the sclera flap was larger, larger area of application of Mitomycin C extending to the fornix posterior to the scleral flap. Tight sutures to flap with laser suturelysis performed where deemed necessary. Routine follow-up postoperatively on day 1, weekly for the first month, and monthly till 3 months and every 3 months. Postoperatively visual acuity, IOP, visual fields, and bleb morphology and post-operative complications were looked at.
Results: Success was defined if a target IOP of 14 or below was achieved, without medication - absolute, with 1 topical medication - qualitative success, and if not achieved with 1 medication was deemed a failure. Survival analysis was done with Kaplan Meier curves. Results were analyzed. At a mean follow-up of 27.3 months 63% of eyes were categorized as absolute success and 84% as cumulative success (absolute + qualified). Post-operative complications were similar ($p < .05$) to other comparable studies.
Conclusions: A simple modification of MMC augmented trabeculectomy is effective in achieving the low-target IOPs required for management of advanced glaucoma without increasing the risk of surgical complications.
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P450 TRABECULECTOMY WITH RELEASABLE SUTURES: OUTCOME OF 1 VS 2 RELEASABLE SUTURE TECHNIQUE

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Objective: To compare the efficacy and complication rate of 1 releasable suture *vs* 2 releasable sutures for scleral flap suturing in trabeculectomy.
Study Design: Prospective non-randomized study.
Participants: Patients undergoing trabeculectomy surgery in 2007 at a tertiary referral hospital in London.
Methods: Patients with the diagnosis of primary open-angle glaucoma, pseudoexfoliation glaucoma and pigmentary glaucoma uncontrolled with maximal medical therapy requiring filtering surgery were included. Twenty-five such patients underwent trabeculectomy surgery augmented with Mitomycin C in 2007. Eight (32%) had a 1 releasable suture technique and 17 (68%) had a 2 releasable suture technique. Visual acuity, intra ocular pressure (IOP) bleb manipulation (massage, removal of releasable suture and 5 fluorouracil injection) and complications were recorded at 1 day, 1 week, 1, 3, 6 and 12 months post-operatively.
Results: There was no statistically significant difference in age or sex between the 2 groups. The mean pre-op IOP was 25 ± 4.5 mmHg in group 1 and 23.9 ± 6.3 mmHg group 2. Twenty-one/25 patients (84%) had POAG, 2/25 (8%) PXF glaucoma & 2/25 (8%) had pigmentary glaucoma (see table on the poster). Four of the eight patients in group 1 and 1/17 in group 2 had a suture removed. There was no significant difference in IOP on day 1 and week 1 between the 2 groups. By 3 and 6 months, group 2 patients had statistically lower IOP than group 1, however, they also had more complications; 1 hyphaema, 2 overdraining blebs and 1 leaking bleb requiring resuturing. At 6 and 12 months there was no significant difference in IOP. The mean number of 5FU injections was 1.8 ± 2.7 group 1 and 0.42 ± 0.53 group 2. The mean number of bleb massages was 0.75 ± 2.73 and 0.57 ± 0.98.
Conclusion: This is the first reported comparison of 1 versus 2 releasable suture technique that we are aware of. We conclude that both 1 and 2 releasable suture technique offer good IOP control at 12 months. There were more complications in the 2 suture group however these resolved and all blebs in both groups were working well at 12 month with mean IOP 12.83 mmHg. Group 1 patients had more bleb manipulations (suture removal, 5FU injections and massage) than group 2 patients and although numbers were small there was no difference in VA acuity outcome between the 2 groups (data not included in abstract).
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P451 ALTERNATIVE VARIANT OF TRABECULECTOMY WITH USING ONLY ABSORBABLE SUTURE OF THE SCLERAL FLAP IN PSEUDOEXFOLIATION GLAUCOMA

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Purpose: To evaluate the early postoperative results after trabeculectomy (TE) by using only 1 absorbable suture 10-0 BioSorb of the scleral flap in patients with pseudoexfoliation glaucoma.
Participants: In 46 eyes (38 patients) with uncompensated pseudoexfoliation glaucoma, TE was done. The average preoperative IOP value was 27.18 ± 5.21 mmHg with anti-glaucoma medication.
Methods: A limbal-based conjunctival flap was formed. The triangular scleral flap was fixed by 1 suture 10-0 BioSorb on the top of the flap. The 10-0 BioSorb suture was made of 100% pure polyglycolic acid with the following specifications: monofilament; tensile strenght- 55% after 2 weeks, 35% after 3 weeks. The absorption of sutures occurs by means of hydrolysis. It begins as a loss of tensile strenght without appreciable loss of mass.
Results: The mean IOP of the eyes seven days after TE was 16.23 ± 2.71 mmHg. Shallow anterior chamber was studied in the post operative period in 15 eyes. Peripheral choroidal detachment was detected in 6 eyes. Missing anterior chamber was not observed in the post operative period, which is the main advantage in using 10-0 BioSorb sutures on the scleral flap. The mean IOP of the eyes one month after TE was 16.35 ± 2.16 mmHg. Very good post-operative results due to this surgical technique were achieved.
Conclusions: 1. The early postoperative results after the utilization of this new variative surgical methods of TE were very good. 2. Using only one 10-0 BioSorb absorbable suture of the scleral flap in TE of patients with pseudoexfoliation glaucoma was possible and successful variant of standard TE and it's modifications.
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12.8.2. Surgical treatment: Filtering surgery: With tube implant or other drainage devices

see also P112, P313, 460, P500, P548

P452 RESULTS OF THE GLAUCOMA VALVE AHMED IMPLANTATION IN THE UKRAINIAN EYE SURGERY CENTER

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Purpose: To analyze the efficiency of using drainage system Ahmed in treating patients with different kinds of refractory glaucoma.
Methods: Drainage system Ahmed has been implanted to 52 patients. The surgical procedures have been conducted to 34 patients with neovascular glaucoma, 8 patients with secondary operated glaucoma combined with complicated cataract, 10 patients with posttraumatic keratopathy. Pre-surgical IOP-level varied from 35,6 to 52,0 mercury column. Thirteen patients were operated with the implantation of the drainage system Ahmed combined with phacoemulsification and IOL implantation, 8 with through ceratoplasty, and 31 patients had glaucoma surgery.
Results: We have observed a hypotensive effect in all cases. In post-surgical period IOP-level did not exceed 12-13 mercury column. In 4 cases shallow anterior chamber and CCD have been observed for 2-3 days, consequently in 2 cases viscoelastics were additionally implanted, 2 patients were treated conservatively. In two weeks one of the operated patients had IOP increase. As soon as additional irrigation of the valve with BSS+ solution through special cannula was conducted, IOP-level normalized. Cataract developed in two cases, which has lead to additional surgery, i.e. phacoemulsification and IOL implantation. IOP-level during post-surgical period was normal.
Conclusion: glaucoma valve Ahmed implantation leads to steady hypotensive effect and can be used in treating refractory glaucomas, especially while conducting complex and reconstructive surgery.
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P453 PRELIMINARY RESULTS OF A NEW STAINLESS STEEL WIRE MICRO-DRAINAGE FILTRATION PROCEDURE IN THE TREATMENT OF ABSOLUTE GLAUCOMA

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Purpose: To evaluate outcomes of a new filtering procedure in the treatment of painful absolute glaucoma.
Design: Prospective pilot study and case series.
Setting: Department of Ophthalmology, Russian People's Friendship University, Moscow; Ophthalmic unit of Skhodnya City Hospital, Moscow region, Russia.

Participants: Twenty-three consecutive patients (15 male and 8 female) scheduled for enucleation or evisceration for painful absolute glaucoma between April 2008 and October 2008 were included in this study.
Methods: Complete examinations were performed before surgery; postoperatively daily during hospital stay, at 1, 2, 3 months, and then every 3 months. Immediate postoperative results were evaluated at the time of discharge, late results at an interval of 6 months. Surgical technique is described below. Criteria for success were relief from pain, normal outlook of the eye ball and decrease in preoperative intraocular pressure (IOP) by 30% or more with or without glaucoma medication. Surgical technique: A parallelogram-shaped micro-drainage was made from a piece of 40 micron vanadium stainless steel wire by winding it once on a 2.5 mm wide and 0.5 mm thick metallic spatula. A fornix based conjunctival flap was prepared superiorly. Approximately 1.0-.5 mm away from limbus and parallel to it, a band of sclera 1.0 x 0.5 mm and 90-95% of the full sclera thickness was dissected and excised. At the base of this groove parallel to ciliary body surface 1.0 mm wide parasynthesis was made into anterior chamber (AC) with a diamond knife. Micro-drainage was inserted into the AC and its other end was fixed to the posterior lip of scleral groove with a 10-0 nylon suture. Conjunctival flap was fixed to limbus with interrupted 10-0 sutures.
Main outcome measures: IOP change, complication rate, outlook of eye ball, additional glaucoma medication, need for surgical revision.
Results: After surgery, all the eyes were saved as an organ. Surgery was technically easy to perform. Surgical time varied from 5 to 7 minutes. In 2 cases there was hemorrhage from AC angle after drainage insertion, which dissolved spontaneously during hospital stay. Postoperatively IOP without medication was controlled in 20 patients (87%), with medication in all cases. The mean IOP decrease was 17.7 ± 2.5 mmHg (56% decrease, $P < 0.05$). In immediate postoperative period there were 2 cases with high IOP, which required evacuation of 1-2 drops of aqueous humour through parasynthesis and thereafter instillation of glaucoma medication. Shallow AC due to choroidal effusion was observed in 7 cases (30.4%). In 2 cases the effusion dissolved spontaneously and in 5 cases a sclerotstomy was required.
Conclusion: Proposed stainless steel wire micro-drainage filtration procedure is technically simple and safe to perform and can serve as an alternative to enucleation and evisceration in difficult situations.
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P454 INTERMEDIATE OUTCOMES OF AHMED GLAUCOMA VALVE SURGERY IN ASIAN PATIENTS WITH INTRACTABLE GLAUCOMA

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Objective: To evaluate the efficacy and safety of Ahmed Glaucoma Valve (AGV) implantation in Asian patients with refractory glaucoma.
Methods: The study was a retrospective interventional case series conducted in a single institution between January 2004 and January 2006. The study population included 91 patients (91 eyes).
Results: Seventy patients were successfully treated (74.5%). More diabetes mellitus (DM) patients were observed in the failed group ($P = 0.051$). Post-operatively, the median IOP declined significantly to 13 mmHg (interquartile range: 10-20 mmHg) on day 1 ($P < 0.001$) and 17 mmHg (interquartile range: 12-19 mmHg) at the last follow-up examination ($P < 0.001$). The cumulative probability of success by Kaplan-Meier life-table analysis was 74% at 12 months and 43% at 2 years. Elderly patients had an increased failure risk of approximately one-fold (1.03, 95% confidence interval [CI], 1.00-1.05, $P = 0.04$). Neovascular glaucoma patients had higher failure rates of nearly five-fold (4.92, 95% CI, 0.87-27.83, $P = 0.071$). The most common complication was hyphema at 12.77%. There were no serious complications involving loss of VA or sight.
Conclusions: AGV implantation is a safe, effective treatment for refractory glaucoma with no significant differences in outcome between Asian and non-Asian patients.
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P455 TRABECULECTOMY VERSUS THE EX-PRESS GLAUCOMA SHUNT UNDER A SCLERAL FLAP IN THE SAME PATIENT: A PROSPECTIVE RANDOMIZED STUDY

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Purpose: To compare standard trabeculectomy to the Ex-PRESS mini glaucoma shunt implantation under a scleral flap in eyes with primary open-angle glaucoma (POAG).
Patients and Methods: Adult subjects with bilateral POAG that needed surgery were randomized to undergo the two procedures in fellow eyes. Mitomycin C (MMC) was used in all the eyes and the surgical technique was comparable in both approaches. Safety and efficacy were evaluated for up to 30 months.
Results: Thirty eyes of 15 subjects were included in this study. The mean follow-up time (± SD) was 23.6 months (± 6.9) [range 12-30 months]. The mean pre-operative (± SD) IOP decreased from 31.1 (± 14.2) and 28.1 (± 9.0) mmHg to 16.5 (± 1.8) and 15.8 (± 2.0) mmHg at last follow-up in trabeculectomy and Ex-PRESS eyes respectively (P= 0.001, Wilcoxon Signed Ranks Test (WSRT)). Mean IOP and percent IOP reduction were similar in both groups at all time points. Visual acuity data remained unchanged from pre-operative values for both groups. The mean number of anti-glaucoma medications decreased from 3.7 pre-operatively in both groups to 0.8 and 0.3 at last follow up in the trabeculectomy and Ex-PRESS eyes respectively (P = 0.001, WSRT). Postoperative complications rate was higher in the trabeculectomy eyes (12.7%) versus the Ex-PRESS eyes (4.5%). In the trabeculectomy group, five eyes (30%) required post-operative interventions and none were needed in the Ex-PRESS eyes.
Conclusions: Both procedures provide similar IOP control but Ex-PRESS eyes have a lower rate of complications and need less postoperative interventions and anti-glaucoma medications than trabeculectomy eyes.
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P456 COMPARISON OF THE SURGICAL RESULTS ACCORDING TO DRAINAGE TUBE MANAGEMENT OF AHMED GLAUCOMA VALVE

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Purpose: To compare the surgical results and complications for the two methods used to manage the drainage tube when an Ahmed Glaucoma Valve is implanted.
Design: Retrospective comparative clinical study.
Participants: We retrospectively reviewed the medical records of 28 eyes from 26 patients who were diagnosed with neovascular glaucoma and underwent Ahmed Glaucoma Valve implantation between January 2001 and December 2007.
Methods: The studied eyes were divided into two groups according to management of the Ahmed Glaucoma Valve. In the GRAFT group (n = 18), the drainage tube was inserted into the anterior chamber and then covered with preserved donor sclera. In the FLAP group (n = 10), the drainage tube was inserted under the half-thickness scleral flap and then covered with the flap again.
Main outcome measure: We compared the postoperative intraocular pressures, surgical success rates, and frequencies of postoperative complications between the two groups.
Results: The GRAFT group has had lower intraocular pressure compared to the FLAP group during the long-term post-operative period. The mean success period was 48.9 ± 9.7 months in the GRAFT group versus 38.9 ± 8.8 months in the FLAP group. The cumulative success rates were 57.4% versus 50.0% at 2 years, and 57.4% versus 30.0% at 3 years, respectively (P = 0.780). Tube migration and tube erosion occurred more frequently in the FLAP group (P = 0.037 and 0.116, respectively).
Conclusions: In the management of the drainage tube of an Ahmed Glaucoma Valve, a scleral graft may provide superior surgical results compared to a scleral flap.
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P457 PRELIMINARY RESULTS OF MOLTENO3 IMPLANT DESIGNED TO FACILITATE COLLAGEN BREAKDOWN BY APOPTOTIC CELLS IN BLEB CAPSULES

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Objective: To compare the structure and permeability of capsules formed around Molteno3 implants (area 175 mm^2) with those around double-plate Molteno implants (274 mm^2)

in cases of non-neovascular glaucoma and to compare the clinical outcomes between the two groups.
Design: Prospective clinical trial with historical comparison group, and histological and immunohistochemical analysis of specimens derived from both groups.
Particpants: Eighty-seven eyes of 74 patients which received the Molteno3 and 115 eyes of 100 patients which received a double-plate Molteno implant.
Intervention: Insertion of a single plate Molteno3 or a double-plate Molteno implant
Main outcome measure: Intraocular pressure, hypotensive medication use, histological structure of bleb capsules.
Results: The intraocular pressures did not differ significantly between the two groups despite the difference in plate area. The capsule in the main drainage area of the Molteno3 bleb showed more widespread and intense apoptosis in its deeper layers than that in the small primary drainage area.
Conclusions: These studies support the previous clinicopathological studies of the process of bleb capsule formation around Molteno implants which suggested the hypothesis that the process of bleb capsule formation consists of the initial fibroproliferative response which builds up a barrier to the flow of aqueous and raises the intraocular pressure sufficiently to collapse the capillaries in deeper layers and start hypoxic apoptotic fibrodegenerative response which inhibits the fibroproliferative response so that the two responses settle into a lifelong equilibrium maintained by mesodermal cells which continuously migrate from the surface of the capsule to the more hypoxic regions towards the bleb cavity where the undergo apoptosis with release of enzymes and death messengers which inhibit the vascular fibroproliferative response and breakdown collagen fibrils of the bleb capsule.
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P458 RESIDENT-PERFORMED EX-PRESS SHUNT VERSUS TRABECULECTOMY: A SINGLE-ATTENDING CONSECUTIVE SERIES
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Purpose: Trabeculectomy is the most commonly performed surgical treatment of most types of glaucoma, but even in very experienced hands commonly results in over and underfiltration. This is particularly problematic, because many glaucoma filtering surgeries in the US are performed by ophthalmologists who perform only a few surgeries per year and who lack glaucoma sub-specialty training. The Ex-PRESS shunt (Optonol Ltd., Neve Ilan, Israel), due to its relative ease of implantation and fixed-diameter tube size, may provide a safer and more reliable filtering procedure than trabeculectomy, especially for those performing glaucoma filtering surgery less frequently. The Ex-PRESS shunt is implanted under a scleral flap, making it similar to traditional trabeculectomy but avoiding the need for scleral punch or iridectomy. A previous study found trabeculectomy and the Ex-PRESS shunt to perform similarly in terms of intraocular pressure (IOP) control, but with reduced rates of early postoperative hypotony and choroidal effusion with the Ex-PRESS shunt. However, all surgeries in this series were performed by a fellowship-trained glaucoma specialist with considerable experience with both procedures.
Design: Retrospective, consecutive, comparative series.
Participants: Fifty-nine patients receiving trabeculectomy (performed by 22 residents) and 40 patients receiving Ex-PRESS shunts (performed by 13 residents) for identical indications.
Methods: Patients with glaucoma filtering surgery performed by a third-year ophthalmology resident under the supervision of a single surgeon (R.L.S.) from 7/1/2000 through 3/31/2008 were reviewed. Only trabeculectomy was performed before 8/1/2005 and only Ex-PRESS shunt placement afterwards in this population. Therefore two similar, consecutive groups of patients were compared. Eyes with less than 6 months of follow-up or patients lost to follow-up for more than 2 years were excluded. If a patient had two eyes that met inclusion criteria, only the right eye was used for analysis.
Main outcome measures: Postoperative IOP, dependence on anti-glaucoma medications and rate of complications.
Results: IOP was not significantly different between groups at pre-op or at all time points post-op (1 day, 1 week, 1, 3 and 6 months, 1 year and annually thereafter) (all, $P = 0.063$). The Ex-PRESS group required less medication to control IOP at 3 months post-operatively ($P = 0.007$), but at all other follow-up points the two groups did not differ (all, $P = 0.41$) The incidences of early post-operative hypotony, choroidal effusion, anterior chamber reformation and re-operation were similar between groups in the first 6 post-op months (all, $P = 0.62$) (no patient experienced blebitis or endophthalmitis).
Conclusions: In our population, trabeculectomy and the Ex-PRESS shunt performed similarly in terms of post-operative IOP, need for anti-glaucoma medications and complications.
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P459 TRABECULECTOMY WITH BIODEGRADABLE 3D-POROUS COLLAGEN-GLYCOSAMINOGLYCAN SCAFFOLD FOR TREAMENT OF REFRACTORY GLAUCOMA

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Purpose: To evaluate the safety and efficacy of trabeculectomy with implantation of a biodegradable 3D-porous collagen-GAG scaffold in refractory glaucoma patients.
Design: Prospective non-control study.
Participants: Nine refractory-glaucoma patients.
Methods: The collagen-GAG scaffold was implanted on the top of the scleral flap before closing the conjunctival wound during trabeculectomy.
Main outcome measure: Intraocular pressure (IOP) and number of antiglaucoma medications pre- and post-operatively. Operation complications are also recorded.
Results: The mean preoperative IOP was 42.5 ± 12.5 mmHg with 2.3 ± 0.5 anti-glaucoma medications. Postoperatively, the mean IOP at last follow up (12 months) for all eyes was 15.93 mmHg (62.6% reduction, $p < 0.01$) with 0.6 ± 0.5 anti-glaucoma medications. Post-operative complications including transient shallow anterior chamber, hyphema, choroidal detachment and hypotony, no endophthalmitis occurred in any patients.
Conclusions: The preliminary results of this study indicate that the new device implantation in trabeculectomy represents a new, safe, simple and effective therapeutic approach for treating refractory glaucoma. A larger-scale study with a longer follow-up period is required to confirm these observation.
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P460 AHMED VALVE IMPLANTATION FOR REFRACTORY GLAUCOMA FOLLOWING PARS PLANA VITRECTOMY: AN INTERVENTIONAL NON COMPARATIVE RETROSPECTIVE STUDY

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Purpose: To report de outcomes of medical and surgical management of Ahmed valve implantation following pars-plana vitrectomy.
Design: Retrospective noncomparative case series.
Participants: Twenty-seven eyes of 27 patients suffering from secondary glaucoma following pars plana vitrectomy underwent Ahmed valve implantation between September 2004 and July 2008. All the eyes were in critical condition, and intraocular pressure could not be controlled with antiglaucoma medications.
Main outcome measures: Intraocular pressure (IOP), number of glaucoma medications and complications.
Results: The total success rate was 81% at the final visit, with a mean SD follow up of 18 ± 12 months. The reduction in intraocular pressure and the number of medications used postoperatively were both statistically and clinically significant ($p < 0.05$). In the surgical group, intraocular pressure was reduced from a mean SD of 28,6 ± 9,6 mmHg before surgery to 12,8 ± 5 mmHg at the last follow-up after surgery. The number of antiglaucoma medications was reduced from 3,0 ± 0,6 before surgery to 1,1 ± 0,9 at the most recent follow-up after surgery. Postoperative complications included: hypertensive phase (11 cases), cystic bleb (5 cases), hyphema (2 cases), hypotony (2 cases), tube exposure (1 case), choroidal detachment (1 case) and restrictive strabismus (1 case).
Conclusions: Ahmed glaucoma valve implantation in patients with refractory glaucoma following pars-plana vitrectomy effectively decreases intraocular pressure and has a low incidence of serious postoperative complications. Thus, this procedure can be considered as primary treatment for refractory glaucoma following vitrectomy.
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P461 DEEP SCLERECTOMY WITH THE EX-PRESS X-200 IMPLANT FOR THE SURGICAL TREATMENT OF GLAUCOMA

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Purpose: To evaluate the efficacy and safety of a newly designed Ex-PRESS X-200 drainage device for the surgical treatment of glaucoma.
Design: Clinical, prospective, monocentric, non-randomised, unmasked study.
Participants: Twenty-six patients with medically uncontrolled primary open-angle glaucoma.
Methods: A superficial scleral flap was created. A posterior

deep sclerectomy (DS) was dissected without opening the Schlemm's canal. An Ex-PRESS X-200 device was inserted under the scleral flap into the anterior chamber to drain aqueous into the intrascleral space. Biomicroscopy, best corrected visual acuity (BCVA), applanation intraocular pressure (IOP) measurements, and fundus examination were performed before surgery, 1 day, 1 week, 1, 2, 3, 6, 12 and 18 months after surgery.
Main outcome measure: IOP, BCVA, number of medication, complication rates.
Results: For the 26 eyes the mean follow-up was 18.6 ± 2.4 months (mean ± SD). Preoperatively, the mean BCVA was 0.6 ± 0.3, the mean IOP was 22.0 ± 5.1 mmHg, and the mean number of medications per patients was 2.8 ± 0.8. Eighteen months after surgery the mean BCVA was 0.5 ± 0.4, the mean IOP was reduced to 12.0 ± 3.9 mmHg, and the mean number of medications per patient was 0.6 ± 1.2. Eighty-five percent of the patients achieved an IOP below 18 mmHg with or without medication and 69% without medication. Postoperative complications were hyphaema (15%), Seidel (15%), encysted blebs (54%) and bleb fibrosis in 8% of patients. Mitomycin C (MMC) was administered to 15 patients (58%) among which needling was performed to 10 patients (38%).
Conclusions: Mid-term results of DS with the Ex-PRESS X-200 implant demonstrated its efficacy in controlling IOP with few postoperative complications.
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P462 COMPARISON OF SUPRACHOROIDAL SHUNT OPERATION WITH MOLTENO TUBE IMPLANTATION IN SIGNIFICANT REFRACTORY GLAUCOMA IN TEN YEARS EXPERIENCE

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Objective: To compare the efficacy and safety of suprachoroidal shunt operation, which aqueous humor is diverted from the anterior chamber to the suprachoroidal space, versus Molteno tube implantation in the management of refractory glaucoma.
Design: Retrospective, comparative.
Participants and Controls: Twelve eyes of 12 refractory glaucoma cases that underwent suprachoroidal shunt operation (Group A) and 16 eyes of 16 refractory glaucoma cases that underwent Molteno Tube implantation (Group B) were evaluated. Demographic characteristics and distribution of the glaucoma types did not differ significantly between two groups (P > 0.05) Mean preoperative (preop) intraocular pressure (IOP) of the Group A patients with mean 2.91 medications, was 30.8 ± 8.2 mmHg compared with the Group B patients value of 49.1 ± 8.1 mmHg, received 1.6 medications.
Methods: In suprachoroidal shunt procedure, after preparation of a limbus based flap, the suprachoroidal space was accessed and the silicone tube was inserted as an connection from the anterior chamber to the suprachoroidal space. The surgical procedure of Molteno tube implantation was a standard one as described
Main outcome measure: Postoperative outcome included IOP control, number of glaucoma medications, visual acuity, and complications.
Results: After a mean follow-up time of 34.3 ± 9.7 weeks, the mean postoperative (postop) IOP was 14.2 ± 4.5 mmHg in Group A; postop IOP was 22.4 ± 5.5 mmHg after the mean follow-up time of 44.1 ± 6.7 weeks in Group B. On the final postoperative visit 1 patient in the group A compared with 7 in the group B were needed IOP-lowering medications. There were no significant intraoperative complications in both groups. Precence of postop.. complications – *i.e.*, hyphaema, early hypotony, choroidal detachment was in similiar frequency in both groups. Anterior chamber inflammation was more frequent in Group B (n = 16) compared to the Group A (n = 2). None of the eyes developed suprachoroidal hemorrhage, shallow or flat anterior chamber, retinal detachment, occlusion of tube or phthisis bulbi in Group A.
Conclusions: In refractory glaucoma, the suprachoroidal shunt presented here drains of aqueous humor from the anterior chamber to the suprachoroidal space, achieves good follow-up results in terms of IOP control. This procedure offers advantages of low complications and higher success rates over tube shunts. Further studies with larger sample size will be needed to elucidate the long term results.
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P463 USE OF THE VALVULATED GLAUCOMA DRAINAGE IMPLANT IN THE TREATMENT OF DIABETIC NEOVASCULAR GLAUCOMA

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Purpose: Usually diabetic neovascular glaucoma (DNVG) is considered to have a very poor visual prognosis. Many times, this is due to concomitant retinal pathology as macular edema or ischemia. Trabeculectomy has a high long term failure rate. Unfortunatly these patients usually have advanced dia-

betic eye disease in both eyes, so rescue treatment is indicated.
Objective: To describe a population of patients with DNVG treated with a valvulated glaucoma drainage implant.
Design: Retrospective review of medical charts.
Participants and Intervention: Twenty patients (22 eyes). All patients recieved full medical treatment before the valve implantation. Panretinal Photocoagulation and/or Bevacizumab was used in all patients according to media opacity before or after surgery. We conducted a demographical characterization of patients, an analysis of their diagnosis, medications, IOP and visual results. Early and late complications were recorded.
Main outcome measure: We defined absolute success as IOP lowering below 21 mmHg without the uso of topical drugs, whereas relative success was defined as IOP under 21 mmHg with the use of adjuntive drugs.
Results: The mean time of follow-up was 24 months. Visual acuity at presentation corresponded to 2.2 ± 0.9 logMAR (approximately counting fingers) which rose to 1.6 ± 1.0 logMAR after the IOP was controlled. This represents a mean 6 line gain in vision. Not all eyes gained vision, 9 eyes mantained their initial visual accuity, 9 eyes gained lines of vision and in the 4 remaining eyes, vision was worse at followup than at firt presentation. The IOP fell from 40.8 ± 12.1 mmHg at first presentation to 14.0 ± 7.1 mmHg at the last visit. The drugs patients were using before surgery fell from 2.7 ± 1.0 to 1.1 ± 0.9. Half of patients were on oral acetazolamide before surgery and none after the intervention. Absolute success was obtained in 31.5% of patients, relative success in 52.6% of patients and failure in 15.9%. The most frecuent complication was a hypertensive phase, which occurred in 40.9% of eyes.
Conclusions: The use of a valvulated glaucoma drainage implant in patients with DNVG was associated with a low number of complications, significant reduction of IOP and an increase in visual accuity. Not only did most patients maintain their presenting visual acuity, but in a subgroup of these it actually increased. Unfortunatly treatment to achieve this results must me aggresive, is expensive and it must be given early on in the course of the disease.
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P464 UVEITIC GLAUCOMA AND VALVULATED DRAINAGE DEVICE IMPLANTATION: AN INTERVENTIONAL NON-COMPARATIVE RETROSPECTIVE STUDY
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Purpose: To present outcomes of valvulated drainage device (VDD) implantation in patients with uveitic glaucoma.
Design: Interventional non comparative retrospective study.
Participants: Retrospective clinical chart review of 20 eyes from 15 patients with refractary uveitic glaucoma who had VDD implantation.
Main outcome measures: Intraocular pressure control, number of medications needed, visual acuity, complications and need of reintervention. According to these, composed outcomes called complete and qualified success were defined.
Results: Mean postoperative follow-up time was 18 (± 11). Eight patients (53%) were women. Mean age at time of surgery was 30 years (range: 2-74 years). Success rate was 95% at 12 months. Preoperative IOP was 31.9 ± 10 mmHg and last control mean IOP was 14.4 ± 5 mmHg, which represents a 55% of IOP decrease. Preoperative drugs (4.1 ± 1) decreased at last visit in 75% (1 ± 0.8). The most common early postoperative complication was hypotony (2 eyes). One eye presented ciliary blockade. At late postoperative period 5 eyes had hypertensive phase.
Conclusions: In patients with uveitic glaucoma, VDD implantation is a safe procedure, with high success rates at medium term follow up. Hypertensive phase was a frequent complication, but in all patients was treated successfully.
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P465 TRIAMCINOLONE ASSISTED VITRECTOMY WITH PARS PLANA AHMED GLAUCOMA VALVE IMPLANTION AND IN THE MANAGEMENT OF REFRACTORY GLAUCOMAS: A PILOT STUDY
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Purpose: To evaluate the efficacy of pars plana Ahmed Glaucoma Valve (AGV) implantation after triamcinolone assisted vitrectomy in eyes with refractory glaucoma.
Design: Prospective, interventional case series.
Participants: Eleven eyes of 11 glaucoma patients with IOP not controlled on maximal medical therapy (3 eyes with aniridia, 1 with primary congenital glaucoma with twice operated trabeculectomy, 1 with aphakic glaucoma and 6 eyes having post penetrating keratoplasty (PKP) glaucoma.
Methods: All eyes underwent pars plana AGV implantation in the superotemporal quadrant and triamcinolone acetonide (preservative free 4 mg/0.1 ml) assisted vitrectomy.
Main Outcome Measures: Clinical outcome assessment included intraocular pressure (IOP), tube assessment with ultrasound biomicroscopy (UBM)/anterior segment OCT (ASOCT), graft clarity, and any associated complications.
Results: Mean age of the patients was 36.6 ± 20.1 years, and the mean follow-up was 14.4 ± 6.4 months (range, 3-27 months). The mean preoperative IOP on an average of 3.1 ± 0.5 drugs was 33.6 ± 5.9 mmHg. The mean post operative IOP on an average of 0.5 ± 0.2 drugs was 17.5 ± 1.8 mmHg. All eyes maintained a patent tube as visualized on UBM/ ASOCT. A clear graft was maintained in 5 out of the 6 PKP patients, 1 patient developed graft infection at 6 months post AGV implantation.
Conclusions: Pars plana AGV with triamcinolone assisted vitrectomy can be used for control of IOP in aphakic eyes with refractory glaucoma. Triamcinolone stains the vitreous and ensures its complete removal around the tube, aids in determining the intraoperative tube patency and decreases post operative inflammation associated with the procedure.
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P466 TIE OR NO TIE: IMPACT OF PARTIAL LIGATION OF THE SILICONE TUBE AS A SIMPLE TECHNIQUE TO AVOID EARLY POSTOPERATIVE HYPOTONY WITH AHMED VALVE GLAUCOMA SURGERY
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Objective: Early postoperative hypotony continues to be a clinical problem with Ahmed glaucoma valve. The majority of reported rates range from 10.8% to 13%, but figures of up to 34% have also been described. Partial or temporary full ligation of the tube has been described in recent years in an attempt to reduce the problem but has not yet been established as the standard technique. Our aim was to evaluate partial ligation of Ahmed glaucoma valve as a means of reducing significant post operative hypotony.
Design: Non-comparative retrospective case series.
Participants: Ten eyes of 9 consecutive patients aged 60-78 who underwent placement of Ahmed glaucoma valve between May 2007 and November 2008 at St Bartholomew's Hospital, London.
Methods: A retrospective review of Ahmed glaucoma valve cases with a follow up of > 3 months was performed (median: 7 months, range: 3-21 months). A partial tie was achieved by tying 8-0 Vicryl over a segment of 6-0 Prolene placed alongside the tube, which was then removed. Other tubes were either fully tied or untied.
Main outcome measure: The occurrence of early hypotony (persistent IOP < 6 mmHg within the first 4 post-operative weeks), re-intervention, IOP at the time of last visit, use of glaucoma drops, and visual acuity.
Results: Seven tubes were partially tied, 1 fully tied, and 2 tubes were not tied. One of the 2 untied tube cases had early hypotony (IOP = 3 mmHg) and required re-intervention (tying off the tube). None of the 8 tied tube cases had early hypotony. Mean first day IOP in the partially tied cases was 17 mmHg (range 7-30 mmHg) and none of them had choroidal folds. At last follow up of those tied off (7 partial, 1 full tie) the mean IOP was 16.75 mmHg (range 10-20 mmHg). Two cases were fully successful (IOP < 21 mmHg and > 6 mmHg, off glaucoma drops, no re-intervention, and no loss of LP) and 6 were partially successful (as above, but on drops). Out of the 2 untied tubes, 1 was a complete success and 1 was deemed as a failure as it required a re-intervention.
Conclusions: In our series, although the sample is small, none of the partially ligated valves had early hypotony or required re-intervention. In addition, IOPs were typically very satisfactory. Partial ligation is a simple technique that may improve the safety of Ahmed Valve glaucoma surgery by preventing severe hypotony of untied tubes, and the high IOP spikes associated with full temporary ligation.
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P467 SHUNTING SURGERY AUGMENTED BY AMNIOTIC MEMBRANE FOR REFRACTORY GLAUCOMA
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Purpose: To evaluate the safety and efficacy of preserved amniotic membrane in the glaucoma shunt surgery for treatment refractory glaucoma.

Design: Interventional case series.
Participants: This study included 7 eyes of 7 patients (5 female, 2 male) with refractory glaucoma such as neovascular, pseudophakic, and prior failed trabeculectomy. Mean age was 32.9 ± 5.4 years.
Methods: Standard shunting procedure was performed through a fornix-based incision. After covering the tube with sclera patch graft, shunt plate was covered with a bulk of cryopreserved human amniotic membranes. The conjunctiva was closed using 10-0 nylon sutures.
Main outcome measure: Preoperative intraocular pressure (IOP), postoperative IOP, topical medications before and after surgery, and complications were reported and analysed.
Results: Mean follow-up was 14.6 ± 3.4 month (range 9-24 months). Mean preoperative IOP was 32 mmHg, that was reduced to 19.6 mmHg at final follow up. There was significant decrease in topical medication after surgery (mean decrease 1.4). there was no encapsulation after surgery. Only one case developed posterior migration of tube which resulted in shunt failure.
Conclusions: Shunting surgery augmented by amniotic membrane is a safe and efficacious procedure that might reduce bleb encapsulation. This procedure should be evaluated as an option in refractory glaucoma.
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P468 AHMED GLAUCOMA VALVE WITH SCLERA PATCH GRAFT VERSUS PARTIAL THICKNESS SCLERAL FLAP

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Purpose: To compare safety and efficacy of two different techniques of Ahmed glaucoma valve (AGV) implants in order to prevent scleral erosion throughout the overlying conjunctiva.
Design: Prospective comparative pilot study.
Participants: Thirty-two eyes of 32 consecutive patients not responsive to medical and not-implant surgical glaucoma treatment underwent to AGV-implant surgery.
Methods: The eyes were randomly assigned to two different groups. Group 1 (16 eyes) underwent to AVG implant with sutureless human sclera donor patch graft technique. The anterior part of the tube was covered with human donor scleral graft and was kept in place with fibrin glue (Tissue Coll®) under the conjunctiva. Group 2 (16 eyes) underwent AGV implant with scleral flap technique. A 6 x 4 mm partial-thickness scleral flap was dissected to cover the extraocular portion of the tube, while a partial-thickness scleral bride of 1.5 mm was created to keep the tube in place under the sclera. Examinations were scheduled at baseline and then at 1 week, 1-,3-,6- and 12-months after surgery.
Main outcome measure: Conjunctival erosion over the AGV tube, mean IOP changes.
Results: At the 12th month of follow-up the BCVA did not significantly improve from baseline in both Groups (Group 1: 0.78 ± 1.2 logMAR, Group 2: 0.70 ± 0.9 logMAR). The mean IOP significantly decreased from preoperative values of 26.9 (SD 8.4) mmHg in Group 1 and 25.8 (SD 10.4) mmHg in Group 2 and the difference between the two groups was not significant. AVG implants were found in place at each check of the follow up period in each patient. Neither conjunctival erosion over the AGV tube nor sign of endophthalmitis were recorded over the follow up period in both groups.
Conclusion: AVG implant surgery with sutureless human sclera donor patch graft as well the partial thickness of scleral flap represent effective surgical and relatively safe procedures for complicated glaucomas. Both techniques can avoid conjunctival erosions over the AGV tube.
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P469 EFFECTIVENESS OF THE SOLX GOLD MICRO SHUNT IN PATIENTS WITH FAILED PRIOR TRABECULECTOMY

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Purpose: To determine the intraocular pressure (IOP) lowering effect and complication profile of the SOLX Gold Micro Shunt in glaucomatous eyes that had failed prior trabeculectomy.
Design: This is a retrospective chart review.
Participants: This is an investigation of 21 eyes (from 20 patients) with open-angle glaucoma that had failed prior trabeculectomy and were on maximally tolerated medical therapy with uncontrolled IOP that had the SOLX Gold Micro Shunt implanted.
Methods: Data was collected pre-operatively, at 1 day, 7 days, 14 days, 1 month, 3 months, 6 months and 1 year following implantation of the device. The primary outcome of the study was IOP control at 6 months and 1 year. In order to investigate the safety profile of the SOLX Gold Micro Shunt, complication rates (of dislocations, repositioning, hemorrhage, hyphema, bleb formation, IOP spikes, hypotony,

pain, inflammation and others) were examined as secondary outcomes.
Main outcome measure: The main outcome was IOP control at 6 months and 1 year.
Results: There was a significant difference between pre and post-operative IOP (F = 3.707, p = 0.006). Mean IOP at baseline was 28.24 mmHg. By 3 months, a 39% decrease in mean IOP was seen (mean = 17.26 mmHg) and at 6 months, there was a 50% decrease (mean = 14.00 mmHg). At 1 year, there was a 46% decrease from baseline IOP (mean = 15.25 mmHg). Postoperative IOP elevations were observed in 15 eyes. All were stabilized using medication except 2 patients who required further surgery. By 1 year, there were no dislocations or incidences of shunt repositioning. Complications were found in a low proportion of patients and were minimal.
Conclusion: The SOLX Gold Micro Shunt was able to provide significiant IOP lowering with no major complications in this high-risk subset of patients with uncontrolled glaucoma having already failed a previous trabeculectomy. The majority of patients required postoperative medications to achieve adequate IOP control.
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P471 ANTERIOR REMEDIAL SHUNT FROM FAILED POSTERIOR GLAUCOMA DRAINAGE DEVICE USING A MINIATURE GLAUCOMA IMPLANT
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Objective: To report the efficacy and safety of an anterior remedial shunt procedure for the previously implanted nonfunctioning glaucoma drainage device (GDD) using a miniaturized membrane tube (mMT) glaucoma implant.
Design: Retrospective, interventional case series.
Participants: Seven eyes from 7 patients with medically intractable elevation of intraocular pressure (IOP), which previously underwent multiple glaucoma surgeries including GDD implantation.
Methods: Aqueous shunt procedure using an mMT was performed on each subject eye between September 2007 and February 2008. An mMT consists of a 6-mm polytetrafluoroethylene tube with an internal caliber of approximately 70 µm, which is fixed between two layers of 3 x 3 mm expanded polytetrafluoroethylene membrane with silicone adhesive. After exposing the tube of previously implanted GDD, the tube of mMT was inserted into the lumen of the tube of GDD through a slit incision toward the anterior chamber. The mMT was sutured onto the scleral bed, and was covered with a patch of preserved human sclera, which was then loosely sutured onto the scleral bed. Conjunctival incision was closed with a 9-0 Vicryl suture. An 8-0 or 9-0 Nylon suture was used as an intraluminal stent of mMT and removed at 1 to 3 weeks postoperatively. Mitomycin C (0.4 mg/ml) was applied to the intraoperatively exposed tissues for 3 to 4 minutes or was injected into the Tenon's capsule (0.1 to 0.2 mL).
Main outcome measures: Mean IOP and number of antiglaucoma medications preoperatively and at 3, 6, and 12 months postoperatively.
Results: Mean age was 44.0 ± 16.5 years, and mean number of previous ocular surgeries was 3.7. Mean IOP significantly decreased from 33.9 ± 12.9 mmHg preoperatively to 16.0 ± 3.5, 15.0 ± 4.1, and 16.3 ± 4.6 mmHg at 3, 6, and 12 months postoperatively (P = 0.012, 0.015 and 0.011, respectively). Mean number of antiglaucoma medications also significantly decreased from 3.6 preoperatively to 0.1, 1.1, and 1.6 at 3, 6, and 12 months postoperatively (P = 0.015, 0.017, and 0.017, respectively). All 7 eyes had an IOP less than 22 mmHg at 12 months postoperatively, with 5 eyes using antiglaucoma medications and 2 eyes having undergone bleb revision at 6 and 9 postoperative month, respectively. Early postoperative hypotony occurred in 2 eyes without shallow anterior chamber, and improved within 2 weeks after additional conjunctival suture. There was no devastating complication, such as suprachoroidal hemorrhage or endophthalmitis.
Conclusions: Anterior remedial shunt procedure using an mMT was effective and safe in treating refractory glaucoma with multiple previous glaucoma surgeries including implantation of GDD. It may be a viable option especially for the eyes with few surgical alternatives for further lowering IOP.
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P472 OUTCOMES OF INFEROTEMPORAL AHMED GLAUCOMA SHUNT IMPLANT IN REFRACTORY GLAUCOMA
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Purpose: To evaluate the surgical outcomes of Ahmed shunt implants in treatment of refractory glaucoma.
Design: Prospective, non-randomized case series.
Participants: Thirteen eyes from 12 patients with refractory glaucoma, who underwent inferotemporal placement of Ahmed glaucoma shunt implant.
Methods: Cases of refractory glaucoma with at least one previous glaucoma surgery that planned for Ahmed glaucoma

shunt procedure and the best shunt location was inferotemporal according to conjunctiva, cornea, angle and others.
Main outcomes: Included intraocular pressure , number of antiglaucoma medications, visual acuity and complications.
Results: The mean follow up of patients was 19.6 ± 17.6 months. Mean of visual acuity was changed but was not statistically. Intraocular pressure was reduced from a mean of 36.3 ± 9.8 mmHg preoperatively to 16.9 ± 4.2 at last follow-up. The mean number of antiglaucoma medications was 3.2± 0.4 preoperatively and 2.4 ± 0.8 at the last follow-up .The complications were hyphema in one patient (7.7%) , cosmetic problem due to large bleb in one patient (7.7%) and corneal decompensation in another one patient (7.7%).
Conclusions: Inferotemporal Ahmed glaucoma implant may be effective and safe surgical option in special situations.
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P474 THE EFFECT OF SYSTEMIC IMMUNOSUPPRESSION ON THE HYPERTENSIVE PHASE IN UVEITIC GLAUCOMA PATIENTS UNDERGOING AHMED GLAUCOMA VALVE IMPLANTATION

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Purpose: To evaluate the effect of systemic immunosuppressive therapy on the development of a postoperative hypertensive phase in uveitic glaucoma patients undergoing Ahmed Glaucoma Valve implantation.
Design: Retrospective cohort study.
Methods: We performed a retrospective chart review of 70 eyes of 59 patients with glaucoma secondary to chronic uveitis who underwent Ahmed valve implantation at 2 tertiary referral centers from 2002 to 2009. Thirty-two eyes had been on systemic immunosuppressive therapy (IT group); 38 eyes had received no systemic therapy (NT group). The occurrence of a postoperative hypertensive phase (IOP ≥ 21 mmHg at any postoperative visit from month 1 to month 6 was compared between the IT and NT groups. Also compared were the development of postoperative hypotony (IOP < 5) and other postoperative complications requiring intervention, and the number of postoperative glaucoma medications required for intraocular pressure (IOP) control.
Results: Twenty-one of 32 (65.6%) eyes in the IT group experienced a hypertensive phase, in comparison to 16 of 38 (42.1%) eyes in the NT group (p = 0.06). There were no differences between groups in mean preoperative or postoperative IOP at any time point. However, the mean postoperative IOP was significantly lower than the preoperative IOP in both groups, (p-values for all time points from day 1 through year 2 < 0.00005). The mean reduction in IOP from baseline at 3 years follow-up was 15.0 mmHg, which represented a 47.4% reduction from baseline. The mean age of those who developed IOP elevation was 10.4 years younger than those who did not develop elevated IOP (p = 0.04). The mean number of postoperative glaucoma medications was similar in the two groups. One or more complications requiring surgical intervention occurred in 28.6% of patients.
Conclusions: Our results suggest that the use of systemic immunosuppressive therapy does not affect the development of a hypertensive phase in Ahmed valve glaucoma drainage implant surgery in patients with uveitis. Our results confirm the effectiveness of this procedure in lowering IOP in these patients. In addition, younger patient age appears to be a risk factor for the development of a hypertensive phase.
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P475 MODIFIED TECHNIQUE FOR EXTENDING TUBE OF GLAUCOMA DRAINAGE DEVICE USING 22-GAUGE ANGIOCATHETER SEGMENT

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Objective: To describe a modified technique using a readily available, sterile and economical 22-gauge intravenous catheter (venflon®) as a preferable option for extending the tube of glaucoma drainage devices (GDD) in cases of tube retraction in complex pediatric cases. Intraocular portion of the implant tube of a glaucoma drainage devices get retracted and may be too short to be repositioned. In such cases one may consider resiting the tube, use a tube extender or insert a new implant. All these options have limitations and technical problems. We present this modified technique for tube extension using a segment of universally available 22-gauge angiocatheter material.
Design: A retrospective non-comparative interventional study of two consecutive cases of complex paediatric glaucoma.
Participants: Two consecutive pediatric cases with tube retraction treated with extension of the tube. The tube of the drainage devices (1 Baerveldt and 1 Molteno) was extended using a segment of a 22-gauge intravenous catheter (venflon®). The available follow-up for both cases is 15 months.

Methods: The extender segment was constructed using a 4 millimeter segment of a 22G intravenous catheter (venflon). Cut ends of the GDD tube were placed in the tube extension segment. An appropriate length of the tube was obtained in the anterior chamber. A 10/0 nylon suture was used to secure the extender to the original tube and to the sclera. A donor scleral patch graft was used to cover the tube. Outcomes were recorded retrospectively.
Outcome Measures: Pre-operative and post-operative visual acuities, intraocular pressures and number of glaucoma medications were recorded. Preoperative and post-operative length of tube in the anterior chamber and the morphology of the bleb over the plate were assessed.
Results: In both cases an adequate length of the tube was obtained in the anterior chamber. In the first case an excellent drainage bleb formed over the plate and the intraocular pressure reduced from 28 mmHg to 11 mmHg. In the second case only a 25% reduction of IOP (from 40 mmHg to 30 mmHg) and a shallow bleb was seen for a few weeks as extensive fibrosis over the plate limited the drainage. There has been no displacement of the tube in the follow up period.
Conclusions: The readily available, sterile and economical 22- gauge intravenous catheter (venflon®) segment is a structurally and functionally appropriate and cost effective option for extension of both Baerveldt and Molteno drainage implants in complex pediatric cases. However other factors limiting drainage from tube, such as extensive scarring over the plate may limit the reduction of IOP.
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P476 AUTOLOGOUS SCLERA PATCH GRAFT IN AHMED VALVE SURGERY

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Purpose: To evaluate the efficacy and safety of autologous sclera patch graft to cover subconjunctival portion of Ahmed valve tube.
Design: Retrospective, non-comparative case series.
Participants: Thirty six patients (39 eyes) undergoing Ahmed valve implant surgery with autologous sclera patch graft to cover the tube with at least 6 months follow-up.
Methods: Consecutive cases of Ahmed valve implant surgery with autologous scleral lamellar patch grafts.
Main outcome measure: Eyes were evaluated for signs of tube erosion, patch graft thinning and melting and intraoperative complications.
Results: The mean follow-up was 19 ± 12.5 months (6-50 months). All eyes tolerated the autologous graft well. In all eyes no clinical evidence of tube erosion, graft melting or intraoperative complications were noted. Thinning of the donor patch graft such that the tube was visible beneath intact conjunctiva occurred in 13 eyes.
Conclusion: Autologous patch graft in Ahmed valve surgery is an effective, safe and inexpensive alternative to donor patch.
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P477 SUCCESSFUL AHMED VALVE IMPLANTATION FOLLOWING COMBINED KERATOPROSTHESIS AND CATARACT EXTRACTION FOR PRESUMED HERPETIC KERATOPATHY

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Objective: To describe successful Ahmed valve implantation following keratoprosthesis surgery.
Design: Case report.
Participants: A 58-year-old man, on his third left penetrating keratoplasty for idiopathic corneal pathology (suspected to be herpes keratitis), presented to our clinic for an evaluation of his visual potential. There was a history of trans-scleral cyclodiode photocoagulation following each keratoplasty, but no previous history of glaucoma. Visual acuity in his left eye was counting fingers (CF) at 1 m. He had a moderately dense cataract, and there was no evidence of previous vitreo-retinal surgery. There was cupping of his optic disc, although the media opacity precluded a thorough assessment. Intraocular pressure (IOP) could not be measured easily by applanation tonometry, but digitally was found to be high.
Intervention: A keratoprosthesis (Boston, type 1) and cataract removal (without a lens implant in the intact posterior capsule) were carried out in combination, followed by a secondary drainage device (Ahmed valve) with a tube in the anterior chamber.
Main outcome measure: IOP control.
Results: The patient currently sees CF at 3m, the anterior chamber appears stable and IOP controlled.
Conclusions: The Ahmed valve can be implanted successfully following keratoprosthesis surgery.
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P478 NOVEL DRAINAGE DEVICES AND ADDITIONAL SCLERAL INCISIONS IN SURGERY OF THERAPY-RESISTANT PRIMARY OPEN-ANGLE GLAUCOMA (POAG) IN ADVANCED STAGES

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Introduction: Scarring in the filtration area and obliteration of aqueous outflow pathways are the major causes of filtering surgery failure, despite evolution and modification of its technique. An alternative could be novel drainage devices, made from Hemashield Gold™ Woven Double Velour Graft, which is polyester collagen impregnated graft used in vascular surgery.
Purpose: To determine the efficiency of additional scleral incisions perpendicular to each side of scleral bed in filtration surgery of therapy-resistant POAG with drainage device, made from Hemashield Gold™.
Design: Prospective and non-randomized study.
Patients: This study involved 11 eyes of 10 patients (IOP = 33,6 ± 5,4 mmHg, age 70,4 ± 10,6 years) with therapy-resistant POAG in advanced stages.
Intervention: The following penetrating surgery was performed: dissection of the conjunctiva 7-8 mm from the limbus and separation of scleral flap 6 x 6 mm, drainage fixation (size1 x 3 mm) at 2 mm from the filtering zone perpendicular to limbus, performing of sinustrabeculectomy 1 x 4 mm with basal iridectomy, additional 6 scleral incisions perpendicular to each side of scleral bed (2 at each side), suturing of scleral flap to underlying sclera with 2 nods, suture on Tenon's capsule and conjunctiva.
Main outcome measures: Intraocular pressure measured at the last visit.
Results: The follow-up period varied from 6 months to 2 years. During this period in all patients IOP remained lower than 20 mmHg without medications. Rejection of the drainage device was not observed.
Conclusions: 1. Drainage devices made from Hemashield Gold demonstrate a pronounced and sustained effect in preventing adhesion of scleral flap in therapy-resistant POAG in advanced stages. 2. Scleral incisions perpendicular to each side of scleral bed represent additional path for aqueous outflow.
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P479 RESULTS OF SUTURE RESTRICTED GLAUCOMA DRAINAGE DEVICE IMPLANTATION IN THE MANAGEMENT OF COMPLEX ADULT AND PEDIATRIC GLAUCOMA

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Objective: To evaluate the results of suture restricted glaucoma drainage device implantation in the management of complex adult and pediatric glaucoma and to evaluate its usefulness in preventing one of the major short-term to medium- term complication which is immediate hypotony after surgery.
Design: A retrospective non-comparative interventional study of consecutive cases.
Participants: Thirty-five eyes of consecutive patients who underwent GDI implantation between 2000 and 2006 at a tertiary university hospital in the UK were included.
Methods: All patients underwent single stage Baerveldt 250 mm^2 or Molteno tube insertion. All GDI tube lumens were occluded partially with 3/0 Supramid suture and then totally with 6/0 Vicryl sutures over the tube. Data was collected retrospectively and all statistical analysis was performed using GraphPad Instat. Comparisons were performed using t-test or Fischer test when appropriate.
Outcome measures: Absolute success was defined as: IOP < 21 mmHg without any medications and no persistent hypotony (IOP less than 5 mmHg on two consecutive follow-up measurements). Success was considered qualified when IOP was < 21 mmHg with lowering drugs medications.
Results: Mean age was 29.0 (range 1 to 98) years old. Fourteen patients were diagnosed to have aphakic glaucoma, 4 had primary open-angle glaucoma, 8 had congenital/developmental and 9 had other glaucoma's including inflammatory and angle dysgenesis. Mean follow up was 39.8 months (range 3 to 96 months). 19 patients had Baerveldt tube and 16 patients had Molteno tube. Mean pre-op IOP was 27.6 mmHg controlled with an average of 3.4 topical medication. 18 of the 35 patients were taking additional oral acetazolamide. At 1 year post-op, mean IOP was significantly reduced to 13.8 mmHg ($p < 0.01$). 18 of the 35 patients had intraluminal Supramid® suture removed by the end of 12 months due to increased IOP. At last follow-up visit, the mean IOP was 16.4 mmHg ($p < 0.01$) with an average of 1.1 topical medication. Only one patient remained on Diamo. 2 patients developed significant hypotony. When compared to previously available literature this appears to be significantly low. Five patients had surgical failure (3 needing cyclodiode laser, 2 patients had complete visual loss), while 1 patient required enucleation following trauma. Significantly more Baeveldt tube patients met the absolute success criteria than Molteno tube patients ($p < 0.01$). The qualified success rate over the follow-up period was 71% and the absolute success rate 34%.
Conclusion: Suture restricted GDI surgery appears to be successful in lowering IOP in complex adult and pediatric patients with complex glaucoma, while minimizing the risk of hypotony which is a major concern with GDI ipmlantation1. Baerveldt tube appears to have a better success rate with lower complication rate.

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P480 GLAUCOMA DRAINAGE DEVICES FOR THE TREATMENT OF KERATOPLASTY PATIENTS WITH GLAUCOMA

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Purpose: To investigate the effectiveness of glaucoma drainage devices in controlling the intraocular pressure in the treatment of glaucoma in keratoplasty patients.
Design and Methods: Twenty-two patients, with keratoplasty and glaucoma who underwent drainage device for the treatment of glaucoma were evaluated. Four eyes had undergone Ahmed valve implant, while 18 eyes had Baerveldt valve implanted. In 8 cases the drainage device implant and the corneal graft were performed in the same day. All the surgeries were done by the same two surgeons in the same setting. These patients were followed-up for 3 years. The main parameter for this research was the intraocular pressure (IOP), which was measured preoperatively and immediately postoperatively. The subsequent IOP measurements were taken at 1 month, 3, 6, 12, 24 and lastly 36 months. Also the number of eye drops used in cases where the drainage device did not sufficiently control the IOP, were evaluated. Lastly, any complications that were encountered were also noted. SPPS 15.0 was used for data entry and analysis.
Participants: Twenty-two patients, sixteen males and six females. The main parameters of outcome: intraocular Pressure, the number of eye drops and complications.
Results: In this sample, there were sixteen males and six females. The majority of the patients were Chinese (10), followed by Malay (7), Indians (4) and others (1). Diagnosis of these patients were mostly psedophakic bullous keratopathy (8), primary open-angle glaucoma (2), neovascular glaucoma (1), corneal scar (5), and lastly others (6) which comprised conditions such as juvenile glaucoma, aniridia and buphthalmos. The mean preoperative IOP was 36.59, with a minimum of 14 and a maximum of 63 mmHg. The first month post-op, the mean IOP was 22 mmHg. At 1 year the mean IOP was 18.91 mmHg, ranging between 8 and 80, at 2 years 17.63, with a minimum of 9 and maximum of 30, and at 3 years 17.72 with a minimum of 10 and a maximum of 30 mmHg. Visual acuity was not given a great significance as several of these patients had other conditions such as diabetic retinopathy. In complications, one patient showed a pale disc, two showed epithelial downgrowth of the corneal graft, two patients needed repeat grafts and one had cyclophotocoagulation and eventually evisceration as a result of a poor control of IOP. Preoperatively the patients were on an average of three different eyedrops and post operatively only one type of eye drop.
Conclusion: Glaucoma drainage devices were successful in controlling the intraocular pressure for the treatment of glaucoma in patients with keratoplasty.
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P481 RESULTS OF ExPRESS MINI SHUNT IMPLANTATION ACCORDING TO DIFFERENT TYPES OF ADVANCED GLAUCOMA NEUROPATHIES – 6-MONTHS OBSERVATIONS

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Aim: To evaluate the efficacy and safety of ExPRESS implantation in different types of advanced glaucoma.
Inclusion criteria: advanced glaucoma stage was described when: c/d ratio > 0.7 and MD < -12 dB, PSD > 5 in HFA visual field testing. Patients were divided into 3 groups. The ExPRESS device was implanted into the anterior chamber, with intraoperative use of 0.2 mg/ml mmc on sponge for 2 minutes.
Participants: Eighteen patients (9 men, 9 women) were included into the study. The age range was: 25-84 years old. The mean age was 58. Group1 consisted of 6 patients with POAG. Group 2 consisted of 7 patients with PCAG.
Group 3 consisted of 5 patients with secondary glaucoma (post inflammatory, pigmentary).
Results: Sixty-seven percent of the patients had no changes in VA in 6 months observations. The mean preoperative IOP was 25 mmHg (gr. 1: 28, gr. 2: 23, gr. 3: 26.8). The decrease in IOP after surgery was significant in all groups and the mean IOP in gr. 1 was 13, in gr. 2: 16, in gr. 3: 14. The mean number of previous glaucoma procedures was 1.7 (from 1 to 4). The overall success rate was 100% in gr. 1 and gr. 3 and 71.5% in gr 2. The complete success rate was in gr. 1: 83.4%, gr. 2: 28.6%, gr. 3: 80%. The mean number of preoperative glaucoma medications was 3.7 and at the last follow-up visit was 06. The difference was significant in all groups. The antiglaucoma drugs had to be used for 7 patients (5 from gr. 2 (71.4%)). We observed only early (till one month) complications: hypotony, hyphema and shallow anterior chamber (all cases occurred in gr. 2).
Conclusions: The ExPRESS mini shunt implantation is a safe, not associated with significant complications procedure even for patients with advanced glaucoma. The shunt is effective for reducing IOP and number of antiglaucoma medicines in 6 months follow-up and not only in POAG patients. In PCAG patients we observed higher risk for postoperative complications (shallow anterior chamber, increase IOP and the need for antiglaucoma local treatment).
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P483 TRABECULECTOMY WITH MITOMYCIN C VERSUS AHMED VALVE IMPLANTATION IN UVEITIC GLAUCOMATOUS EYES

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Purpose: To compare the safety and efficacy of trabeculectomy using mitomycin C (MMC) with Ahmed valve implantation in uveitic glaucomatous eyes.
Design: Consecutive case comparitive study.
Participants: Fifty-eight uveitic glaucoma patients (58 eyes) who had undergone trabeculectomy with MMC (group T, 31 eyes) or Ahmed valve implantation (group A, 27 eyes).
Methods: Rretrospectively reviewed the medical records.
Main outcome measures: Intraocular pressure reduction rates, cumulative probabilities of surgical success, and postoperative complications.
Results: Intraocular pressure levels at postoperative 12 months were lower in group T (11.8 ± 5.1 mmHg) than in group A (13.6 ± 6.4 mmHg, p = 0.46. Cumulative probabilities of surgical success at postoperative 12 months were higher in group T (75.0%) than in group A (64.2%, p = 0.38). No significant differences were noted in the in two groups.
Conclusions: Trabeculectomy with MMC can be simillar effective and preferable as a primary surgical option as Ahmed valve implantation for uveitic glaucomatous eyes.
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P484 HYSTOMORPHOLOGICAL STUDY OF PROLIFERATIVE REACTION AFTER MICRODRAINAGE DEVICE INSERTION

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Objective: To analyze and describe morfological structure of bleb formation after insertion of the microdrainage device at the celullar level.
Design: Hystomorphological light microscopy investigation on animal model after microdrainage surgery.
Controls: Laboratory animals – 20 rabbits (chinchilla), 20 eyes.
Methods: Hystologic features of capsules including cell distribution of activated proliferating cells were assessed by light microscopy in 20 rabbits eyes obtained 6 months to 2 years after insertion of microdrainage device.
Main outcome measure: By light microscopy analysed the amount and maturity of connective fibroblastic tissue, wich forms a filtering bleb around implanted device: cell distribution, layers, collagen fibres and blood vessels formation.
Results: All bleb capsules demonstrated two distinct layers. The thin external layer was cellular with fairly numerous small blood vessels coursing through normally staining, regularly arranged collagen fibres. The thicker deeper layer was avascular relatively acellular and characterized by regularly arranged swollen and fragmented collagen fibres. Cytological changes characterized by metabolic activation or apoptosis in external and internal layers.
Conclusion: The balance between activation and apoptosis regulates the thickness and permeability of bleb capsules. The bleb capsules around microdrainage device includes continual inner surface degeneration and external surface renewal.
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P485 THE HYPERTENSIVE PHASE AFTER INSERTION OF THE AHMED GLAUCOMA VALVE

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Purpose: To investigate the postoperative hypertensive phase in patients undergoing glaucoma drainage implant surgery.
Design: A retrospective chart review of patients, who underwent placement of Ahmed glaucoma valve with a follow-up of 3 months.
Participants: Thirty-two patients with refractory advanced glaucoma (35 consequtive eyes).
Methods: Ophthalmologic examinations included slit-lamp examination, applanation tonometry, corneal pachymetry, tonography, gonioscopy and optic disc grading.
Main outcome measures: Evaluation of stability of IOP con-

trol as an efficacy of Ahmed glaucoma valve in group of most severe cases of secondary refractory glaucoma.
Results: A hypertension phase was observed in 10 eyes (28,6%). It occurred after a mean 6-7 weeks with an average of 24 ± 3,4 mmHg. Eyes with HP needed medications up to 6 month after surgery for improvement of IOP control.
Conclusion:The hypertensive phase occurs frequently after implantation of Ahmed glaucoma valve. In severe cases of refractory glaucoma there are still a number (approximately 1/3) of eyes with refractory hypertension, which have no significant improvement of IOP control and continue to require the same number of glaucoma medications as they did during the hypertensive phase.
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P486 CREATION OF A DRUG-COATED GLAUCOMA DRAINAGE DEVICE USING POLYMER TECHNOLOGY: IN VITRO AND IN VIVO STUDIES
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Purpose: To create and test a slow-release antifibrotic drug-coated glaucoma drainage device, using in-vitro and in-vivo experiments.
Methods: A slow-release mitomycin C (p(HEMA)-MMC) device was developed using redox-polymerization techniques. A standardized preparation of this drug delivery device was attached to the Ahmed Glaucoma Valve (AGV). Semi-circular disks of P(HEMA)-MMC (5 mm x 6 mm) containing varying concentrations of MMC/g dry weight of the gel were attached to the lower half of an AGV plate. Water was pumped through the modified AGV at a rate comparable to that of aqueous outflow and MMC release was measured. Modified and unmodified AGV were implanted in a rabbit model and drug release and fibrosis were assessed after 3 months.
Results: P(HEMA)-MMC was found to release MMC over a 1-2 week period in-vitro. Rabbit studies revealed that MMC was released from the disks during the 3-month implantation. Histological studies demonstrated a significant reduction of inflammatory reaction and fibrosis in the resulting blebs.
Conclusions: We successfully created a slow release drug-coated GDD that decreased the degree of fibrosis and inflammation in the resulting bleb in a rabbit model.
Clinical Relevance: This device could reduce the failure rate of GDDs.

12.8.3. Surgical treatment: Filtering surgery: Non-perforating

see also P445, P489

P487 SURGICAL OUTCOMES FOLLOWING REPEAT NON-PENETRATING GLAUCOMA FILTRATION SURGERY AT A TERTIARY REFERRAL CENTRE
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Purpose: To determine the surgical outcomes of patients undergoing repeat deep sclerectomy with collagen implant (DSCI) at a tertiary referral centre.
Design: Retrospective study.
Participants: The medical records of 736 consecutive patients who underwent DSCI in the glaucoma unit, Jules-Gonin Eye Hospital, were identified from a surgical database.
Methods: The case notes were reviewed and pre and post operative data were recorded. Patients were divided into 3 groups: group A (control): underwent only one DSCI; group B: underwent at least two DSCIs; group C: at least 3 DSCIs. Data were collected for months 1, 3, 6, 9, 12, 18, 24, 30, 36 and end of follow-up.
Main outcome measures: Each of the groups were assessed for: complete and qualified success; number of glaucoma medications, IOP; time interval to: re-starting glaucoma medication, re-operation, needling, antimetabolite injection, goniopuncture, suture lysis, iris incarceration; complications, and cause of failure.
Results: There was a reduction in the proportion of complete and qualified success between groups A and B and between B and C. Mean intervals to re-starting glaucoma medications, re-operation, antimetabolite injection and goniopuncture all decreased as the number of operations increased. Few minor complications were observed in all 3 groups.
Conclusions: Despite the existence of bleb independent outflow pathways in patients undergoing non-penetrating filtration surgery, there are significantly reduced success rates in eyes undergoing repeat deep sclerectomy. This has important implications for the choice of subsequent operations in patients who have failed non-penetrating filtration surgery.
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P489 OUTCOMES OF DEEP SCLERECTOMY VS TRABECULECTOMY
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Introduction: Deep sclerectomy is a non-penetrating filtering

surgery that has been proven to be safe and effective in lowering intra-ocular pressure (IOP) with fewer complications than trabeculectomy – the 'gold standard' filtering operation.

Purpose: To compare the surgical outcome of patients undergoing deep sclerectomy versus trabeculectomy.

Methods: Patients who underwent glaucoma filtering surgery between February 2006 and February 2008 were identified by theatre coding. A retrospective case note audit was thus conducted on 21 patients, giving a total of 25 eyes. Intra-ocular pressure, visual fields and cup:disc ratio were noted pre- and post-operatively.

Main outcome measure: The main outcome measure was post-operative IOP, which was noted at 1 day, 1 week, 2 weeks, 1 month, 3 months, 6 months,12 months and 24 months. Other outcome measures included pre- and post-operative visual acuity, the number of glaucoma medications, operative complications and number of post-operative procedures required.

Results: Both groups showed a 43% mean reduction in IOP post-operatively, showing no significant difference. There was also no significant difference in post-operative visual acuity or number of glaucoma medications. Deep sclerectomy had a greater number of operative complications. Trabeculectomy patients required many more post-operative procedures; 5 trabeculectomy patients underwent 1-6 procedures each, whereas 4 deep sclerectomy patients required one further procedure.

Conclusions: Deep sclerectomy and trabeculectomy are very comparable with regards to operative success. Deep sclerectomy is technically more difficult. However, patients undergoing trabeculectomy require more post-operative procedures to achieve long-term success.

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P490 CARBON DIOXIDE LASER IN NON-PENETRATING GLAUCOMA SURGERY

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Purpose: Non-penetrating deep sclerectomy (NPDS) is an effective glaucoma surgical procedure with low complication rate; however it has a long learning curve when performed manually. We investigated the feasibility and safety of utilizing CO_2 laser for NPDS based on this laser's unique physical characteristics.

Methods: Pilot studies were preformed using the first prototype (OT-133) in animal models and human cadaver eyes followed by a series of human studies in 23 patients (South Africa, India and Israel). A modified and improved model (OT-134) was then developed and studied in laboratory and clinical studies (37 patients in Mexico, India and Russia). Carbon Dioxide laser application ablates the dry scleral tissue. When aqueous percolates through the thinned scleral wall the laser is absorbed by the fluid leaving an intact Trabeculo-Descemet's membrane.

Results: Initial human studies (23 patients), demonstrated the high safety profile of the treatment and its short term efficacy; however photocoagulation occasionally resulted in tissue scarring and filtration failure. The second model (OT-134) and modified surgical technique (37 patients), were associated with a high success rate of IOP reduction by 42.38% (from 24.62 mmHg to 14.19 mmHg, $p < 0.001$) at 6 months, whereas anti-glaucoma medications dropped from 2.5 to 0.3 ($p < 0.001$).

Main outcome measure: 1. Intra ocular pressure before and after surgery. 2. Anti-glaucoma medication, before and after surgery.

Conclusions: CO_2 laser assisted non penetrating deep sclerectomy is a highly effective and relatively simple surgical procedure. Laboratory studies and clinical experience exhibit a high safety profile and very promising mid-term clinical results.

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P491 CANALOPLASTY VERSUS TRABECULECTOMY: A HEAD-TO-HEAD COMPARISON

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Purpose: To compare and evaluate outcomes and complications after non-penetrating Schlemm's canaloplasty versus conventional trabeculectomy as surgical treatment for patients with open-angle glaucoma.

Methods: This study was a retrospective chart review comparing 30 patients who underwent conventional trabeculecomy with adjunctive intraoperative mitomycin-C versus 23 patients who underwent non-penetrating Schlemm's canaloplasty for open-angle glaucoma in a non-randomized fashion. Data with respect to demographics, ocular history, indication for surgery, intraoperative and postoperative complications were collected. Preoperative and postoperative visual acuity (VA), intraocular pressure (IOP), and number of glaucoma

medications were recorded at 6 months postoperatively. Snellen visual acuities were converted to logMAR values for statistical analysis.
Results: No statistically significant change was observed in best corrected visual acuity preoperatively when compared to 6 months postoperatively in either group. IOP in the trabeculectomy group improved from 25.7 mmHg to 10.5 mmHg ($p < 0.01$) with the average number of topical glaucoma medications decreasing from 2.7 preoperatively to 0.3 postoperatively ($p < 0.01$). In the Schlemm's canaloplasty group, IOP improved from 20.0 mmHg to 11.1 mmHg ($p < 0.01$) with the average number of topical glaucoma medications decreasing from 2.5 to 0.6 ($p < 0.01$). Statistical analysis comparing trabeculectomy versus canaloplasty with regards to visual acuity, IOP reduction, and medication usage reduction showed no significant difference between the two groups. Postoperative complications from the trabeculectomy group included bleb fibrosis requiring revision, bleb encapsulation, hypotony, and suprachoroidal hemorrhage. Complications in the canaloplasty group included localized Descemet's detachment, hyphema, iris incarceration into the trabeculodescemet window, conversion to penetrating subconjunctival bleb or tube shunt.
Conclusions: Conventional trabeculectomy when compared with non-penetrating Schlemm's canaloplasty showed no statistically significant difference with regards to visual acuity, IOP reduction, and reduction in medication usage. Non-penetrating canaloplasty may provide glaucoma patients with an equally effective and possibly safer alternative to standard trabeculectomy with its known extensive complication profile.
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P492 LONG-TERM FOLLOW-UP (9 YEARS) OF VISCO-CANALOSTOMY AND PHACO-VISCOCANALOSTOMY
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Purpose: To investigate and compare long-term success of viscocanalostomy and phacoviscocanalostomy.
Methods: A prospective and consecutive study evaluated 300 eyes; 144 viscocanalostomy and 156 phacoviscocanalostomy with IOL implatation, performed by the same surgeons (VZ, DP). All patients underwent surgery between october 1998 and December 2004. All patients were Caucasian or Hispanic.
Main outcome measures: Intraocular pressure (IOP) and requirement for topical antiglaucoma medication. The mean age was 62.77 (10/80) and 74.35 (30/91) in visco and phacoviscocanalostomy, respectively. The mean preoperative IOP was 26.21 mmHg (± 10.59) and 22.62 mmHg (± 7.62) and average of 3.02 (± 0.85) and 2.55 (± 0.63) medication in viscocanalostomy and phacoviscocanalostomy.
Results: The mean follow-up was 78 months ± 22.4 (SD) (range 48 to 108 months). There was an statistically significant decrease in IOP, from 24.6 ± 9.1 mmHg preoperative to 14.8 ± 2.5 mmHg ($P < .001$). The overall mean number of medications per eye decreased significantly from 2.8 ± 0.8 before surgery to 0.4 at the last follow-up ($P < .001$). Overall complete success defined as an IOP ≤ 20 mmHg without medications was achieved in 70% of eyes, with 43% of eyes having an IOP of less than 16 mmHg. Better control and IOP was obtained after phacoviscocanalostomy than after viscocanalostomy in these series of patients. Goniopuncture were performed in 26% in VC, and 17% in Phacoviscocanalostomy. There was a rapid visual recovery and no relevant complications in both techniques.
Conclusions: Better IOP control in phacoviscocanalostomy was probably due because patients that underwent combined surgery presented different type and severity of glaucoma, and isolated phacoemulsification also helps to lower IOP. Nevertheless both techniques were safe and effective for the management of eyes with medically uncontrolled glaucoma and in those co-existing cataract, providing a stable and sustained reduction in IOP with a minimum requirement for topical medication. To obtain long term fup in large combined procedures populations is difficult due to patient aging at the time of the surgery.
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P493 NON-PENETRATING VERY DEEP SCLERECTOMY WITH HYALURONIC ACID IMPLANT AND MITOMYCIN C IN PATIENTS WITH GLAUCOMA - A THREE-YEAR FOLLOW-UP
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Purpose: To compare the efficacy and complications of non-penetrating very deep sclerectomy (NPVDS) with hyaluronic acid implant (SKGEL) and Mitomycin C versus trabeculectomy (TB/Control) in high-surgical-risk patients.
Design: A single-centre, prospective, randomized, controlled

study of high-surgical-risk patients with open-angle glaucoma.

Participants and controls: Sixty-two eyes of 62 patients with medically uncontrolled glaucoma were randomized either to NPVDS or to TB group. There were 30 male and 32 female patients, mean age was 63.29 ± 12.3 years. Patient evaluation was performed before and at 7days of surgery, and then at 1, 6, 12, 24, 36 months following the procedure.

Methods: NPVDS was similar to NPDS; however, excision of sclera and exposure of the ciliary body were performed, and only a narrow scleral flap was retained at a distance of 0.5 mm from Schlemm's canal. In TB group standard Cairns' trabeculectomy was used. Paracentesis of the cornea was performed in all patients in both groups. Mitomycin C 0.2 mg/ml was administered on and under the superficial flap.

Main outcome measures: Intraocular pressure, the number of glaucoma medications a patient was taking, complications.

Results: Success rates at 36 months were 93.5% and 90.3% in NPVDS and TB group, respectively. No statistically significant difference was found between intraocular pressure in NPVD (14,74 ± 4,3 mmHg) and TB (15,61 ± 3,48 mmHg) groups (p = 0,393). The number of glaucoma medications decreased significantly in both groups (p < 0.001). Complications included three cases of hyphema, two of choroidal detachment, two of filtering bleb fibrosis, and four of cataract progression in NPVDS group, and five cases of hyphema, three of choroidal detachment, three of filtering bleb fibrosis, and seven of cataract progression in TB/Control group.

Conclusions: 1.NPVDS with SKGEL and MitomycinC is an effective surgical option for high-surgical-risk patients with open-angle glaucoma. 2. NPVDS is associated with a lower risk of and fewer severe complications in comparison to TB.

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P494 MITOMYCIN C AUGMENTED DEEP SCLERECTOMY IN EYES WITH PREVIOUS FAILED GLAUCOMA SURGERY

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Purpose: To study the efficacy and safety of Mitomycin C augmented Deep Sclerectomy (DS-MMC) in eyes with previous failed glaucoma surgery.

Design: Retrospective study.

Participants: Two district general hospitals in UK.

Methods: Fifty-seven eyes of 57 consecutive patients with previously failed glaucoma surgery who had DS-MMC between August 2001 and January 2006 were identified from a database of all glaucoma surgeries performed by a single surgeon. MMC 0.2-0.4 mg/ml was applied intraoperatively for 2-3 minutes. No MMC was applied in 1 eye, 7 eyes underwent combined phacoemulsification and deep sclerectomy, and 2 eyes had intraoperative perforation.

Main outcome measure: Inrtaocular pressure < 18 mmHg.

Results: Mean follow-up was 34 ± 12 months (median 36). Mean IOPs decreased from 24.7 ± 8 mmHg preoperatively to 13.3 ± 4.87 at 1 year and 12.2 ± 4.0 at 3 years after surgery. The probability of a final IOP of 18 mmHg or less with medications was 93% and 90% and without medications was 84% and 76% at 1 and 3 years respectively. Laser goniopunctures (LGP) was done in 40 eyes (70%). Needle revisions with concurrent antimetabolite injections were done in 10 eyes (18%). There were no serious complications except hypotony following LGP in 1 eye.

Conclusions: Deep sclerectomy augmented with Mitomycin C is an safe and effective procedure to lower IOP in eyes with previous failed glaucoma surgery.

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P495 SAFETY AND EFFICAY OF COMBINED DEEP SCLERECTOMY AND PHACOEMULSIFICATION FOR OPEN ANGLE GLAUCOMA IN INDIAN EYES

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Objective: To study the safety and efficacy of combined deep sclerectomy and phacoemulsification for open-angle glaucoma in Indian eyes.

Design: A retrospective non-comparative interventional study of consecutive cases.

Participants: Forty-one consecutive patients who had a combined phacoemulsification and deep sclerectomy for open-angle glaucoma. All patients gave informed consent and had a minimum regular follow-up period of one year.

Intervention: A combined superior approach deep sclerectomy with fornix based incision and a temporal approach phacoemulsification was done.

Main outcome measures: Preoperative and post operative intraocular pressure (IOP), change in visual acuity, and intraoperative and postoperative complications were recorded.
Results: Preoperative mean IOP of 24.2 (± 8.3) mmHg and the postoperative mean IOP at one year follow-up was 17.8 (± 4.36) mm. The mean IOP reduction was 28.52% mmHg. Snellen acuity improved by a mean value of 3.4 Snellen lines. No significant intraoperative or complications were recorded. Postoperatively there were no cases of persistent hypotony (IOP less than 5 mmHg lasting more than one week) or reduction in vision.
Conclusions: Combined deep sclerectomy and pacoemulsification is safe and effective procedure for open-angle glaucoma in Indian eyes.
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P496 COMPARISON OF SURGICAL OUTCOMES: CANALOPLASTY VERSUS TRABECULECTOMY AT 12 MONTH FOLLOW- UP

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Purpose: To compare surgical outcomes of patients following canaloplasty and trabeculectomy at 12-month follow-up.
Methods: Twenty-five eyes in 22 patients who underwent canaloplasty and 39 eyes in 34 patients who underwent trabeculectomy with 12 months postoperative follow- up were included in the study. All surgeries were performed by a single surgeon (RSA). Outcomes measured included, intraocular pressure (IOP), visual acuity, postoperative medications, and complication rates.
Results: There were no differences in baseline demographics between the two study groups except for an imbalance in the race distribution. Whites and African Americans had comparable baseline IOP ($p = 0.39$), visual acuity ($p = 0.58$) and number of medications ($p = 0.59$). IOP was higher in the canaloplasty group at 1 week and 1 month ($p < 0.001$), however the groups were not significantly different at 12 months ($p = 0.12$). Medications at 6 and 12 months were similar although a slightly higher distribution at 12 months in the canaloplasty group was observed. Overall failure rates were 8% in canaloplasty and 13% in trabeculectomy. Postoperative visual acuity recovery was significantly faster in the canaloplasty group ($p < 0.01$).
Conclusions: Canaloplasty is a promising new technology with comparable results to the gold standard trabeculectomy.

P497 EFFICIENCY OF NON-PENETRATING DEEP SCLERECTOMY WITH T-FLUX IMPLANT WITH OR WITHOUT CONCOMITANT PHACOEMULSIFICATION

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Purpose: The intraocular pressure (IOP) lowering effects of non-penetrating deep sclerectomy (NPDS) with T-Flux scleral implant were evaluated.
Design: Prospective interventional case series.
Participants: Patients visited at our hospital glaucoma unit.
Methods: Fourty-one patients with medically uncontrollable glaucoma underwent NPDS with T-Flux implant associated or not with phacoemulsification (combined procedure group). In some cases antimetabolites (either mitomycin-C or 5-fluouracil) were used. Follow up examinations were performed at 24 hours, 1 week, 1 month, 3, 6, 9 and 12 months after the intervention.
Main Outcome Measure: Prior to surgery, IOP was 29.9 ± 8.1 mmHg and 12 months after surgery it was 15.3 ± 2.4 mmHg .
Results: The number of antiglaucomatous meds used prior to surgery was 2.6 ± 1.4 and 12 months after surgery 0.3 ± 0.5 mmHg. NPDS combined with cataract surgery was performed in 47.5% of cases. Antimetabolites were used in 82.5% of cases. Goniopunctures after 12 months were 35% and suture lysis 12.50%. Subconjunctival injection of 5-fluouracil or corticosteroids was performed in 17% of cases. After surgery 5 patients (12.5%) needed medical therapy, 2 of whom had uveitic glaucoma and 3 primary open-angle glaucoma. Complications were mild hyphema, Seidel, hypotony, choroidal detachment and tenon cyst, all of them satisfactorily resolved.
Conclusions: The short- and mid-term IOP lowering effects in NPDS with T-Flux were quite satisfying but postoperative manoeuvres such as laser goniopunctures/suture lysis or subconjunctival injections were frequently required. No significant important complications were observed. There was no difference in NPDS whether or not combined with phacoemulsification.
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12.8.4. Surgical treatment: Filtering surgery: Using laser

P498 BLEB NEEDLING REVISION WITH THE USE OF SODIUM HYALURONATE 2.3%: 1-YEAR OUTCOMES

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Objective: Bleb needling revision (BNR) with the use of antimetabolites is an accepted technique in modulating bleb function and architecture following trabeculectomy. Sodium hyaluronate 2.3% (HGV) may augment bleb formation through its mechanical and antifibrotic properties. We report on the safety and efficacy of 5-fluorouracil (5-FU) augmented BNR in combination with HGV in a large case series.
Design: Retrospective consecutive case series.
Participants: Sixty-two eyes of 55 patients undergoing first BNR augmented with subconjunctival 5-FU and HGV. The procedure was performed by a single surgeon at a single institution from June 2004 to June 2007. Outcomes were assessed over a 12-month period. Thirty-three eyes had clinically advanced glaucoma (53.2%).
Methods: BNR was performed using a 30-gauge needle which was passed temporally into the bleb. Multiple puncturing motions were made through the encapsulated bleb to restore aqueous drainage. Approximately 0.4 ml of HGV was injected between the bleb and the superficial conjunctiva. Subconjunctival injection of 5-FU (10 mg in 0.4 ml) was administered into the substance of the HGV.
Main outcome measure: The main outcome measure was defined as (A) a complete success if the intraocular pressure (IOP) was reduced by ≧ 20% and to ≦ 21 mmHg without any antiglaucoma medication and (B) a qualified success if the IOP was reduced by > 20% and to ≦ 21 mmHg with or without antiglaucoma medication. Patients requiring additional needling or surgery, or with IOP > 21 mmHg or IOP reduction < 20%, were considered to have failed.
Results: Mean preoperative IOP was 22.6 ± 7.88 mmHg, which was reduced to13.5 ± 5.64 mmHg at the last follow up. Mean follow-up was 10.2 ± 3.68 months and the mean time from index filtration surgery to primary BNR was 43.1 months (range 15 days-24 years). Complete success rates were 62.1%, 32.3%, 30%, 21.8% and 20.8% at 1 week, 1 month, 3 months, 6 months and 1 year respectively. Results for definition B were not significantly different. Bleb morphology was rated from 1 (flat bleb) to 4 (diffuse and raised bleb). The mean bleb morphology at last follow up was 3.1 2.0 *vs* preoperative bleb morphology of 2.5 1.1 (P < 0.01).Transient complications occurred in 15 eyes, 3 of which required surgical intervention.
Conclusions: This is the first study describing the safe and effective use of subconjunctival HGV in 5-FU augmented BNR. It has been shown to enhance bleb survival rates in the short to medium term and is associated with a more diffuse bleb morphology at final follow up. Longer term results show that additional intervention is often necessary, as in our case series which encompassed a high proportion of advanced glaucoma patients. Comparison studies are needed to investigate the benefits of this procedure versus 5-FU augmented needling alone.
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12.8.5. Surgical treatment: Filtering surgery: Other

see also P217

P499 COMPARISON OF BIODEGRADABLE COLLAGEN IMPLANT IN PATIENTS UNDERGOING PHACO-TRABECULECTOMY

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Objective: To assess the safety and efficacy of the biodegradable collagen implant in patients undergoing combined phacoemulsification, intraocular lens implantation and trabeculectomy.
Design: A retrospective study was conducted using the clinical records of patients who had undergone combined phaco-trabeculectomy using the biodegradable collagen implant. Each of these patients was then matched with a patient who had undergone combined phaco-trabeculectomy with mitomycin C (MMC) as recorded in an existing database. The patients were matched for age group, gender, ethnic group, diagnosis, pre-operative intraocular pressures (IOP), and the number of medications required to control the IOP pre-operatively.
Methods: Similar surgical approaches were adopted for both groups as the surgeries were performed by a single surgeon. The only difference occurred just after the scleral flap was raised. For the implant group, the collagen implant was then placed on top of the scleral flap, whereas for the MMC-trabeculectomy group, MMC at a concentration of 04 mg/ml was applied for 3-4 minutes before being flushed away. Postoperative management was similar for both groups with prescription of topical steroids for 3-4 months, topical antibiotics for 1 month and laser suturelysis routinely being carried out at 3-6 weeks post-op as deemed necessary by the surgeon.
Main outcome measure: Data collected for both groups included the IOPs at 3, 6 and 12 months post-operatively, and also the number of medications required at 3, 6 and 12 months post-operatively. The mean IOP at each time point was compared using the Mann-Whitney U test. Statistical significance was set at $p < 0.05$.
Results: A total of 19 patients underwent surgery with the biodegradable collagen implant and were matched with 19 patients who had undergone MMC-augmented phaco-trabeculectomy. At each time point, the mean IOP in the collagen implant group was statistically significantly higher than in the MMC group. At one year, complete success (intraocular pressure below 22 mmHg without any medications) was achieved

in all of the MMC group patients. In the biodegradable collagen implant group, 18 of 19 patients (94.75%) achieved complete success, and 1 patient (5.25%) achieved qualified success (intraocular pressure below 22 mmHg with medications). The difference between the two groups was not statistically significant.

Conclusions: Use of the biodegradable collagen implant for phaco-trabeculectomy is safe and effective although the IOP lowering effect is less than for MMC-augmented phaco-trabeculectomy. Although our numbers were too small to compare the complication rates, the implant could conceivably be associated with fewer complications than MMC as it does not compromise conjunctival defense or immunity, unlike MMC.

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P500 ExPRESS DEVICE IN EYES ALREADY TREATED WITH FAILED PENETRATING SURGERY FOR PRIMARY CHRONIC GLAUCOMA

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Aim: To evaluate the efficacy of ExPRESS device (Optonol) for the treatment of PCG in patients already treated unsuccessfully with other penetrating surgical techniques.

Methods: In a series of 50 eyes, we implanted ExPRESS devices in 15 phakic patients' eyes (A) and 35 aphakic or pseudophakic patients' eyes (B). The average age was 58 aa. ± 8 SD in both groups.

Results: Preoperative IOP, evaluated one day before the surgery was 24 ± 3 mmHg in group A, 22 ± 2 mmHg in group B; a day after postop the IOP was 16 ± 2 mmHg in group A and 12 ± 4 mmHg in group B; 5 days postop the IOP was 10 ± 4 mmHg in group A and 8 ± 2 mmHg in group B; 10 days postop the IOP was 6 ± 5 mmHg in group A and 5 ± 3mmHg in group B; 30 days postop the IOP was 11 ± 3 mmHg in group A and 9 ± 2 mmHg in group B; 60 days postop the IOP was12 ± 2 mmHg in group A and 9 ± 4 mmHg in group B;150 days postop the IOP was 13 ± 2 mmHg in group A and 12 ± 2 mmHg in group B. Choroid's detachment, infections, conjunctival erosions and blebs have never been observed.

Conclusions: The ExPRESS implants effectively reduced the IOP in both groups where the other procedures failed and it is safe. We discussed about the drop down of IOP in all eyes during the follow-up without complications.

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P501 THE FILTERING, CLEAR- CORNEA DIATHERMAL KERATOSTOMY

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Purpose: To investigate if the micro-penetrating, clear-cornea procedure, the Intrastromal Diathermal Keratostomy (IDK) has the potential to be an alternative to traditional filtering procedures judged from the initial IDK results of four Danish Eye departments.

Design: After an IDK course, four glaucoma surgeons performed consecutive IDK procedures. The patients were followed for at least 10 months. A copy of each patient file was sent to a central registration centre for analysis.

Participants: A total of 54 eyes (48 patients) were studied. Advanced glaucoma (cup/disc ratio = 0.8) was present in 63% of the cases.

Intervention: Preoperative, subconjunctival injection of individual Mitomycin-C doses were recommended according to a scheme on risk-of-failure. One week later a micro-penetrating, clear cornea procedure, the Intrastromal Diathermal Keratostomy (IDK) was peformed.

Main outcome measures: New IOP success criteria (IOP ≤ 15 mmHg and = 30% IOP decrease) were employed for the advanced glaucomas and traditional (IOP = 18 mmHg and 30% decrease) for moderate glaucomas (cup/disc ratio = 0.7).

Results: The preoperative mean IOP was 29 mmHg. After 10 months the success rate was 76% in the advanced group without medication in 71% of the cases and 80% in the moderate group without medication in 60%. The mean IOP for the successful eyes was 10 ± 2.5 mmHg and 13 ± 2.5 mmHg, respectively. The results of the most experienced surgeon (33 operations) compared with less experienced (≦ 11 operations per surgeon) showed the same total success rate and number of risk-of-failure factors per eye, but significantly more postoperative IOP lowering procedures for the less experienced and more postoperative temporary com-plications, especially for one of the less experienced surgeons.

The 'knife time' for the most experienced surgeon averaged 15 minutes (range: 10 to 20 min). The success rate after IDK re-vision with internal needling through the original corneoscleral tunnel incision was 69%. No intraoperative complications were registered and no serious postoperative except from 1 case of visual impairment after hypotension maculopathy.
Conclusion: The short-term results of the minimal invasive MMC IDK, carried out by surgeons with different levels of experince, are promising. IDK seems to be easier and quicker than traditional filtering procedures and revision with internal needling is easy and efficient. Thus the MMC IDK may be a valid alternative and may also be recommended after failed trabeculectomy, replacing shunting. Randomized, controlled studies are indicated.
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12.8.10. Surgical treatment: Filtering surgery: Woundhealing antifibrosis

see also P119, P407, P444, P483, P494, P506

P502 PURIFIED TRIAMCINOLONE ACETATE AS ANTIFIBROTIC ADJUNCT IN GLAUCOMA FILTERING SURGERY

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Purpose: To evaluate the differences in failure rate between intraoperative Triamcinolone (TAC) versus Mitomycin C (MMC) in filtering surgery.
Design: Retrospective study observational case series.
Methods: Guarded trabeculectomies were performed either with TAC or with MMC. Intraoperative and postoperative complications related to filtering surgery were recorded.
Results: We included 28 eyes consecutively undergoing primary TE with TAC and compared them with 39 eyes consecutively undergoing primary TE with MMC. The follow-up period was 24.3 months on average (range 22-31 months). We performed a retrabeculectomy and cyclodiode lasertreatment in the eyes of 2 different MMC treated patients (7.7%) versus 0 resurgery procedures in the TAC treated eyes (p = 0.08). At the end of the follow-up period 14.3% TAC treated eyes and 15.4% MMC treated eyes had an intraocular pressure of more than 18 mmHg (p = 0.91). The TAC treatment resulted in 0% hypotony cases compared to 2.6% hypotony cases after MMC treatment because of overfiltration of the blebs (p = 0.32).
Conclusion: TAC as a antifibrotic agent in the trabeculectomy procedure does not increase the failure rate compared to MMC.
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P503 THE EFFECT OF INTRACAMERAL AND SUBCONJUNCTIVAL INJECTIONS OF BEVACIZUMAB IN TRABECULECTOMY WITH ANTIMETABOLITE

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Objective: To evaluate the additive effect of intracameral and subconjunctival injections of bevacizumab in trabeculectomy with 5-fluorouracil (5-FU) or mitomycin C (MMC).
Design: Prospective and retrospective, comparative, interventional study.
Participants: Patients with chronic open-angle glaucoma (COAG), chronic angle-closure glaucoma (CACG), or secondary glaucoma were included in the study.
Methods: Trabeculectomy was performed in 12 eyes with 5-FU and bevacizumab (group 1), 24 eyes with 5-FU only (group 2), 10 eyes with MMC and bevacizumab (group 3), and 20 eyes with MMC only (group 4). Bevacizumab was administered as intracameral (1.25 mg/0.05 mL) and subconjunctival (1.25 mg/0.05 mL) injections at the end of surgery.
Main outcome measure: Postoperative intraocular pressure (IOP), antiglaucoma medications, bleb needling, complications, and success rates were compared between groups 1 and 2 and between groups 3 and 4, at 6, 12, and 18 months postoperatively.
Results: The proportion of eyes with COAG, CACG, or secondary glaucoma was the same between groups 1 and 2, and between groups 3 and 4 (P = 1.0). There was no significant difference in IOP (mean standard deviation; 14.1 ±

3.6 *vs* 14.6 ± 2.1 mmHg), mean number of antiglaucoma medications (0.41 ± 0.79 *vs* 0.25 ± 0.53), bleb needling (0.50 ± 0.79 *vs* 0.33 ± 0.65), complete success rate (75.0% *vs* 79.2%), or qualified success rate (83.3% *vs* 95.8%) between groups 1 and 2 at 12 months postoperatively (P > 0.5). There was also no significant difference in the above outcome parameters (IOP of 13.5 ± 5.2 *vs* 13.1 ± 6.6 mmHg; 0.40 ± 0.97 *vs* 0.65 ± 1.14 antiglaucoma medications; 0.40 ± 0.52 *vs* 0.30 ± 0.57 postoperative bleb needling; complete success rate of 80.0% *vs* 75.0%: qualified success rate of 90.0% *vs* 90.0%) between groups 3 and 4 at 12 months postoperatively (P > 0.5). Comparative analyses at 6 and 18 months postoperatively also showed comparable statistical significance between groups 1 and 2 and between groups 3 and 4 (P > 0.5). Early conjunctival leakage was the most common postoperative complication, and it occurred in 15 to 33% of eyes in each group. No visible tissue damage to the conjunctiva or the cornea was noted after bevacizumab administration in any of the eyes.

Conclusions: This study suggests that intracameral and subconjunctival injections of bevacizumab may have no significant additive effect when used in conjunction with 5-FU or MMC in trabeculectomy.

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P504 NEEDLE REVISION OF FAILED BLEB WITH BEVACIZUMAB IN PEDIATRIC GLAUCOMA

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Purpose: To report an 11-year-old girl with a failing bleb after trabeculectomy that received bleb revision with bevacizumab and to discuss the role of this novel antiangiogenic treatment.

Design: Case report.

Participant: An 11-year-old girl presented 3 weeks following trabeculectomy with amniotic membrane (AM) with increasing intraocular pressure (IOP), reduction of the bleb height and a vascularized bleb. Visual acuity was 20/30 and IOP 24 mmHg. Treatment options, including needle bleb revision with fluorouracil (5-FU) or bevacizumab, were discussed with both parents. The off-label use of both medications and the potential risks and benefits of the treatment were fully explaining to the parents and an informed consent form was signed.

Intervention: After installation of a single drop of gatifloxacin, bleb revision was performed with a 30-gauge needle and 1.25 mg (0.05 mL of 25 mg/mL) of the sterile, undiluted, commercially available bevacizumab was injected into the bleb at the end of the needling procedure. Topical gatifloxacin was prescribed q.i.d. for 3 days.

Main outcome measures: IOP and bleb appearance (area, height and vascularity).

Results: The following day, the patient reported no ocular discomfort. IOP decreased from 24 to 10 mmHg. Bleb area, diffuseness and height increased considerably. Regression of of bleb vascularization was observed 3 days after the procedure. No systemic or ocular complications were observed after the injection. At 3 months follow up, the IOP was 12 mmHg and the bleb remained functional with diffuse appearance and normal vascularization.

Conclusion: Needle bleb revision with bevacizumab has demonstrated to be safe an effective to treat a failing bleb in a girl with childhood glaucoma. It may be a valid tool to modulate the wound healing response following trabeculectomy. More patients are needed to validate our findings.

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P505 BEVACIZUMAB-ASSISTED TRABECULECTOMY FOR NEOVASCULAR GLAUCOMA: ONE-YEAR RESULTS

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Objective: To evaluate results of intravitreal bevacizumab (IVB)-assisted trabeculectomy for medically uncontrollable neovascular glaucoma (NVG).

Design: Retrospective, consecutive, non-comparative, interventional case series.

Participants: Fifteen patients (16 eyes) with medically uncontrollable NVG.

Methods: Patients underwent adjunctive IVB injections followed by trabeculectomy and were followed for ≧ 1 year.

Main outcome measures: Kaplan-Meier survival analysis, with failure defined as IOP ≧ 22 mmHg on at least 2 consecutive follow-up, additional glaucoma surgery to control IOP, or loss of light perception (LP). IOP, visual acuity, anterior segment neovascularization and surgical complications

at 1, 3, 6 months, 1 year and last follow-up visit. Patients were divided into two subgroups: NVG with an open angle (group O-NVG), and NVG with angle closure (group C-NVG) for outcomes analysis.
Results: Mean IOP at base line *vs* IOP at final examination was 41 ± 15 and 14 ± 5 mmHg, respectively ($p < 0.001$). Surgical success rate at the 1-, 3-, 6-months and 1-year interval was 88%, 81%, 69% and 69%, respectively. The 1-year success rate for patients in the O-NVG group was 83% compared with a 50% success rate for patients in C-NVG group. Five eyes (31%) achieved visual improvement ≧ 0.2 logarithm of the minimum angle of resolution units and no eye lost light perception. Intraoperative bleeding occurred in 2 eyes (13%) and postoperative bleeding occurred in 4 eyes (25%) but was self-limited.
Conclusions: IVB-assisted trabeculectomy appears to be effective to stabilize IOP with visual recovery in patients with intractable NVG. However, the overall success rate at the long term follow-up was similar to that of conventional trabeculectomy
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P506 COMPARING SUBCONJUNCTIVAL INJECTION VERSUS SUBSCLERAL MITOMYCIN C APPLICATION DURING DEEP SCLERECTOMY IN GLAUCOMA PATIENTS
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Purpose: To compare the efficacy and the safety of subconjunctival injection versus subscleral application of a 0.02% solution of Mitomycin C (MMC) during deep sclerectomy (DS) in glaucoma patients.
Design: Prospective, randomized, unmasked study
Participants: Fifty-two eyes of 52 patients with primary and secondary glaucoma undergoing DS in the glaucoma unit, Jules Gonin Eye Hospital .
Methods: Inclusion criteria: Medically uncontrolled glaucoma, over 180 degrees of open angles including the superior quadrant on gonioscopy, prior consent obtained for DS. Exclusion criteria: History of adverse reactions to MMC, monocular patients and neovascular glaucoma. Study consent was obtained and patients were randomized to DS and subconjunctival MMC injection (Group I, n = 26) or to DS and subscleral MMC application (Group II). For each group: best corrected visual acuity (BCVA), intraocular pressure (IOP), number and type of medications were recorded preoperatively and postoperatively at days 1 and 7 and at 1, 3, 6, 12, 18 and 24 months. All complications and additional interventions were recorded.
Main outcome measures: Complete success was defined as IOP less than 18 mmHg without glaucoma medication and qualified success rate with glaucoma medication. Failure was defined as IOP over 18 mmHg, or the need for further surgery or cyclophotocoagulation.
Results: Postoperative IOP and number of medications decreased significantly in groups I and II. The BCVA remained unchanged. Twenty eyes (38%) had a history of previous filtration surgery. There were no differences between the groups in the type and number of complications and number of additional postoperative MMC injections required. At 24 months, 43 patients completed the study, 2 patients were lost to follow up and 7 patients required further glaucoma filtration surgery or cyclophotocoagulation. Based on Kaplan-Meier survival curves, complete and qualified success rates were 48% and 68% for group I and 51% and 76% for group II, respectively ($p = 0.8$)
Conclusions: No significant differences were observed in surgical success or complication rates between subconjunctival injection and subscleral application of Mitomycin C during deep sclerectomy.
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P507 CARE-FREE WAY OF USING MITOMYCIN IN GLAUCOMA SURGERY
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The current 'soak and irrigate'-method of applying mitomycin C in glaucoma filtering surgery is rather crude and messy, with guesswork. There are so many variables involved. Nobody knows how much of the drug is actually given to the eye. How widespread the drug diffused to adjacent tissue. And serious complications associated with its use. To overcome the above shortcomings, the present article describe the use of a simple applicator which delivers a known quantity (microgram) of drug, to a highly targeted area of the eye. And there is no need for saline irrigation of treated area following application. In small series of 14 consecutive cases of filtering procedures, using the mitomycin applicator, with two years of follow up. None of the commonly observed complications occurred.

P508 TNF ALPHA AND IL-10 IN AQUEOUS HUMOR PREDICT GLAUCOMA SUGERY OUTCOME
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Purpose: To investigate the influence of inflammatory molecules in the aqueous humor and the parameters of ocular

surface inflammation on the outcome of trabeculectomy in glaucoma patients.
Design: Case prospective study.
Participants: Thirty glaucoma patients with uncontrolled glaucoma on medical therapy who needed filtering surgery.
Methods: The inflammatory molecules interleukin 1 (IL-1) IL-8, IL-1b, IL-6, IL-10, tumour necrosis factor (TNF) and IL-12 were determined from aqueous humor specimens by flow cytometry. The imprints of ocular surface from the upper bulbar conjunctiva were collected one, two and three months after surgery and analyzed for expression of inflammatory markers by flow cytometry.
Main outcome measures: Cytokines from aqueous humor and HLA-DR and CD 80 from impression cytology specimens. The success of trabeculectomy was defined as intraocular pressure less than 21 mmHg without antiglaucoma medication at 3, 6 and 12 months after surgery.
Results: Eyes with trabeculectomy failure at 3, 6 and 12 months showed significantly higher TNF levels and lower IL-10 levels than eyes with successful surgery. Higher percentage of HLA positive epithelial cells 1 months after trabeculectomy was associated with early surgery failure. However the percentage and the mean fluorescence of inflammatory molecules on epithelial cells and CD80 positive cells at 3 months were not associated with the trabeculectomy outcome.
Conclusions: Higher levels of TNF and diminished expression of IL-10 in aqueous humor may contribute to the development of infammatory milleu and reduce the success of glaucoma surgery.
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P509 TRABECULECTOMY WITH MITOMYCIN C AND AMNIOTIC MEMBRANE TRANSPLANTATION IN TREATMENT OF REFRACTORY GLAUCOMA

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Purpose: To evaluate the outcome of trabeculectomy with mitomycin C (MMC) and amniotic membrane transplantation (AMT) for treatment of refractory glaucoma.
Design and Participants: Medical records for 13 eyes of 11 patients who underwent trabeculectomy with MMC and AMT between March 2002 and December 2006 at Yamaguchi University Hospital were reviewed retrospectively.
Methods: In the surgery, a limbus-based conjunctival flap was constructed, and amniotic membrane with the epithelial side down was sutured to the sclera at the corneoscleral limbus to cover the scleral flap of trabeculectomy. Outcome measures included intraocular pressure (IOP) and complications. Success rate was assessed by Kaplan-Meier analysis. Success was defined as achievement of an IOP of < 22 mmHg with or without antiglaucoma medication.
Results: The median number of prior surgeries including glaucoma filtration surgery was five (range, 2-9). The median follow-up time was 27 months (range, 18-54). IOP decreased from 30.2 ± 8.8 mmHg preoperatively to 13.3 ± 4.2 mmHg at 12 months without failure. Success rate was 92.3% at 18 months, 76.9% at 24 months, and 67.3% at 27 months. Early postoperative bleb leakage occurred in nine eyes and late-onset bleb leakage in one eye, but such leakage did not persist. Blebs became diffuse in 12 eyes and ischemic in one eye. Bleb infection did not occur.
Conclusions: Trabeculectomy with MMC and AMT was effective for reducing IOP in refractory glaucoma. However, the IOP-lowering effect decreased substantially after 24 months. Failure of the treatment necessitated repeat or further surgery.
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P510 SLIT-LAMP NEEDLING REVISION IN LATE FAILED OR ENCAPSULATED FILTERING BLEBS WITH ADJUNCTIVE MITOMYCIN-C

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Purpose: To assess the efficacy and safety of bleb needling in patients with late encapsulated or failed filtetring blebs.
Design: Retrospective noncomparative interventional case series.
Participants: Thirty-two eyes from 32 patients with encapsulated bleb (13 eyes) or failed bleb (19 eyes) 2-60 months after failed filtering surgery (mean 23.1 months) included in the study.
Method: Slit lamp needling bleb revision was performed under topical anesthesia using 27 G needle. The needle was entered into the anterior chamber when the bleb was failed, then 0.1 mL of MMC (0.2 mg/mL) injected subconjunctivally in the opposite side. Complete success was defind as reduction of IOP equal or lower than 21 mmHg without any antiglaucoma medications and qualified success was defined as reduction of IOP equal or lower than 21 mmHg with antiglaucoma medicatins.

Main outcome measures: Pre- and post-operative visual acuity, IOP, number of antiglaucoma medication, and complications were evaluated for a mean follow-up 19 months (1-61 months).
Results: Mean IOP was 25.2 ± 4.8 mmHg before surgery and 19.2 ± 4.8 mmHg in the last follow-up postoperatively. Complete success was 12.9%, qualified success was 51.61%. The mean number of bleb needlings was 1.3. The mean antiglaucoma medications was reduced from 3.1 ± .3 preoperatively to 2.2 ± 1.3 postoperatively.
Conclusions: It appears that slit-lamp needle revision in office is a safe, simple, not expensive and effective method for treating encapsulated bleb or failed filtering blebs, and may be a substitute for major reoperations even years after a filtering surgery with previously functional bleb.
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P511 TRABECULECTOMY USING BIODEGRADABLE COLLAGEN MATRIX IMPLANT IN CHRONIC PRIMARY GLAUCOMA PATIENTS : BLEB ANALYSIS WITH ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY
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Purpose: To analyse bleb of trabeculectomy using biodegradable collagen matrix implant in chronic primary glaucoma patients with anterior segment optical coherence tomography.
Methods: A prospective interventional preliminary study was conducted at the Glaucoma unit, Departement of Ophthalmology, Dr Cipto Mangunkusumo General Hospital (CMGH). The study took place from January 2008 until December 2008. Trabeculectomy was done for uncontrolled chronic primary glaucoma patients using biodegradable collagen matrix implant. Intraocular pressure was measured as well as the Moorfields Bleb grading system were done on day 7, 14, 28 and 56 postoperatively. Bleb analysis using anterior segment optical coherence tomography (AS-OCT) were done on day 28 and 56 postoperatively. The heigh bleb, area of subconjunctiva cavity were calculated using computer program.
Results: Ten chronic primary glaucoma patients were follow up for two months: there were 8 female patients and the mean age was 59,3 (SD 6) years old. In two months, IOP of less than 21 mmHg was 80% of eyes with the mean of IOP was 15.8 mmHg. Majority of successful bleb showed high subconjungtiva cavity with micro-hiporeflective spaces in the bleb wall with the mean of subconjungtiva cavity was 1.09 on day 28 and 0.93 on day 56. The bleb height obtained by fotography were not full agreement with height obtained by AS-OCT
Conclusions: Trabeculectomy using biodegradable collagen matrix implant showed a tendency to maintained a good IOP with the presence of characteristics functioning bleb for up two months
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P512 COMPARISON OF BLEB OUTCOME BETWEEN BEVACIZUMAB AND MITOMYCIN C IN OPEN ANGLE GLAUCOMA- PROSPECTIVE CLINICAL OBSERVATION STUDY
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Exuberant scarring is a major cause of failure of trabeculectomy surgeries. The purpose of this presentation is to study the bleb characteristics between use of Inj. Bevacizumab (off-label use of Avastin) and Inj. Mitomycin C. This prospective study uses off-label Inj. Avastin sub conjuntivally intraoperatively during a routine trabeculectomy procedure in one eye and using Inj. Mitomycin C (prescribed method of application for 2 minutes) in the other eye of the same patient in 3 such cases. Subsequent outcome characteristics were documented by photographs from day 1, day 7, day 21, 6 weeks, and 3 months. Outcome measures and results with conclusions would be discussed.

P513 INTRACAMERAL BEVACIZUMAB IN GLAUCOMA FILTERING SURGERY
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Objective: To study the role of Intracameral Bevacizumab as an adjuvant in glaucoma filtering surgery.
Design: Prospective interventional study.
Participants: Glaucoma patients who needed filtering surgery.
Methods: Fifteen eyes underwent a standard trabeculectomy procedure, except that Bevacizumab 1.25 mg/0.05 ml was injected into the anterior chamber at the end of surgery. Post-

operatively patients were followed-up with visual acuity (VA), intraocular pressure (IOP), anterior segment reaction and bleb morphology, using Indiana Bleb Grading system, for at least 6 months.
Main outcome measres: IOP and bleb morphology.
Results: Pre-operative VA was < 6/36 in all patients with mean IOP of 40.6 mmHg (range 26 to 60mmHg). No complications attributable to Bevacuzimab were noted in the post operative period. VA was unchanged in 9 patients, improved by one step in 4 patients, and deteriorated in 2 patients. Mean IOP was consistantly low at one month (12 mmHg, range (10-26), 3 months (16 mmHg, range (10-40)) and 6 months (14 mmHg, range(10-27)) post-operatively. At 6 months 11 (73.3%) patients had IOP ≦ 21 mmHg without drugs and had diffuse blebs with healty conjuctiva. Four patients needed additional medicines to control IOP. Three patients developed Tenon's cyst at trabeculectomy site.
Conclusion: Intracameral Bevacuzimab has the potential to be used as an adjuvant in trabeculectomy to retard wound healing and hence improve filtraion.
References:
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P514 CONJUNCTIVAL FLAP EDGE PROTECTION AND POSTERIOR MITOMYCIN C APPLICATION IN GLAUCOMA OPERATION: EFFECTS ON BLEB MORPHOLOGY
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Objective: To assess the effect on bleb avascularity, oozing and leaks, of the change in Mitomycin C (MMC) application technique during glaucoma operation from anterior to posterior and diffuse subconjunctival application.
Design: Retrospective study.
Participants: Two district general hospitals in UK.
Methods: Cross-sectional analyses of theMMC augmented operations with established filtration blebs with at least two years follow-up. Data on bleb parameters was confirmed in all cases by one observer (NA). Technique for MMC application was changed from anterior subconjunctival application on the scleral flap area to a diffuse, posterior application with edge protection by a clamp of the fornix based conjunctival flap.
Main outcome measure: Bleb avascularity.
Results: Two hundred seventy-eight eyes of 226 patients were included, 154 eyes in the anterior application (MMC-A) and 124 eyes in the posterior application (MMC-P) groups. The MMC-A had significantly longer follow-ups than the MMC-P group (43 *vs* 32 months). Bleb avascularity, transconjunctival oozing (TCO) and bleb leaks were observed in 105 (58%), 99 (64%) and 23 (15%) of eyes of the MMC-A group and 33 (27%), 23 (19%) and 0(0%) of eyes respectively, of the MMC-P group and these differences were statistically significant. Logistic regression analyses suggested that the MMC application technique (odds ratio (OR) 0.23, $p < 0.00$) and to a lesser extent, the type of surgery (trabeculectomy or deep sclerectomy, OR 0.54, $p = 0.04$) had a statistically significant effect on the bleb avascularity.
Conclusions: Diffuse and posterior application of MMC with protection of the edge of the conjunctival flap appears to decrease the frequency of bleb avascularity, TCO and delayed leaks two years after glaucoma operation.
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P515 AMNIOTIC MEMBRANE DRAPING TECHNIQUE FOR LEAKY CYSTIC BLEBS
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Purpose: To describe the successful use of amniotic membrane graft for the repair of leaking cystic blebs following MMC trabeculectomy.
Methods: In this retrospective study, 20 eyes of 20 patients with leaky cystic blebs and hypotony following trabeculectomy with mitomycin C were treated with amniotic membrane graft over the leaking area with or without conjunctival advancement with out excision of the cystic bleb. Success was defined as IOP between 6-20 mmHg with or with out additional medications, no re-leaking, no re-operations, post-op vision not less than 2 lines because of the surgery and no infection.
Results: Ninety-five percent (19/20) achieved non-leaking bleb with IOP controlled without surgical intervention. All patients had IOP > 7 mmHg one day after surgery and the average IOP was 12 mmHg ± 3 at last follow-up. Patients recovered baseline vision with in 3 weeks. To control IOP at the end of 24 ± 4 months 18.75% required at least 1 med, and none of the patients had any infections or loss of vision.
Conclusions: Amniotic membrane draping with conjunctival advancement technique successfully maintains bleb function with excellent IOP control with decreased risk of hypotony and rapid visual recovery.

12.8.11. Surgical treatment: Filtering surgery: Complications, endophthalmitis

see also P448, P517

P516 SLIDING CONJUNCTIVAL FLAP WITH ADJUNCTIVE FIBRIN GLUE FOR SURGICAL REVISION OF DYSFUNCTIONAL FILTRATION BLEBS

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Objective: The introduction of anti-metabolite regimens to glaucoma filtration surgery has improved post-operative outcomes for intraocular pressure control, however it has also increased the frequency of bleb complications. Post-antimetabolite blebs may become progressively thin and predisposed to overfiltration and blebitis, resulting in serious vision threatening hypotony and endophthalmitis. Closure of bleb leaks generally requires surgical revision. A surgical technique is described (including video) for the repair of dysfunctional trabeculectomy blebs whilst maintaining intraocular pressure control.
Design: Retrospective, noncomparative, consecutive case series.
Participants: Nine eyes from nine patients (6 male, 3 female) with surgical trabeculectomy bleb complications.
Intervention: Surgical repair utilizing a conjunctival flap to cover the preserved underlying bleb and subconjunctival injection of fibrin glue.
Main outcome measures: Repeat bleb failure, requirement for further bleb revision, pre- and post-operative intraocular pressure (IOP), number of IOP lowering medications.
Results: All eyes had symptom resolution post-operatively. There were no bleb leaks or hypotonous eyes after an average follow-up of 16 months (range: 6- 31 months). Two patients required 5FU needling to maintain IOP control. Intraocular pressure decreased from a mean 13.6 ± 2.0 mmHg preoperatively to 11.4 ± 1.0 mmHg post-operatively. The mean number of medications increased from 0.4 to 1.1 post-bleb repair.
Conclusions: Conjunctival flap advancement with bleb preservation and adjunctive fibrin glue is a useful technique for the management of bleb complications with maintenance of IOP control.
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P517 ROLE OF UBM IN PREDICTING THE OUTCOME OF NEEDLE REVISION OF FAILED TRABECULECTOMY BLEBS

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Purpose: To evaluate the role of Ultrasound Biomicroscopy (UBM) in predicting the outcome of needle revision of failed trabeculectomy blebs.
Design: Prospective interventional study.
Participants: Adult patients with a failed filtering bleb (diagnosed on the basis of morphological features of encapsulation or scarring) and unsatisfactory IOP control were enrolled for this study. The study adhered to the Declaration of Helsinki and was approved by the Institute Ethical Committee. Informed consent was obtained from all recruited patients.
Methods: All patients underwent comprehensive ophthalmic examination. The bleb was assessed clinically and by ultrasound biomicroscopy using the UBM Model 840, Paradigm Medical Industries Inc. To assess patency of the subscleral space, the route of aqueous flow under the scleral flap was looked for and the blebs classified further as scleral route patent (SRP) or scleral route occluded (SRO). The bleb was needled in the operation theatre using standard technique, under a peribulbar block. At the end of the procedure, subconjunctival 5-FU was injected away from the bleb area. Fisher exact test was used to determine any difference in outcome based upon the presence of fluid under the scleral flap before and after needling. Student's paired t test was used to analyze the intraocular pressure (IOP) change following needling. Kaplan-Meier survival analysis was used to determine the duration of effect of the procedure.
Main outcome measures: Post-needling bleb appearance, IOP control, and requirement for antiglaucoma drugs.
Results: Sixteen eyes of 15 patients were included in the study. Eleven eyes had SRP and 5 eyes had SRO on UBM. Of the 11 eyes with SRP on UBM, 8 eyes had successful outcome. Of the 5 eyes with SRO on UBM, only 2 eyes were successful. Success of needling procedure was more common in the group with scleral route patent on UBM, though this was not found to be statistically significant (Fisher's exact test = 0.299). Post-needling reduction in IOP and reduction in requirement of antiglaucoma drugs was significant in the SRP ($p = 0.002$) group but not in SRO ($p = 1.00$) group. On comparing survival plots for eyes with SRP and SRO, in the SRP group more number of patients survived for longer duration.
Conclusions: Subtenon needling appears sufficient and effective in re-establishing filtration in failed blebs with scleral route patent on UBM. In blebs with scleral route occluded on UBM, the decision may tilt towards a full bleb revision rather than a needling alone. If needling is planned it may be worthwhile to consider needling under the scleral flap rather than just in the sub-tenons space.
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Khatana AK, Swendris RP, Parrow KA. Needling revision of failed filtering bleb with adjunctive 5-FU. Ophthalmic Surg 1993; 24: 242-247. 5. Broadway DC, Bloom PA, Bunce C, et al. Needling revision of failing & failed trabeculectomy bleb with adjunctive 5 FU. Survival Analysis. Ophthalmology 2004; 111: 665-673.

P518 THE LONG-TERM EFFECT OF EXCISION OF AVASCULAR BLEB AND ADVANCEMENT OF ADJACENT CONJUNCTIVA FOR TREATMENT OF HYPOTONY

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Purpose: To evaluate the long-term effect of excision of avascular bleb and advancement of adjacent conjunctiva (EBAC) for treatment of hypotony after trabeculectomy with mitomycin C (MMC).
Design: Non-comparative interventional cohort study.
Participants: Seventeen eyes (15 patients) received EBAC for correction of hypotony between September 1996 and June 2008.
Methods: All patients followed-up at least 6 months after EBAC, whose medical records were reviewed retrospectively.
Main outcome measure: Intraocular pressure (IOP) and postoperative complications.
Results: Hypotony (IOP < 6 mmHg) of 8 eyes (47.1%, 7 patients) was caused by bleb perforation, and 2 eyes (2 patients) of them had trauma history. Hypotony was appeared at 33.9 ± 30.8 months after trabeculectomy with MMC, and EBAC was performed at 48.2 ± 35.3 months after trabeculectomy. The mean follow-up time was 38.3 ± 29.8 months. Qualified success rate of EBAC was 100% at 51 months after EBAC, and complete success rates of EBAC were 76.5%, 70.6% at 6, 51 months, respectively by Kaplan-Meier analysis. The post-EBAC complications were blepharoptosis in 4 eyes (23.5%), and bleb perforation in one eye (5.9%). This blepharoptosis was disappeared within one month after EBAC in 2 patients. But in the others, mild blepharoptosis was remained at postoperative 17 months and 22 months respectively.
Conclusion: EBAC was an effective method for treatment of hypotony after trabeculectomy with MMC, and postoperative blepharoptosis was a major complication.
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P519 THE ENCYSTED BLEB. WHAT CAN WE LEARN FROM THE HYPERTENSIVE PHASE?

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Bleb formation in a glaucoma implant has three phases. The hypotensive phase, the hypertensive phase, and the stable phase. The hypertensive phase is caused by an inflammatory reaction over the pate. This reaction is due to three factors: The pro-inflammatory substances in the aqueous; the pressure within the bleb wall; and the overlying tissue reaction. Controlling these factors will allow for a less intense hypertensive phase, resulting in better long-term bleb function. The initial aqueous contains pro-inflammatory substances, due to increased pressure within the the eye. This aqueous must be prevented from reaching the plate surface until the intraocular pressure has been normalised for three to four weeks. This is achieved by using a non-valved implant and stenting and tying off the implant tube, until pressure has been normalized. The intraocular pressure during this time is controlled by venting the tube with slits.The pressure within the bleb can be controlled by medical means as well as by removing aqueous at regular intervals from the bleb, until pressure is normalized. Anticipation of a severe tissue reaction can be controlled with the use of systemic antifibrosis medication beginning prior to opening the tube. Clinical evidence has shown that a less intensive hypertensive phase results in better bleb function in the long term.
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P520 THE USE OF FIBRIN ADHESIVE FOR REPAIR OF ENCIRCLING BLEB FORMATION WITH HYPOTONY FOLLOWING TRABECULECTOMY

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Purpose: To present the clinical features and management outcome of fibrin adhesive-assisted bleb revision in eyes with encircling bleb formation following trabeculectomy.
Design: Interventional case series.
Participants: Two eyes of two patients (1 with steroid-induced glaucoma and 1 with chronic angle-closure glaucoma) which had trabeculectomy followed by encircling bleb formation with hypotony and choroidal effusion persisting more than 1 month.
Intervention: The conjunctiva and Tenon's capsule was incised at superior temporal and superior nasal side. Tenon's capsule on the superior margin was fixed onto the sclera with

9-0 nylon interrupt sutures. The fibrin glue was applied between the sclera and the overlying conjunctiva on the temporal and nasal side, where the encircling bleb was present, to get firm adhesion.
Main outcome measure: Slitlamp findings and intraocular pressure (IOP).
Results: Hypotony and choroidal effusion resolved within a few weeks after the revision. IOP was stable, and there was no recurrence of encircling bleb formation for the 6 months' follow-up period. No complication was noted in both cases.
Conclusions: Fibrin glue-assisted bleb revision is an effective and safe procedure for the repair of the encircling bleb formation with hypotony following trabeculectomy.
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P521 LONG-TERM OUTCOME OF NEEDLING REVISION WITH PRE-OPERATIVE MITOMYCIN-C INJECTION FOR FAILED FILTERING BLEBS
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Purpose: To evaluate the long-term effect of needling revision with pre-operative subconjunctival injection of Mitomycin-C for the failed filtering blebs.
Design: Retrospective, consecutive, noncomparative interventional case series.
Participants: Sixty-seven patients (83 eyes) undergoing bleb revisions by a single surgeon at a single institution from October 2001 to December 2006.
Methods: Retrospective chart review of 83 eyes in 67 patients with failed filtering blebs was performed. Mitomycin-C (0.13 ml; 0.04 mg/ml) was injected subconjunctivally at least 4 hours before needling revision. A 30-gauge needle was used to perforate the area of subconjunctival fibrosis and re-establish flow.
Main outcome measures: Intraocular pressure, visual acuity, complications, number of glaucoma medications used at the final visit.
Results: Overall, 145 needling procedures (mean, 1.7 revisions per eye; SD, 1.0; range, 1.0-6.0) were performed on 83 eyes (mean follow-up, 38.6 months; SD, 26.8 months; range, 3-95.0 months). Forty-three eyes (52%) were needled once, 40 eyes (48%) underwent more than two needling procedures. Intraocular pressure decreased from 24.2 mmHg (SD, 8.8 mmHg; range, 11-50 mmHg) before surgery to 16.2 mmHg (SD, 8.0 mmHg; range, 2-53 mmHg) at last follow-up ($P < 0.05$). Antiglaucoma medications decreased form 2.5 (SD, 1.3) to 1.6 (SD, 1.7) ($P < 0.05$). Total success was 80% (66/83), including complete success in 31 eyes (37%) and qualified success in 35 eyes (42%). Complications of 145 procedures included suprachoroidal hemorrhage (1), transient hypotony (16), hyphema (3) and bleb leaking (1).
Conclusion: After long-term outcome evaluation, needling revision with preoperative subconjunctival Mitomycin-C injection is an effective method to control intraocular pressure in dealing with failed filtering blebs.
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12.9. Surgical treatment: Trabeculotomy, goniotomy

see also P279, P303

P522 MICRO-ELECTROABLATION, A NEW METHOD FOR TRABECULOTOMY AB INTERNO
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Purpose: To describe a new surgical technique for open-angle glaucomas (micro-electro trabeculotomy ab interno) and outcomes summaries on over 1500 surgeries with follow-up out to five years in cases from Mexico, Canada, and the US 2003-2008.
Design: Retrospective non-comparative interventional case series.
Participants: One thousand six hundred ninety-two patients with COAG or combined cataract and COAG.
Intervention: Microsurgical electroablation of meshwork and inner wall of Schlemm's canal.
Methods: Micro-surgical electroablation of an arc of angle tissues with simultaneous infusion (18.5 gauge sleeve) and aspiration (25 gauge) of tissue debris under gonioscopic control via one or two 1.7 mm clear corneal incisions. The device's ceramic coated footplate, inserted into Schlemm's canal, functions to feed target tissues into the ablation gap during rotation within the canal while protecting adjacent tissues from mechanical and thermal injury. Phacoemsulsification can follow through an expanded incision.
Main outcome measures: Mean preoperative and postoperative IOPs; adjunctive medications, complications, and sub-group analyses including Kaplan-Meier curves on COAG, pseudoexfoliation, pigmentary, uveitic, and with/without prior laser or filtering surgery.
Results: Kaplan-Meier analyses (failure = IOP > 21 and not reduced by 20% below baseline on two consecutive visits beyond 3 months or repeat surgery) indicate success has

remained approximately 75% at two-years (N = 79) for glaucoma-only and approximately 93% for combined glaucoma-phaco cases at one-year (N = 82). Ten patients from the original Mexican cohort (N = 37) have achieved five-year follow-up with a mean IOP of 16.4 mm ± 2.3 mmHg, down from a mean preoperative IOP of 28.2 ± 4.4 mmHg. Three out of five congenital glaucomas have benefited. Among adults, uveitis-related (N = 25) glaucomas demonstrated the largest mean decrease in IOP (+ 50%) at six months (n = 11). Vision-threatening complications remain minimal and this technique does not appear to accelerate cataract. Adjunctive medications decreased across all sub-groups. Only a weak correlation has so far been demonstrated between IOP outcome and the ablation arc with postoperative photography (Sit and Khaja ARVO 2008 P# O102). Surgeon-estimated ablation arcs (< or > 90°) have not demonstrated a statistically significant correlation between IOP outcome and degrees treated.

Conclusions: Trabeculotomy ab interno via micro-electroablation achieves normalization of IOPs with decrease in adjunctive medications in COAG in spite of prior failed filters or laser trabeculoplasty. Complications remain far less frequent and serious than after trabeculectomy. Survival curves in all subgroups have remained flat beyond 18 months out to five years.

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P523 COMPARATIVE EVALUATION OF TRABECULOTOMY-TRABECULECTOMY WITH MITOMYCIN C VERSUS TRABECULECTOMY WITH MITOMYCIN C FOR PRIMARY CONGENITAL GLAUCOMA

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Purpose: To compare the outcomes of combined Trabeculotomy-Trabeculectomy with Mitomycin C Versus Trabeculectomy with Mitomycin C alone in the treatment of primary congenital glaucoma.

Design: Prospective comparative case series.

Participants: Thirty-two eyes of eighteen patients with primary congenital glaucoma in the age group of two months to two years.

Intervention: Combined Trabeculotomy-Trabeculectomy with Mitomycin C was performed in sixteen eyes (group 1) and Trabeculectomy with Mitomycin C in sixteen eyes (group 2) with a follow up of six months.

Main outcome measures: Pre- and postoperative intraocular pressures (IOP), bleb status and complications were evaluated. Success was defined as IOP was < 18 mmHg without any medication.

Results: Intraocular pressure (mean ± SD) reduced from a preoperative level of 26.87 ± 6.81 (range 20-38) in group 1 and 27.25 ± 4.55 (range 18-32) in group 2 to 12.5 ± 4.97 and 13.12 ± 5.36, respectively, at one week postoperative ($P < 0.001$). At one month follow-up the IOP was 15.37 ± 4.17 and 14.87 ± 6.32 ($P < 0.001$) respectively, at the end of 3 months 15.25 ± 3.92 and 14.62 ± 5.14 ($P < 0.001$) and at six months, 15.87 ± 4.09 and 15.0 ± 5.36 ($P < 0.001$) respectively in the two groups. Twelve eyes (75%) in group 1 and 13 eyes (81.25%) in group 2 had IOP < 18 mmHg at the end of 6 months follow-up. Three eyes in group1 and one eye in group 2 had postoperative hyphema.

Conclusions: Both trabeculotomy-trabeculectomy and trabeculectomy alone with mitomycin C application give comparable short term results for IOP control in primary congenital glaucoma. Trabeculectomy alone is technically easier to perform and may be the preferred option for primary surgery.

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P524 TRABECTOME FOR TREATMENT OF OPEN-ANGLE GLAUCOMA 60 MONTHS FOLLOW DATA

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Purpose: Extended surgical follow-up of 37 adults with open-angle glaucoma (OAG).

Design: Prospective interventional case series.

Participants: Thirty-seven adult Hispanic and Caucasian patients with OAG.

Methods: Gonio-electro surgical handpiece with continual infusion/aspiration removing 60-90 degrees of trabecular meshwork via a 1.7 mm corneal incision.

Main outcome measure: Intraocular pressure (IOP) were measured before and after sugery.

Results: IOP (preop) 28.2 ± 4.4 mmHg (n = 37). IOP 12 months 16.3 ± 2.1 mmHg (n = 33), 2 failed, 1 moved; 1 died. IOP 24 months 16.4 ± 4.4 mmHg (n = 31), 4 failed, 1 moved, 1 died. IOP 36 months 16.2 ± 2.6 mmHg (n = 30), 5 failed, 1 moved, 1 died. IOP 48 months 15.9 ± 1.9 mmHg (n = 26), 5

failed, 3 moved, 3 lost, 1 died. Failure defined as: Secundary surgery or IOP > 21mmhg and IOP not reduced by 20% of pre-op.
Conclusion: Gonio-electro surgical handpiece offers safe and effective IOP control without bleb formation and trabeculectomy risks.
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P525 IMPACT OF LASER TRABECULOPLASTY ON TRABECULOTOMY AB INTERNO OUTCOMES

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Objective: To report the impact of prior laser trabeculoplasty on clinical outcomes of trabeculotomy ab interno surgery.
Design: Retrospective, non-comparative study.
Participants: A total of 1345 consecutive patients underwent trabeculotomy ab interno surgery with 36 months follow-up.
Methods: All cases performed by participating surgeons were included. Baseline demographic and medical data were collected. The surgical procedure utilizes a thermal microsurgical unit to unroof Schlemm's canal and expose the collector channels to aqueous humor and the anterior chamber.
Main outcome measures: Intraocular pressures (IOP), number of glaucoma medications and the occurrence of complications or secondary procedures were recorded.
Results: In the trabeculoplasty group of 493 eyes, mean IOP measured 16.5 ± 4.0 mmHg with an average drop of 24% from preoperative IOP at 12 months. In 852 eyes without previous trabeculoplasty, mean IOP measured 15.7 ± 3.0 mmHg with an average drop of 30% from preoperative IOP at 12 months. Adjunctive postoperative glaucoma medications decreased to 2.05 and 1.5 medications in each group respectively. Secondary procedures were performed in 83 and 60 eyes, respectively.
Conclusion: Previous laser trabeculoplasty may increase the need for postoperative glaucoma medication in patients undergoing trabeculotomy ab interno surgery.
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12.10. Surgical treatment: Cyclodestruction

see also P538

P526 THE UK NATIONAL CYCLODIODE SURVEY

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Purpose: Cyclodestructive procedures in the management of refractory glaucoma had previously been regarded as a last resort treatment. However, the improving safety profile and outcomes of cyclodiode laser has made this treatment modality increasingly more attractive. In the absence of national guidance, we sought to ascertain current practice and perceptions of cyclodiode laser treatment amongst UK ophthalmologists.
Design: All UK consultant ophthalmologists were identified through The Royal College of Ophthalmologists. Initially participants were contacted via email to complete an online survey. All non-respondents were subsequently sent a paper-based version.
Participants: Nine-hundred and fifty two UK consultants, all members of The Royal College of Ophthalmologists.
Methods: Consultant email addresses were obtained through their respective NHS secretary. Participants were invited by email to participate in an online survey using a direct web-link. A further reminder was sent after 2 weeks. All non-respondents were sent a paper-based version after 6 weeks.
Main outcome measure: To identify variation in practice of cyclodiode laser treatment.
Results: A total of 510 participants (53.6%) completed the survey. One-hundred and eighty (35.3%) reported performing cyclodiode laser treatment, of which 84 (46.7%) were glaucoma specialists. Initial median power settings used were 1500 mw and 2000 ms. The average number of shots delivered per sitting was 23.1 ± 9.8 shots (range 8-50) in the seeing eye *vs* 27 ± 10.2 (range 10-60) in the blind eye ($P < 0.0001$). Only 64.9% reported routinely transilluminating the globe. Thirty percent lower settings in uveitic glaucoma, whilst 31.7% lower settings in patients of pigmented ethnicity and 20.7% lower setting in eyes with visual potential. Eighty-one percent considered 'hearing a pop' unnecessary, whilst 6% considered 10 'pops' to be safe. Sixty percent perform cyclodiode at any visual acuity. Forty-seven percent consider the 66 years and over age group the most responsive to treatment only. Thirty-seven percent consider 3 re-treatments acceptable. Thirty three percent would consider performing bilateral cyclodiode in one sitting whilst 22% would perform combined cyclodiode and cataract surgery.
Conclusions: In the UK, cyclodiode laser is used in the treatment of glaucoma in all age groups and at all levels of visual acuity. Practice between the seeing eye and a blind eye appear to differ, with the average number of shots performed reaching statistical significance. Whilst in some areas there

is consensus on its use, in others there remains quite wide variation. The results of this study will be useful in developing local and national guidelines on the use of cyclodiode laser treatment.

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P527 CLINICAL EXPERIENCE WITH TRANSSCLERAL LASER CYCLOTHERAPY IN POSR PENETRATING KERATOPLASTY EYES

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Purpose: Glaucoma is a frequent problem in post keratoplasty eyes and there is no consensus how best to treat these eyes when medical therapy is inadequate. We wished to rreview the results of treatment with transscleral laser cyclotherapy.
Design: A retrospective chart review was conducted.
Participants: We reviewed the charts of all post keratoplasty patients who had been treated with transscleral laser cyclotherapy who had been followed-up for at least one year.
Intervention: Transscleral laser cyclotherpy.
Main outcome measures: IOP, VA, duration of follow-up, number of laser treatments.
Results: We reviewed the charts of 24 patients who had received transscleral laser cyclotherapy. They had been followed for a mean of 55 months (range 12-1280). At the time of the last visit IOP was a mean 17 mmHg lower than it was pre Rx (range 9-27 mmHg). Visual acuity had decreased by a mean of less than one line, although two eyes had progressed from HM and LP to NLP. No eyes had suffered acute graft rejection but two eyes did suffer last graft failure. These eyes required an average of two transscleral laser treatments (range1-4).
Conclusions: Transscleral laser cyclotherapy appears to be a good option tdo treat medically uncontrolled glaucoma in post penetrating keratoplasty eyes.

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P528 FOUR YEAR OUTCOME FOLLOWING CYCLODIODE LASER TREATMENT IN NEOVASCULAR GLAUCOMA

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Purpose: To evaluate the outcomes of cyclodiode laser after four years in patients with neovascular glaucoma.
Design: Retrospective study.
Participants: Records for 53 eyes of 49 patients with neovascular glaucoma who underwent cyclodiode laser treatment at Queen Alexandra Hospital, Portsmouth, UK were obtained and reviewed in the study.
Methods: Data was collected via an electronic patient records system.
Outcome measure: Success was defined as: Intra ocular pressure 21 mmHg or less at final visit.
Results: Mean follow-up was 48 months. Mean intraocular pressure was reduced from 39.6 mmHg to 19.6 mmHg at one week, 18.7 mmHg at 6 months and 16.84 mmHg at four year follow-up following cyclodiode laser treatment. Mean number of treatment sessions per eye was 1.33 (range 1-3) and over all re- treatment rate was 22.64%. Treatment regime was a variation of the Moorfields protocol. Mean energy delivered per eye was 18 J. Success was noted in 63.6% (n = 22) eyes at four year follow up. Visual acuity was no projection of light in 7 (13.2%) eyes at the time of diagnosis. Visual acuity deteriorated in 22 (41.5%), unchanged in 17 (32%) and improved in 2 (3.7%) eyes at final visit. 6 (11.3%) eyes developed pthisis bulbi and 4 (7.5%) eyes underwent enucleation/ evisceration. 11.3% eyes continued to remain on antiglaucoma medications and 3.7% were on oral acetazolamide. 71.4% (35) patients died within 8 yrs of diode laser treatment.
Conclusions: Diode laser yields a short and long term reduction of intraocular pressure in patients with neovascular glaucoma. These patients represent a group with a very high risk of mortality.

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P529 CYCLOCRYOTHERAPY, TRANSCLERAL DIODE LASER CYCLOABLATION AND TUBE SHUNT SURGERY IN NEOVASCULAR GLAUCOMA: EFFECTIVENESS AND COMPLICATIONS

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Objective: To compare cyclocryotherapy, transcleral diode laser cycloablation and tube shunt surgery in neovascular glaucoma affected patients. To evaluate anatomical results, functional results and complications of these therapies.
Design: Retrospective study including 84 patients affected by neovascular glaucoma submitted to parasurgical or surgical therapy.
Participants: Eighty-four patients affected by neovascular glaucoma and followed in the last decade in our institute.
Intervention or methods or testing: Thirty patients were treated using cyclocryotreatment, 30 patients using diode laser cycloablation and 24 patients underwent acqueos humour shunt surgery. In the follow up we evaluated patients at 3, 10, 30 days and 3, 6, 9, 12 months, collecting intraocular pressure, visual acuity, complications, reinterventions.
Main outcome measure and Results: A lowering of the intra-ocular pressure (IOP ≦ 25 mmHg with or without drugs) in 12 months has been observed in 26 cases on 30 (86.7%) in the cryotreatment group, in 24 cases on 30 (80%) in the diode laser group, in 18 cases on 24 (75%) in the valve implant group. The difference among these three groups is not significant ($p > 0,05$). During the follow up 10 patients (33.3%) in the cryotreatment group and 4 patients (13,3%) in the laser cyclophotocoagulation group repeated the treatment. In the immediately post-intervention time the visual acuity of draining-valve group was worse than visual acuity before the treatment in a rate of 41,6%, in comparison to 20% (diode laser) and 26,66% (cyclocryotherapy) of the other groups ($p < 0.05$). The final visual acuity in draining-valve group was better than preoperatory-acuity in a rate equal to 33.3%, compared to the other two groups, in which visual acuity improved in 73.3% of the cases. ($p < 0.05$). Progression into complete blindness without ocular pain has been recorded in 2 cases (6.67%) in the cryotreatment group, 4 cases (6.66%) in the diode laser group, 4 cases (16.67%) in the shunt surgery group. 3,3% of the patients in the cryotreatment group, 6.6% in the laser group and 16.6% in the shunt surgery group developed ocular phthisis. Persistent ocular pain occurred in the 3.3% in the group cryotreated, 6.6% in the group submitted to laser, 8.3% in the group submitted to surgery. Rising of IOP caused by the occlusion of the shunt tube (valve implants) occurred in 20,8% of the patients and remotion of the tube from the anterior chamber in 8.3%.
Conclusions: From the present retrospective case-study results that cryotreatment and diodes-laser therapy represent the best treatments for decreasing intraocular pressure in patients with uncontrolled neovascular glaucoma, with a lower rate of complications and the possibility of reintervention.

P530 USE OF ENDOSCOPIC CYCLOPHOTOCOAGULATION IN PATIENTS WITH UNCONTROLLED REFRACTORY GLAUCOMA

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Purpose: To report the results of endoscopic cyclophotocoagulation (ECP) in patients with refractory glaucoma who failed to respond to other filtering procedures.
Design: Retrospective, chart review study.
Participants: Patients with refractory glaucoma who underwent ECP.
Methods: Medical records of all patients who underwent ECP were reviewed, and patients' data such as age, race, sex, mechanism of glaucoma, previous glaucoma surgery, lens status, pre- and postoperative intraocular pressure (IOP), pre- and postoperative best corrected visual acuity (BCVA), pre- and postoperative glaucoma medications, and intra- and postoperative complications were recorded.
Main outcome measures: Post operative IOP, BCVA, medications and complications.
Results: A total of seventeen eyes of twelve consecutive patients were treated. The mean age was 57.17 ± 14.86 years (range, 31-74). Mechanisms of glaucoma included primary open angle (n = 8), chronic angle closure (n = 4), pigmentary (n = 2), uveitic (n = 2) and congenital (n = 1). The mean number of previous glaucoma surgeries was 2.94 ± 1.29 per patient. One eye was phakic, 16 eyes were pseudophakic. The mean follow-up time was 17.53 ± 13.47 months. The mean IOP was 25.12 ± 6.36 mmHg pre-operatively and 10.53 ± 3.84 at last follow-up ($p < 0.001$). The mean number of glaucoma medications per patient was 3.76 ± 1.30 pre-treatment and 0.94 ± 1.08 at last follow-up ($p < 0.001$). No significant intraoperative complication was noted. Postoperative complications were serous choroidal effusion, increased lens opacity, and dislocation of retained lens material into vitreous and macular haemorrhage, each in one case.
Conclusion: Endoscopic cyclophotocoagulation appears to be a sufficiently safe and highly effective method of controlling IOP in patients with refractory glaucoma. This technique is a reasonable therapeutic option in the treatment of patients with glaucoma, especially those who have failed more conventional approaches.
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12.12. Surgical treatment: cataract extraction

P531 LONG-TERM OUTCOME OF CATARACT SURGERY AS AN INITIAL TREATMENT FOR PRIMARY ANGLE CLOSURE

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Purpose: To investigate the long-term efficacy of cataract surgery as an initial treatment for primary angle-closure glaucoma (PACG), primary angle closure (PAC), and PAC suspect (PACS).
Design: Retrospective, consecutive, interventional case series.
Participants: Seventy-three eyes with PACG, 81 eyes with PAC, and 77 eyes with PACS that underwent cataract surgery alone from April 2003 through March 2007, with a minimum 1 year follow-up period. Eyes that had a past history of acute primary angle closure or had undergone intraocular surgery or glaucoma laser treatment were excluded. Intervention: Two hundred and thirty eyes underwent phacoemulsification and intraocular lens (IOL) implantation and 1 eye did extracapsular cataract extraction and IOL implantation.
Main outcome measures: Intraocular pressure (IOP), the need for further antiglaucoma therapy, and progression rate of PAC/S to PACG.
Results: The follow-up period after the surgery was 39.8 ± 13.5 months (mean standard deviation). Postoperative IOP significantly reduced from the preoperative one at every follow-up time point in each group (PACG, PAC, PACS). In the PACG group, the mean IOP decreased from a preoperative value of 19.0 ± 4.4 mmHg to 15.1 ± 2.8 mmHg at the last visit ($P < 0.000001$) and the number of glaucoma medications decreased from 1.2 ± 1.5 to 0.71 ± 1.1 ($P = 0.012$). Forty-eight eyes (65.8 %) were followed up without any treatment, 22 eyes (30.1 %) with only medications, 1 eye underwent goniosynechialysis, and 2 eyes did trabeculectomy. In the PAC group, the mean IOP decreased from a preoperative value of 17.5 ± 3.2 mmHg to 15.9 ± 2.6 mmHg at the last visit ($P < 0.000001$) and the number of glaucoma medications decreased from 0.39 ± 0.85 to 0.11 ± 0.57 ($P = 0.002$). Seventy-eight eyes (96.3 %) were followed up without any treatment, 1 eye with only medication, 2 eyes underwent laser gonioplasty. In the PACS group, the mean IOP decreased from a preoperative value of 15.7 ± 2.5 mmHg to 14.3 ± 2.4 mmHg at the last follow-up ($P < 0.000001$) and all eyes were followed without glaucoma medication ($P = 0.034$). No eye with PAC or PACS progressed to PACG.
Conclusions: In primary angle closure eyes, cataract surgery alone significantly reduced both IOP and the number of glaucoma medications in the long term. Cataract surgery was effective to minimize the need for further treatment in PACG, and to halt progression of PAC/S to PACG.
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P532 MONITORING OF INTRAOCULAR PRESSURE AFTER MULTIPLE CAPSULAR TENSION RING IMPLANTATION

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Purpose: Outcomes of monitoring intraocular pressure (IOP) in case of patients they who underwent subluxated cataract surgery with posterior intraocular lens and multiple capsular tension ring (CTR) implantation, in comparison with patients after the same procedure with single CTR.
Methods: Retrospective study of 55 patients after cataract surgery and posterior intraocular lens implantation divided into two groups: first group with multiple CTR and second group with single CTR. First group consisted of 25 patients, mean age 66.3 ± 14.6 years. Second group consisted of 30 patients, mean age 67.6 ± 13.2 years. IOP before and 1-st day, 2, 4, 6 weeks after operation was measured using Goldmann applanation tonometry. Central corneal thickness (CCT; Visante OCT), visual outcomes, postoperative complications were analyzed. Patients with glaucoma were excluded from this study.
Results: In first group the mean value of IOP before operation was 14.83 ± 1.69 mmHg, 1-st day after operation 13.47 ± 1.86 mmHg, after 2 weeks 14.27 ± 1.39 mmHg, after 4 weeks 14.46 ± 1.46 mmHg and after 6 weeks 14.92 ± 1.28 mmHg. In second group value of IOP were, respectively: 15.12 ± 1.83 mmHg, 14.23 ± 1.59 mmHg, 14.84 ± 1.38 mmHg, 14.92 ± 1.43 mmHg, 15.08 ± 1.47 mmHg. There was no significant difference between IOP measurements ($p < 0.05$). The mean CCT in the first group was 530.47 ± 62.60 µm, in second group was 542.12 ± 53.72 µm. The mean BSCVA in the first group was 0.73 ± 0.29, in second group 0.68 ± 0.32. There was no significant difference between mean CCT and BSCVA.
Conclusions: Multiple CTR implantation does not increase IOP, CCT and gives satisfactory visual outcomes.
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P533 - withdrawn

12.12.3. Surgical treatment: Cataract extraction: Phacoemulsification

see also P225, P332

P534 PHACOEMULSIFICATION IN THE EYES WITH AHMED-GLAUCOMA-VALVE IN NEOVASCULAR GLAUCOMA

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Purpose: Phacoemulsification becomes the most effective method for treatment of cataracts in the eyes with Ahmed valve (AGV). Neovascularisation occurred due to diabetic retinopathy still to be the major risk factor for complications during ultrasound's intervention. Our purpose was to prevent intraoperative and postoperative complications in NVG with AGV and find the most optimal steps for that.
Design: AGV gives normalization of intraocular pressure (IOP) and minimization of new formed vessels in anterior chamber angle. Phacoemulsification could cause another wave of IOP elevation and increase neovascularisation.
Participants: To find the most effective steps, we investigate 38 eyes with neovascular (diabetic) glaucoma who had AGV implanted and and normal IOP, and whom phacoemulsification with lens implantation performed.
Methods: These eyes were undergone avastin intravitreal injection 1 week before surgery, kertotomy was done at least 4-5 mm farther from AGV tube location and minimal viscoelastic was used (anterior chamber could be filled by permanent irrigation through special canula). The tube in anterior chamber was maximally protected by special spatula. Mild inflammation after AGV implantation caused thickening of anterior and posterior capsules, which prevents frequent rupture of posterior capsule, which is very important for these eyes.
Main outcome measure: The measurements done before and after were visual acuity, IOP, B-scan, biomicroscopy to evaluate the level of vascularisation and the rate of complications. The results show that no IOP elevation found, 2 Pts had hypertensive fase to 21 and 24 mmHg.
Results: Vascularisation in anterior chamber did not get any worse. Visual acuity improved from ~20/400 before and ~20/40 after the surgery. No retinal detachments or choroidal detachment was found. Mild hyphema 2 mm for 3 patients. Inflammation was more often found (78%more than moderate), anti-inflammatory drugs were used to resolve it.
Conclusion: Pre- and intra- operative manipulations allow to significantly improve surgical outcomes in phacoemulsification for the eyes with AGV implanted due to NVG. Using this effects of outcomes increased to 30%.
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P535 THE RESULTS OF COMBINED INTERVENTIONS IN CO-EXISTING CATARACT AND REPEATED INTRAOCULAR PRESSURE ELEVATION AFTER PREVIOUS FILTERING GLAUCOMA SURGERY

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Purpose: To estimate the efficacy and complications after cataract removal with IOL implantation and restoration of filtering outflow pathway after previous glaucoma surgery with repeated IOP elevation.
Design: A retrospective analysis of 46 operations for cataract and repeated IOP elevation after previous glaucoma surgery has been performed. Surgical tactics was chosen on the basis of complex estimation of outflow block level including biomicroscopy, gonioscopy and ultrasound biomicroscopy of operation zone. The technique of operation included phacoemulsification of cataract with IOL implantation and an additional intervention restoring previously formed outflow pathway. Additional interventions were mechanical liberation of the inner ostium of the fistula, transcorneal or transconjunctival revision of operation zone with dissection of scars; in case of iris incarceration in operation zone intraocular posterior chamber revision was used. Before surgery, visual acuity ranged from light perception to 0.5 (mean, 0.18 ± 0.11), IOP varied from 20 to 49 mmHg (mean, 32.6 ± 0.13). All patients were on hypotensive drops.
Results: Complications included hypotony in 4 eyes, choroidal effusion - in 2, hyphaema - in 6. Inflammatory reaction was marked in 4 cases and hypertension in 5. Follow-up period was 12 to 48 months (mean, 26,4 ± 5,1). Late complications included secondary cataract in 6 cases, repeated IOP elevation in 23 eyes (11 of them were treated medically and 12 required repeated filtering surgery). By the end of follow-up period visual acuity ranged from 0.02 to 1.0 (mean, 0.43 ± 0.13), IOP was from 13 to 21 mmHg (mean, 17.3 ± 0.14).
Conclusions: The suggested surgical tactics gave a possibility to improve visual acuity and to lower IOP simultaneously, using the potential of previously performed filtering operation. Hypotensive effect without repeated operation in another zone was achieved in 34 cases (74%).

P536 COMPARISON OF THE EFFECTS OF VISCOELASTIC AGENTS ON POSTOPERATIVE INTRAOCULAR PRESSURE AND CENTRAL CORNEAL THICKNESS IN CLEAR CORNEAL PHACOEMULSIFICATION SURGERY

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Purpose: To compare the effects of the frequently used viscoelastic agents, such as, 1.4% Sodium hyaluronate, 3% Sodium hyaluronate combined with 4% Chondroitin sulfate and 2% Hydroxypropyl methylcellulose, in a routine no stitch, small incision - clear corneal phacoemulsification surgery on postoperative intraocular pressure and central corneal thickness.
Design – setting: This prospective randomized study performed in Department of Ophthalmology, Harran University School of Medicine.
Participants: Ninety eyes of 90 patients are equally divided into 3 groups in which a different viscoelastic agent was used.
Methods: All operations are performed by clear corneal - small incision endocapsular phacoemulsification and foldable acrylic intraocular lens implantation into the capsular bag by the same surgeon.
Main outcome measure: Intraocular pressure was measured by applanation tonometer and central corneal thickness was measured by ultrasonic pachymeter 24 hours before and 8, 16, 24 hours and 1 week after the operation.
Results: Statistically significant intraocular pressure increase was detected in all groups at postoperative 8th and 16th hour measurements. Despite to significant differences determined in the first 16 hours postoperatively, no statistically significant differences were identified among the viscoelastic agents in terms of intraocular pressure values at 24th hour measurements. The highest intraocular pressure values requiring urgent treatment in the first 16 hours after the operation were those measured in group following the operations in which Sodium hyaluronate-Chondroitin sulfate combination was used. Intraocular pressure spikes to 30 mmHg or higher occurred in 2 eyes in the Hydroxypropyl methylcellulose group, 4 eyes in Sodium hyaluronate group, 7 eyes in the Sodium hyaluronate-Chondroitin sulfate group ($P < .01$). An increase in the central corneal thickness was detected in all groups in the first postoperative day, but not statistically significant differences were found among the groups. In the measurements at 1st week intraocular pressures and central corneal thicknesses approached to their preoperative values and there were no significant differences among the groups.
Conclusions: Temporary intraocular pressure increase may be encountered during early postoperative period after clear corneal phacoemulsification surgery with especially heavier molecular weight viscoelastic substances. To minimize this risk to the lowest degree attainable, the viscoelastic substances should be removed from the anterior chamber and antiglaucomatous treatment should be applied postoperatively. No significant differences were determined among the most frequently used viscoelastic agents concerning their effect on central corneal thickness during the early postoperative period.
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P537 EFFECT OF CATARACT SURGERY ON ANTERIOR CHAMBER DEPTH, INTRAOCULAR PRESSURE AND CENTRAL CORNEAL THICKNESS IN PATIENTS WITH AND WITHOUT GLAUCOMA

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Purpose: To evaluate the impact of phacoemulsification on anterior chamber depth (ACD), central corneal thickness (CCT), and intraocular pressure (IOP) in eyes with open-angle glaucoma (OAG) and in eyes with no evidence of glaucoma.
Design: A comparative, non-randomized study.
Participants: Two groups of patients undergoing phacoemulsification with implantation PC IOL in January 2008 and February 2008. Group-N: 70 eyes (70 patients) without glaucoma. Group-G: 17 eyes (17 patients) with OAG: POAG (14), NTG (1), EXG (2).
Main outcome measure and Methods: ACD and CCT were examined by using anterior segment OCT and IOP was measured by non-contact tonometer. All measurements were realised before surgery and at the1st day (1.D), the 7th day (1.T) and 3 months (3.M) after surgery.
Results: The mean preoperative ACD in group-N 2.67 μm increased to 3.65 μm (Δ 0,98) at 1.D, 3.62 μm (Δ 0,95) at 1.T and 3.62 μm (Δ 0,94) at 3 months. The mean preoperative ACD glaucoma group 2.72 μm increased to 3.77 μm (Δ 1.05) at 1.D, 3.68 μm (Δ 0.96) at 1.T and 3.63 μm (Δ 0.92) after 3 months. The mean preoperative CCT in group-N 528.39 μm increased to 569.14 μm (Δ 40.75) at 1.D, 548.67 μm (Δ 20.28) at 1.T and 526.2 μm (Δ -2.19) at 3 months. The mean preoperative CCT in group-G 548.06 m increased to 588.65 μm (Δ 40.59) at 1.D, 570.29 μm (Δ 22.24) at 1.T and 547.12 μm (Δ -0.94) after 3 months. The mean preoperative IOP in non-glaucoma patients 17.64 mmHg and 20.24 mmHg in glaucoma patients increased to 18.40 mmHg (Δ 0.76) in group-N and 22.70 mmHg (Δ 2.46) in group-G at 1.D after surgery. The mean postoperative IOP in group-N decreased to 15.27 mmHg (Δ -2.37) at 1.T and 14.19 mmHg (Δ -3.45) after 3 months after surgery. The mean IOP in group-G decreased to 18.44 mmHg (Δ -1.80) at 1.T and 16.96 mmHg (Δ -3.28) after 3 months. All measurements of IOP were regulated by actual CCT.
Conclusion: In both groups, cataract surgery induces deepening of ACD and lowering of IOP. The mean increase of ACD was 35% in nonglaucoma patients and 33.8% in glaucoma patients after 3 months following surgery. The mean postoperative IOP in group-G decreased 16.20% and in group-N decreased 19.56% after 3 months. In both groups, the transient increase of CCT can be found on the 1st week following cataract surgery. The transient increase of IOP, which can be associated to retained viscoelastic substances or eventual structural changes in trabecular meshwork in patients with glaucoma can be found on the 1st day following

cataract surgery. In group-G the increase of IOP was 12.2% and in group-N the increase of IOP was 4.3%.

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12.14. Surgical treatment: Combined cataract extraction and glaucoma surgery

P538 PHACOEMULSIFICATION AND ENDOSCOPIC CYCLOPHOTOCOAGULATION AS PRIMARY SURGICAL PROCEDURE IN COEXISTING CATARACT AND GLAUCOMA

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Purpose: To evaluate the safety and efficacy of phacoemulsification and endoscopic cyclophotocoagulation (ECP) as a primary surgical treatment for glaucoma and cataract.

Methods: Three hundred sixty-eight eyes from 243 patients with primary open-angle glaucoma and cataract from the Centro Brasileiro de Cirurgia de Olhos that underwent an uncomplicated surgery from October 1998 to December 2004 with at least 2 years of follow-up were retrospectively enrolled. The patients were excluded if presented with a history of any intra-ocular surgery or glaucoma laser treatment. Qualified success was defined as 5 mmHg < intraocular pressure (IOP) < 21 mmHg with or without topical anti-glaucomatous drugs, and complete success as the same IOP levels without therapy at all timepoints. Additionally, the needed of any further glaucoma surgery was defined as failure.

Results: The mean follow-up was 35.15 ± 8.14 months. The IOP pre-operatively (23.07 ± 5.52 mmHg) was significantly greater than in the first day post-operatively (13.14 ± 6.09 mmHg), and months 1 (11.03 ± 2.59 mmHg), 6 (12.33 ± 3.01 mmHg), 12 (12.19 ± 2.19 mmHg), 24 (12.14 ± 2.89 mmHg) and in the last appointment (12.29 ± 2.44 mmHg) ($p < 0.001$ in all timepoints). The number of medications pre-operatively (1.44 ± 0.97) decreased (0.37 ± 0.74) ($p < 0,001$). Furthermore, there was significantly improvement in the LogMar visual acuity ($p = 0.01$). Three hundred thirty-four (90.76%) eyes achieved qualified success, and 205 (55.7%), complete success. Complications included immediate post-operative IOP spike 14.4% (53/368), post-operative fibrin exudates in anterior chamber 7.06% (26/368), cystoid macular edema 4.34% (16/368), transitory hypotony 2.17% (8/368), iris bomb 1.08% (4/368).

Conclusions: Phacoemulsification associated with endoscopic cyclophotocoagulation is safe and effective as a primary procedure for combined glaucoma and cataract.

P539 COMPARISON OF SURGICAL OUTCOME FOLLOWING PHACOEMULSIFICATION ALONE VERSUS COMBINED TRABECULECTOMY AND CATARACT SURGERY IN PATIENTS WITH ANGLE CLOSURE GLAUCOMA

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Purpose: To compare the surgical outcomes between phacoemulsification alone and combined trabeculectomy and cataract surgery in patients with primary angle-closure glaucoma (PACG).

Design: Retrospective comparative case series.

Participants: Forty one consecutive eyes (41 patients) with PACG who had phacoemulsification alone (20 eyes) or combined trabeculectomy and cataract surgery with mitomycin (21 eyes).

Methods: Records of patients with PACG who had undertaken phacoemulsification alone or combined trabeculectomy and cataract surgery with mitomycin were reviewed retrospectively. Preoperative and postoperation best-corrected visual acuity, intraocular pressure (IOP), number of anti-glaucoma medications, postoperative adverse events, and additional operation required were evaluated.

Main outcome measures: Mean age was 69.43 ± 9.75 years in the phacoemulsification group and 72.05 ± 8.03 years in the combined trabeculectomy and cataract surgery group ($p = 0.262$). Mean preoperative visual acuity was 0.35 ± 0.28 for phacoemulsification group and 0.27 ± 0.21 for combined trabeculectomy and cataract surgery group ($p = 0.485$). Mean visual acuity at last follow up was 0.58 ± 0.38 for phacoemulsification group and 0.54 ± 0.31 for combined trabeculectomy and cataract surgery group ($p = 0.599$). Mean preoperative IOP was 23.86 ± 10.23 mmHg for phacoemulsification group and 19.55 ± 8.54 mmHg for combined trabeculectomy and cataract surgery group ($p = 0.179$). Mean last IOP was 13.71 ± 2.33 mmHg for phacoemulsification group and 13.85 ± 5.65 mmHg for combined trabeculectomy and cataract surgery group ($p = 0.328$). Decrease of IOP after surgery was larger in the combined trabeculectomy and cataract surgery group (10.14 ± 9.49 mmHg) rather than the phacoemulsification group (5.70 ± 9.29 mmHg), but it was not statistically significant ($p = 0.220$). Preoperative number of medication was 1.67 ± 1.02 for phacoemulsification group and 2.30 ± 0.80 for combined trabeculectomy and cataract surgery group ($p = 0.045$). Number of medication at last follow-up was 0.43 ± 0.60 for phacoemulsification group and 0.55 ± 0.69 for combined trabeculectomy and cataract surgery group ($p = 0.639$).

Results: Mean follow-up period was 25.76 ± 16.77 months. There was no significant difference of best-corrected visual acuity and IOP at preoperative and last follow-up in both study groups. Although the number of anti-glaucoma medications was higher in the combined trabeculectomy and cataract surgery group preoperatively ($p = 0.045$), but it was similar in both groups at last follow-up ($p = 0.639$). Postoperative hypotony (2 cases) occurred only after combined trabeculectomy and cataract surgery but not after phacoemulsification; second operation (1 case) was needed only after

phacoemulsification. Other postoperative complications were not detected.
Conclusions: In PACG patients, phacoemulsification only and combined trabeculectomy and cataract surgery both showed a good surgical outcome. It can be presumed that both procedures are equally effective in treating patients with PACG.
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P540 OUTCOMES OF COMBINED CATARACT AND TRABECULECTOMY SURGERY
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Objective: To assess long-term outcomes of combined cataract and trabeculectomy surgery.
Design: Prospective, non-comparative, longitudinal, outcomes analysis of combined trabeculectomy and cataract surgeries performed from 1987 to 2009.
Participants: One thousand twenty-one patients (442 male, 579 female) with glaucoma and visually significant cataract who had combined cataract and trabeculectomy surgery.
Methods: One thousand three hundred fifty-three combined cataract and trabeculectomy surgeries were performed on 1021 patients (332 on both eyes) from 1987-2009 by one surgeon. Data collected included age, gender, race, glaucoma diagnosis, history of previous ocular surgery, axial length, type of cataract surgery, antimetabolite use, pre- and postoperative visual acuity, IOP, and glaucoma medications, time to glaucoma reoperation (failure), and postoperative events. A survival analysis was performed and risk factors for poor visual acuity outcome and filtering surgery failures were assessed.
Main outcome measures: Postoperative visual acuity, IOP reduction, glaucoma medication change, time to filter failure, and postoperative events, both related to and unrelated to surgery.
Results: At the time of last follow-up, visual acuity was improved in 1047 (77.4%), unchanged in 110 (8.1%), and worse in 196 (14.5%). Mean preoperative IOP decreased from 21.2 to 16.2 mmHg postoperatively, and mean glaucoma medication decreased from 2.2 to 0.7 (all $p < 0.001$). Mean time to glaucoma surgical reoperation was 40.9 months (range 1-177 months) for 91 (6.7%) of eyes with filter failure. Adverse events included endophthalmitis 1.6%, choroidal hemorrhage 0.9%, retinal detachment 0.4%, and revision of bleb for late leak 0.9%. One percent have needed corneal transplant. Antimetabolite use was associated with a lower postoperative IOP and increased risk of late bleb leak. Increasing age was associated with poorer long-term visual acuity. Despite early improvement of visual acuity, late postoperative loss of visual acuity occurred because of events (dry AMD 2.8%, wet AMD 1.9%, myopic degeneration 0.6%, ERM 2.4%, CRVO/BRVO 0.6%, DME 0.7%, NVG/PDR 0.2%, ocular lymphoma 0.1% and compressive optic neuropathy 0.1%) not related to combined surgery. Severe dementia precluded visual acuity assessment in 1.0% by the time of last follow-up.
Conclusions: Combined cataract and trabeculectomy surgery improves visual acuity and reduces IOP and glaucoma medication. Serious adverse events were uncommon. Glaucoma reoperation (6.7%) was associated with glaucoma diagnosis other than open-angle, history of previous ocular surgery and high preoperative IOP. Mean IOP was reduced by 5.0 mmHg and glaucoma medication by 1.5. Antifibrosing agents may improve postoperative IOP reduction but with greater risk. Despite sucessful surgery, late visual loss can occur as a result of nonglaucomatous optic nerve and retinal disorders.
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P541 COMBINED PHACOEMULSIFICATION AND VALVULATED GLAUCOMA DRAINAGE IMPLANT PURPOSE
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Objective: To examine the indications, safety and efficacy of the combined procedure of phacoemulsification and a valvulated glaucoma drainage implant. To analyze the visual results and the intraocular pressure (IOP) lowering effect.
Design: Prospective case series of 17 eyes of 15 patients.
Participants: Seventeen eyes of 15 patients.
Methods: We conducted a demographical characterization of patients an analysis of their diagnosis, medications, IOP and visual results, also early and late complications were recorded. We defined absolute success as IOP lowering below 21 mmHg without the use of topical drugs, whereas relative success was defined as IOP under 21 mmHg with the use of adjuntive drugs.
Results: The mean age was 58.5 ± 19 years. The most frecuent reason for the combined procedure was failure of previous trabeculectomy, this was the cause in 10 patients (59%). In 72% of eyes visual accuity increased and in 28% of them it remained unchanged. Mean IOP before surgery was 28.4 mmHg and 13.7 mmHg after the combined procedure (this represents a 52% decrease). Absolute success was achieved in 47%, qualified success in 53% with no fail-

ures. IOP lowering drugs descended from a mean of 3 preop to 1 postop. The most frecuent complication was a hypertensive phase, which was happened in 59% of eyes.
Conclusion: Combined surgery represents a safe and effective alternative in refractory glaucoma associated with a visually significant cataract.
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P542 OUTCOMES OF TRABECULECTOMY FOLLOWED BY CATARACT SURGERY VS. CATARACT SURGERY FOLLOWED BY TRABECULECTOMY VS. PHACOTRABECULECTOMY

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Objective: Should cataract surgery or trabeculectomy be performed first, or is a combined procedure the best option?
Methodology: Retrospective case note review of 101 eyes. Forty-two eyes had trabeculectomy followed by cataract surgery, 26 eyes had cataract surgery followed by trabeculectomy and 33 eyes had phacotrabeculectomy. Information collected on diagnosis, combination of surgery, surgical augmentation, intraocular pressure, topical antihypertensives, further trabeculectomy bleb manipulation and complications.
Results: The mean time between trabeculectomy and cataract surgery was 39.3 months (7-122) and the mean follow-up time was 39.9 months (3-108). Intraocular pressure was reduced after the trabeculectomy, and this reduction was generally maintained after cataract surgery was performed, with an overall reduction in topical glaucoma medications for most patients. One NTG patient required a series of 5 fluorouracil injections to maintain bleb function. Two POAG and one PXF patient required type 2 needling, and one POAG and one PXF patient needed to have a repeat trabeculectomy augmented with 5 fluorouracil (initial surgery not augmented). There was no worse outcome in patients that had cataract surgery within 12 months of their trabeculectomy. The mean time between cataract surgery and trabeculectomy was 21.62 months (1-78), and mean follow-up after cataract surgery was 41.27 months (7-88). Cataract surgery appears to have had little benefit on the intraocular pressure or the number of topical glaucoma medications. After trabeculectomy there was a fall in intraocular pressure as well as a decrease in the number of topical medications required, with only seven patients staying on medication. Sixteen patients had 1-4 injections of 5 fluorouracil in clinic with needling to maintain a functional bleb. One of the Fuchs uveitis patients had a further trabeculectomy with mitomycin C (previously 5 fluorouracil augmented), and one of the PXF patients required a type 2 needling. About two-thirds of patients were off their topical medications with IOPs below 20 mmHg. In the first few months after surgery 20 patients required 1-4 injections of 5 fluorouracil in clinic with needling to maintain a functional bleb. One NAG patient required bleb resuturing. One POAG and one NAG patient were later treated with cyclodiode for IOP lowering but still require one and three topical medications (respectively) to maintain a stable IOP. Two uveitic patients and 2 POAG patients had type 2 needling at 14-24 months. All now have good intraocular pressure on no medication. The two main failures are both NTG patients on four topical medications and oral acetazolamide, with IOPs in the mid twenties and no better than before surgery.
Conclusion: Fit the procedure to the current status of the patient. Trabeculectomy alone is always best. Cataract with stable controlled glaucoma → cataract surgery. Asymptomatic cataract with progressing glaucoma → trabeculectomy. Symptomatic cataract and progressing glaucoma → consider phacotrabeculectomy or non-penetrating glaucoma surgery combined with cataract surgery.
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P543 COMBINED CATARACT SURGERY WITH CANALOPLASTY VERSUS PHACO-TRABECULECTOMY: A HEAD TO HEAD COMPARISON

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Purpose: To compare and evaluate outcomes and complications after combined phacoemulsification and non-penetrating canaloplasty versus combined phacoemulsification with conventional trabeculectomy as surgical treatment for patients with concurrent cataract and open-angle glaucoma.
Methods: This study was a retrospective chart review comparing 27 patients who underwent combined phacoemulsification and conventional trabeculecomy with adjunctive intraoperative mitomycin-C versus 27 patients who underwent combined phacoemulsification and non-penetrating Schlemm's canaloplasty for open-angle glaucoma in a non-randomized fashion. Data with respect to demographics, ocular history, indication for surgery, intraoperative and postoperative complications were collected. Preoperative and postoperative visual acuity (VA), intraocular pressure (IOP), and number of glaucoma medications were recorded at 6 months postoperatively. Snellen visual acuities were converted to logMAR values for statistical analysis.
Results: Best corrected visual acuity preoperatively in the phacotrabeculectomy group improved by 1 line in Snellen

visual acuity while the phaco-canaloplasty group showed a 2.5 line improvement at 6 months postoperatively. IOP in the phacotrabeculectomy group improved from 23.5 mmHg to 13.4 mmHg ($p < 0.01$) with the average number of topical glaucoma medications decreasing from 3.8 preoperatively to 0.4 postoperatively ($p < 0.01$). In the phaco-canaloplasty group, IOP improved from 21.8 mmHg to 13.4 mmHg ($p < 0.01$) with the average number of topical glaucoma medications decreasing from 4.1 to 0.4 ($p < 0.01$). Statistical analysis comparing phacotrabeculectomy versus phaco-canaloplasty with regards to visual acuity change, IOP reduction, and medication usage reduction showed no significant difference between the two groups. Postoperative complications from the trabeculectomy group included bleb fibrosis requiring revision, bleb encapsulation, hypotony, and suprachoroidal hemorrhage. Complications in the canaloplasty group included localized Descemet's detachment, hyphema, iris incarceration into the trabeculodescemet window, conversion to penetrating subconjunctival bleb or tube shunt.

Conclusions: Phacoemulsification combined with conventional trabeculectomy when compared with phacoemulsification combined with non-penetrating Schlemm's canaloplasty showed no statistically significant difference with regards to visual acuity, IOP reduction, and reduction in medication usage. Combination cataract surgery with non-penetrating canaloplasty may provide cataract and glaucoma patients with an equally effective and possibly safer alternative to standard phacotrabeculectomy with its known extensive complication profile.

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P544 EFFECT OF PHACOEMULSIFICATION ON THE MORPHOLOGY OF THE ANGLE IN PRIMARY ANGLE-CLOSURE GLAUCOMA: AN ULTRASOUND BIOMICROSCOPIC STUDY

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Objective: To evaluate the change in morphology of the anterior chamber angle after phacoemulsificiation in primary angle-closure glaucoma (PACG) using ultrasound biomicroscopy (UBM).

Design: Prospective interventional study

Participants and/or controls: Patients with primary angle closure as defined by presence of an occludable angle with raised intraocular pressure (IOP) or peripheral anterior synechiae (PAS) with glaucomatous optic neuropathy, and a visually significant cataract.

Methods: Eligible patients were recruited from the Glaucoma Clinic of a tertiary care referral centre. Pre-operative BCVA, IOP, Gonioscopy, Optic disc evaluation, number of antiglaucoma medications required for IOP control were noted. The axial length, lens thickness, anterior chamber depth, AOD 250, AOD 500, TCPD were measured on the UBM. All patients underwent clear corneal phacoemulsificiation with implantation of foldable IOL. All parameters were noted 6 weeks following surgery.

Main outcome measure: Change in anterior chamber angle parameters on the UBM.

Results: Nine males and 4 females were recruited. The mean age was 62 ± 10.4 years. Mean pre-operative visual acuity, IOP, axial length, lens thickness and anterior chamber depth, were 0.4 ± 0.16, 15.2 ± 4.9 mmHg, 22.7 ± 0.92 mm, 2.6 ± 0.46, 4.76 ± 0.28 mm and 2.6 ± 0.46 respectively. The mean post-operative visual acuity, IOP, and anterior chamber depth were 0.56 ± 0.36 (0.069), 16.15 ± 6.6 mmHg ($p = 0.753$) and 4.07 ± 0.38 mm ($p = 0.001$). The AOD 250, AOD 500 and TCPD changed significantly from 70.1 ± 40.9, 132.1 ± 76.8 and 731.9 ± 138.9 microns to 107.4 ± 49.4 ($p = 0.011$), 193.2 ± 77.03 ($p = 0.009$) and 833.54 ± 111.7 ($p = 0.007$) microns respectively. Requirement of topical anti-glaucoma drugs reduced significantly, and 3 patients were on systemic acetazolamide pre-operatively compared to none after surgery.

Conclusions: Phacoemulsificiation appears to significantly open the anterior chamber angle in patients with PACG, and favourable alter the course of disease by better controlling the IOP also.

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P545 COMPARISON OF EXTRACAPSULAR CATARACT EXTRACTION WITH IOL PLUS TRABECULECTOMY WITH PHACOEMULSIFICATION AND IOL PLUS TRABECULECTOMY - SHORT TERM RESULTS IN OMANI (ARAB) POPULATION

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Purpose: The aim of this study is to find out if there is any significant difference in the outcome after combined trabeculectomy with cataract extraction by phaco or ECCE in Omani (Arab) population.
Design and Participants: Twenty eyes of 20 patients who had undergone combined extracapsular cataract extraction (ECCE), intra-ocular lens (IOL) implantation and trabeculectomy (ECCE-trab) and 20 eyes of 20 patients who had undergone combined cataract phaco-emulsification, IOL implantation and trabeculectomy (phaco-trab) were reviewed over a period of 6-12 months.
Results: Postoperatively, intra-ocular pressure (IOP) in both groups fell significantly as compared to the preoperative IOP. After 6-12 months, IOP in the phacotrab group was similar to that in the ECCE-trab group. The number of pre-operative medications were significantly reduced after the surgery in both groups and there was no statistical difference between the two groups. Visual recovery was faster in the phaco-trab group as compared to the ECCE-trab group. The frequency of complications was significantly different between the two groups specially the appearance of post operative inflammation which was higher in the ECCE-trab group.
Conclusion: Both combined surgery techniques (phacotrab and ECCE-trab) are effective and have similar short-term results. However phacoemulsification decrease the post operative complications rate. The pattern of visual outcome with IOP control and rate of complication in this Arab subset of patients is not very different from the other Caucasian subset of patients.
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P546 MULTIPLE iSTENT SCHLEMM'S CANAL PLACEMENTS COMBINED WITH PHACOEMULSIFICATION

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Purpose: The iStent is a trabecular stent placed through the inner wall of Schlemm's canal. The purpose of this study was to evaluate the IOP-lowering effect and side effect profile of multiple iStent implantation combined with phacoemulsification.
Design: Prospective non-comparative consecutive series.
Participants: Twenty-five patients with open angle glaucoma and cataract.
Methods: Participants underwent combined phacoemulsification with either two (n = 14) or three (n = 11) iStent implantations within Schlemm's canal was conducted. Pre- and postoperative IOP and meds were compared, and postoperative complications, including hypotony, IOP spikes, stent migration or blockage were assessed.
Main outcome measures: Intraocular pressure, glaucoma medications.
Results: In the entire cohort, over a minimum of 6 months follow up, mean preoperative IOP was reduced from 20.5 to 13.2 mmHg ($p < 0.001$), with a reduction of medications from a mean of 2.9 to 1.1 meds ($p < 0.001$). The 3-stent group was on less medications postoperatively than the 2-stent group ($p = 0.02$) with similar postoperative IOPs. Two eyes had iris synechaie to the iStent which were successful released with laser. There were no serious postoperative complications.
Conclusions: Multiple iStent placements in Schlemm's canal, combined with phacoemulsification, had a significant IOP lowering effect without serious adverse events. Three-stent placement seemed to be more effective than 2-stent placement.

P547 IS COMBINED PHACOEMULSIFICATION WITHTRABECULECTOMY WITH VERY LOW DOSE MITOMYCIN-C AS EFFECTIVE AND SAFE AS TRABECULECTOMY AUGMENTED WITH MTOMYCIN-C

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Objective: To compare the results of combined phacoemulsification and trabeculectomy with very low dose mitomycin-C (MMC) (0.1 mg/ml) and MMC augmented trabeculectomy. This shall be discussed in context of the debate regarding lower efficacy of combined phacoemulsification and trabeculectomy compared to trabeculectomy alone. The published world literature is discussed for an evidence based discussion.
Design: A retrospective case note review of consecutive cases undergoing combined phacoemulsification and trabeculectomy with very low dose MMC and those undergoing MMC augmented trabeculectomy at a university hospital in UK. The literature comparing results of combined phacoemulsification and trabeculectomy and MMC augmented trabeculectomy is reviewed and discussed.
Participants: Thirty-nine patients who had a phacoemulsification and trabeculectomy with very low dose MMC over last five years and had a minimum regular follow up period of 12 months were compared with 22 patients who underwent a MMC augmented trabeculectomy.
Methods: A two-site combined phacoemulsification and trabeculectomy with very low dose mitomycin-c or a standard a trabeculectomy with MMC was done. Statistical analysis including survival analysis was done. The literature comparing results of combined phacoemulsification and trabeculec-

tomy and MMC augmented trabeculectomy is reviewed and discussed.
Main outcome measures: Main outcome measures were intraocular pressure (IOP) reduction, change in visual acuity, intraoperative and postoperative complications survival of the IOP reduction effect and the number of postoperative visits and interventions required. The published success rates and effectivity of the two procedures are compared.
Results: In our study group the mean IOP reduction was 44.32% from a preoperative mean IOP of 28.3 (± 10.3) mmHg to postoperative mean IOP at last follow-up visit of 12.9 (± 3.36) mmHg. Snellen acuity improved or remained same in 94.9% of cases. No intraoperative complications or major postoperative complications were seen in this series. Minor postoperative complications like a small leak or hyphema were noted in a small number of patients. The mean IOP drop was lower than that achieved in the patients undergoing only MMC augmented trabeculectomy (61.8%), but there was no significant difference in complications and number of postoperative visits required (table1). The published literature suggests that Mitomycin C improves efficacy of combined phacoemulsification and trabeculectomy but increases the complication rate. We found that the studies using MMC have mainly used a higher concentration (0.4 to 0.5 mg/ml) which can cause the higher rate of complications.
Conclusion: Combined phacoemulsification and trabeculectomy with a very low dose mitomycin-C is safe and effective in suitable patients. The IOP reduction achieved may be more with MMC trabeculectomy alone.
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P548 A PROSPECTIVE RANDOMIZED DOUBLE-BLIND 15-MONTHS PILOT STUDY ON THE EFFICACY OF THE TRABECULAR STENT (ISTENT) IMPLANTATION WITH COMBINED PHACOEMULSIFICATION
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Aim: To evaluate the difference of IOP lowering effect in two groups of primary open-angle glaucoma patients (POAG) undergoing phaco with implant of the iStent (group A) or phaco alone (group B).
Methods: Group A (12 eyes) and B (24) were matched. IOP was measured at 24 h, 1 week and at 1, 2, 3, 6, 9, 12 and 15 months. At 15 months the patients were washed out (1 m).
Results: IOP was not significantly different between group A and B throughout the follow-up. At 15 months group A was on a significantly lower number of drugs (A: 0.5, B: 1.3; $p < 0,05$), with no serious adverse events. After wash-out, group A had a significantly lower IOP (A: 16.6 ± 3.1; B: 19.2 ± 3.5; $p < 0,05$).
Conclusions: The iStent can provide a significant IOP reduction when compared with phaco alone in POAG patients.

12.14.2. Surgical treatment: Combined cataract extraction and glaucoma surgery: Extracapsular

P549 INTRAOCULAR PRESSURE CONTROL AFTER GONIOSYNECHIALYSIS IN EYES WITH PRIMARY ANGLE CLOSURE AND PRIMARY ANGLE-CLOSURE GLAUCOMA
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Purpose: To evaluate the effect of goniosynechialysis on intraocular pressure (IOP) control for primary angle closure (PAC) and primary angle-closure glaucoma (PACG).
Design: Retrospective, consecutive, noncomparative, interventional case series.
Participants: Patients with PAC or PACG who underwent surgery to lower IOP between June 1992 and December 2007 were included in this study. The extent of peripheral anterior synechiae of all eyes was 180 degrees or more.
Methods: Goniosynechialysis (with cataract surgery for phakic eyes) was performed in 32 eyes with PAC and 72 eyes with PACG.
Main outcome measure: Surgical outcome was assessed in terms of IOP change, and additional glaucoma medication.
Results: Patients ranged in age from 47 to 83 years (mean, 67.1 ± 9.5), and the mean follow-up was 6.2 ± 10.3 years. In 98 eyes (94.2% of all eyes), IOP was controlled below 21 mmHg after surgery. IOP averaged 23.6 ± 7.6 mmHg preoperatively, 15.0 ± 3.2 mmHg after 6 months, 14.7 ± 3.0 mmHg after 1 year, 14.4 ± 2.6 mmHg after 5 years and 14.2 ± 3.3 mmHg after 10 years. The mean postoperative IOP was consistently lower than preoperative IOP after surgery over a period of up to 10 years, and the mean number of glaucoma medication significantly decreased postoperatively. In 6 eyes (5.8 % of all eyes), additional glaucoma surgery was required to lower IOP after goniosynechialysis. No major surgical complications (except for one ciliary block glaucoma) occurred in any cases.
Conclusions: Goniosynechialysis was a safe and effective procedure to lower IOP in eyes with PAC or PACG.
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P550 MITOMYCIN C AUGMENTED TRABECULECTOMY COMBINED WITH SINGLE-SITE MANUAL SMALL INCISION CATARACT SURGERY-A RETROSPECTIVE ANALYSIS

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Purpose: To analyze the outcomes of Mitomycin C (MMC) augmented trabeculectomy combined with manual small incision cataract surgery (MSICS/Trab) at 6 months.
Design: Retrospective analysis of case records of patient who underwent MSICS/Trab.
Participants and Methods: Records of 103 MSICS/Trab augmented with MMC (two minutes of 0.2 mg/ml) performed from January 2006 to May 2007, by a single, experienced surgeon, were reviewed by an independent investigator. MSICS was done through a superior straight scleral tunnel and after implantation of PCIOL; a Kelly's punch was used to make the internal ostium of the trabeculectomy. Peripheral iridectomies were performed and scleral tunnel was closed with two 10'0 nylon suture.
Main outcome measure: Intraocular pressure (IOP) reduction and achievement of target IOP (< 18 mmHg) at 6 months.
Results: The minimum follow-up was 6 months for all patients. Out of the 103 patients, 64 (62.1%) had primary open-angle glaucoma (POAG), 23 (22.3%) had secondary open-angle glaucoma (SOAG) due to pseudoexfoliation (PXF) or pigment dispersion (PD) and 16 (15.5%) had chronic angle-closure glaucoma (CACG). The demographics and mean IOP at the time of surgery (30.4 ± 10.3 mmHg) were comparable in all three groups. A significant reduction in IOP levels (16.64 ± 4.75 and 16.59 ± 4.01 mmHg) was observed at 3rd and 6th month follow up ($p = 0.035$) using the paired T-test, irrespective of the type of glaucoma. Subgroup analysis showed that there was a significant difference in IOP levels of CACG group compared to the SOAG group ($p = 0.015$) at 6 months follow up using the Mann-Whitney Test for statistical significance. However, no statistically significant difference was observed in the IOP comparisons between POAG and CACG groups or POAG and SOAG groups. Intraoperative as well as post operative complications were similar in all the three groups. About 10.7% patients needed one antiglaucoma medication to achieve target IOP at 6 months and 2 patients need 2 antiglaucoma medications.
Conclusion: MMC augmented MSICS/Trab is a safe and effective method of tackling coexistent glaucoma and cataract. Results in CACG seem to be better than SOAG; however POAG and CACG results are comparable.
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12.14.3. Surgical treatment: Combined cataract extraction and glaucoma surgery: Phacoemusification

see also P062, P140, P492

P551 COMBINED PHACOEMULSIFICATION AND VISCOGONIOSYNECHIALYSIS IN THE MANAGEMENT OF PATIENTS WITH CHRONIC ANGLE-CLOSURE GLAUCOMA

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Objectives: Cataract extraction in eyes with angle-closure glaucoma lowers the intraocular pressure. However, the trabecular meshwork will remain occluded by peripheral anterior synechia (PAS) and only is exposed if goniosynechialysis is performed to break the PAS. This study was conducted to evaluate the effectiveness of phacoemulsification and viscogoniosynechialysis in the management of patients with chronic angle-closure glaucoma (CACG).
Design: Interventional study.
Participants and controls: Fifty-six eyes of 45 recruited patients were classified as medically controlled CACG (IOP≤21 mmHg) as group 1 comprising 35 eyes, and medically uncontrolled CACG (IOP > 21 mm-Hg with maximum tolerated medications) as group 2 including 21 eyes. All of the patients had at least one quadrant without peripheral anterior synechia in indentation gonioscopy by Sussman goniolens.
Intervention: In all patients, the cataract extraction was performed with routine phacoemulsification through a temporal clear corneal incision and a foldable posterior chamber intraocular lens was placed within the capsular bag. Then, with a viscodispersive ophthalmic viscosurgical device (hydroxypropyl methylcellulose 2%) the anterior chamber was deepened and then the OVD was injected two times over the entire angle to break the synechia, principally to the area of PAS without touching the trabecular meshwork or iris. At the end of the surgery the OVD was carefully removed and the anterior chamber was formed with balanced salt solution.
Main outcome measures: Surgical outcome was assessed as IOP ≤21 mmHg with (relative success) or without (absolute success) medications, the number of anti-glaucoma medica-

tions4, complications, need for further surgeries, as well as visual acuity, and status of angle in gonioscopy.
Results: There were no statistically significant differences between the 2 groups regarding the age and gender. In group 1, the mean IOP and number of medications declined from 16.7 ± 2.9 to 14.4 ± 2.9 ($p < 0.0001$) and 2.6 ± 0.8 to 0.82 ± 0.82 ($p < 0.0001$), respectively. The absolute success rate at the last follow up (9 ± 5.3 months) was 40%. In group 2, the mean IOP and number of medications diminished from 27.95 ± 8.1 to 15.5 ± 2.8 ($p < 0.0001$) and 2.9 ± 0.62 to 1.2 ± 1.2 ($p < 0.0001$), respectively. The absolute success rate was 38.1% at the last follow up (9.5 ± 5.3 months). Postoperatively, seven patients developed pupillary fibrin formation that was treated using steroid and ND:YAG laser. In the two other patients, the medically unresponsive cystoid macular edema was treated successfully by intravitreal Bevacizumab.
Conclusion: Combined phacoemulsification and viscogoniosynechialysis seems to be an effective surgical procedure in the treatment of patients with CACG whether controlled or uncontrolled by medication.
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P552 OUTCOME OF ONE-SITE AND DOUBLE-SITE PHACOTRABECULECTOMY USING ACRYLIC ASPHERIC FOLDABLE IOL IN PATIENTS HAVING COEXISTING CATARACT AND GLAUCOMA
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Purpose: To compare the outcome of single-site and double-site phacotrabeculectomy in patients having co-existing cataract and glaucoma.
Design: Prospective non-randomized comparative study.
Participants: A total of 82 eyes underwent phacotrabeculectomy.
Method: Forty-two eyes of 40 patients underwent double site phacotrabeculectomy using superior triangular flap with foldable acrylic IOL. Similary, 40 eyes of 40 patients underwent double site phacotrabeculectomy with 2.8 mm temporal incision and superior trabeculectomy using foldable aspheric acrylic IOL.
Main outcome measure: Mean IOP at a mean follow-up of 18 months and no. of antiglaucoma medication at the end of follow-up.
Results: The mean IOP lowered from 24.81 ± 5.24 mmhg to 13.9 ± 2.1 mmHg after a mean follow-up of 18 months in patients undergoing one-site phacotrabeculectomy. Two patients required 1 topical antiglaucoma medication. Similarly, mean IOP decreased from 25.6 ± 4.4 mmHg to 14.3 ± 1.95 mmHg after a mean follow up of 18 months in patients undergoing double-site procedure. Two patients required antiglaucoma medication to control IOP. There was no statistically significant difference in controlling IOP between the two groups ($p > 0.1$).
Conclusion: Both one-site and double-site phacotrabeculectomy appears to be safe and effective technique for controlling IOP in patients having co-existing cataract and glaucoma.
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P553 ASTIGMATISM SURGICAL CORRECTION IN COMBINED GLAUCOMA AND CATARACT SURGERY
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Objective: To study the corneal refractive dynamics after phacotrabeculotomy with paired opposite clear corneal incisions (OCCIs).
Design: Prospective clinical investigation.
Methods: Sixty-three patients (63 eyes) with a mean age of 70.7 ± 1.15years (range 37 to 96 years) who underwent standard phacotrabeculotomy with IOL implantation have been under our observation. Inclusion criterion was the preexisting ATR corneal astigmatism (range 0.5 D to 5.5 D). None of the patients had a history of previous ocular surgery or disease that affected corneal refraction. All patients were divided into 2 groups. The first group - 30 patients (30 eyes) after phacotrabeculotomy with IOL implantation through temporal incision, and the second group - 33 patients (33 eyes) after phacotrabeculotomy with paired OCCIs. The horizontal corneal axis was marked 0.5 mm anterior to the limbus with YAG Laser before surgery with the patient in an upright position. The surgeries were performed by the same experience surgeon. The surgical methods in all eyes were identical. A temporal clear corneal incision was created with a 3.0 mm keratome. A similar incision was made opposite the first incision on the axis 0°-90° in the second group. All patients received complete ophthalmic examination at baseline. Preoperatively and 1, 3, 6 and 12 months postoperatively corneal refraction and corneal topography with orbscan were evaluated. Student t test was used for statistical analysis.
Main outcome measure: Changes in corneal refraction.
Results: There were no complications in any patient. There

was no statistically significant difference in the spherical equivalent of corneal refraction pre- and postoperatively (P > 0.05). Flattening of the cornea in meridian of phacoincision and steepening in perpendicular meridian occurred in all cases. It have been established, that mean corneal refraction changes in horizontal axis was -0.26± 0.06 D and -1.14 ± 0.13 D in group 1 and group 2, respectively. The mean corneal refraction changes in vertical axis was +0.18 ± 0.06 D and +0.78 ± 0.09 D in group 1 and group 2, respectively. The mean astigmatic surgical correcting effect was 0.44 ± 0.05 D after phacotrabeculotomy with single temporal clear corneal incision and 1.91 ± 0.17 D after phacotrabeculotomy with paired OCCIs.

Conclusions: More expressed surgically induced corneal astigmatism was formed in the group after phacotrabeculotomy with OCCIs (1.91 ± 0.17 D) than after phacotrabeculotomy with temporal clear corneal incision (0.44 ± 0.05 D). Paired OCCIs may be recommended in the horizontal meridian of eyes with preexisting corneal ATR astigmatism of 2.0 D in phacotrabeculotomy.

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P554 RESULTS OF COMBINED PHACOEMULSIFICATION AND VISCOCANALOSTOMY IN CATARACT ASSOCIATED WITH PSEUDOEXFOLIATIVE GLAUCOMA VERSUS PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: To study the outcome and the rate of intraoperative and postoperative complications of combined viscocanalostomy and phacoemulsification (phacoviscocanalostomy) in eyes with pseudoexfoliation glaucoma (PEXG) versus eyes with primary open-angle glaucoma (POAG).

Methods: A prospective comparative study that included 60 consecutive eyes of 60 patients with medically uncontrolled PEXG (30 eyes) or POAG (30 eyes) associated with visually significant cataract. Phacoviscocanalostomy was performed in all patients. Success rate based on postoperative intraocular pressure (IOP) reduction and requirement for topical antiglaucoma medication was evaluated as the main outcome measure. Visual acuity and complication rates were secondary outcomes.

Results: The mean follow-up was 19.7 ± 7.01 months (range 12-36 months). There was a statistically significant decrease in mean IOP in both groups at all postoperative follow up intervals ($p < .05$). At last postoperative visit, the mean percentage of IOP reduction was 49.8% in the PEXG group, and 30.9% in the POAG group. Complete surgical success (IOP ≤ 21 mmHg without medication) was achieved in 28 eyes (93.3%) in the PEXG group, and in 25 eyes (83.3%) in the POAG group. Qualified success (IOP ≤ 21 mmHg with or without glaucoma medication) was achieved in all eyes (100%) of both groups. All patients in the study demonstrated significant improvement of uncorrected and best-corrected visual acuity postoperatively. Transient complications that did not affect the surgical outcome included: Descemet membrane microperforations, macroperforation, zonular dehiscence, vitreous loss, and postoperative transient IOP spike and iris plugging. No eye developed a trabeculectomy-type bleb, hyphema, fibrin exudation, or bleb-related complications. None required peripheral iridectomy, goniopuncture, or further glaucoma surgery.

Conclusion: Phacoviscocanalostomy achieved excellent IOP control and visual acuity improvement in both PEXG and POAG patients with coexisting cataract. The PEXG group demonstrated lower IOP reduction and fewer postoperative antiglaucoma medications than the POAG group. Complication rate was low and did not affect the surgical outcome. Therefore, phacoviscocanalostomy is an effective and safe surgical procedure that can represent an alternative to phacotrabeculectomy in both groups of patients.

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P555 GOLD MICRO SHUNT COMBINED WITH CATARACT SURGERY FOR OPEN-ANGLE GLAUCOMA PATIENTS TREATMENT – SHORT-TERM RESULTS

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Purpose: To evaluate the effectiveness and safety of phacoemulsification and GMS+ for POAG treatment in 18 months follow-up.

Methods: This prospective analysis included 36 eyes of 36 patients with POAG and cataract. The indication was uncontrolled primary open-angle glaucoma and coexisting cataract. Best corrected visual acuity (BCVA), intraocular pressure (IOP), appearance of the anterior and posterior segments of

the eye, and number of medications were examined. Follow-up examinations were done on days 1 and 7, and at 1, 3, 6, 12 and 18 months. Complete success was defined as an IOP ≤ 16 mmHg without any medications, and qualified success as an IOP ≤ 16 mmHg with medication. For statistical analyses, Mann-Whitney U test, Student's t-test, pair sequence Wilcoxon test, and analysis of variance were used; survival analysis was done using the Kaplan-Meier test.

Results: After 18 months of observation, mean IOP was decreased by 22.1% from 19.5 ± 2.5 to 15.2 ± 1.3 mmHg ($p < 0.001$). Fewer antiglaucoma medications were used after surgery and the results were statistically significant (2.1 *vs* 0.14, $p < 0.05$). Complete and qualified success rates, respectively, were 75% and 97%. The BCVA before the operation took out into the distance 0.4 and grew significantly to 0.87 ($p < 0.05$).

Conclusions: Gold Micro Shunt implantation combined with phacoemulsyfication provides good control of IOP in short period follow-up with a few post-op complications.

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P556 COMBINED PHACOEMULSIFICATION AND NON-PENETRATING SCLERECTOMY WITH AND WITHOUT T-FLUX IMPLANT IN OPEN-ANGLE GLAUCOMA PATIENTS

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Purpose: To compare the efficacy of combined phacoemulsification and non-penetrating sclerectomy with and without T-Flux implant in open-angle glaucoma patients.

Design: Prospective interventional clinical study.

Participants: Seventy-four eyes of 37 glaucoma patients.

Methods: Patients underwent combined phacoemulsification and non penetrating sclerectomy with and without the non-absorbable T-Flux implant (IOL TECH Laboratories, France). To evaluate efficacy of this implant in combined cataract and glaucoma surgery, we compared both groups. Each eye of the same subject was submitted to a different technique (with or without T-Flux). Best corrected visual acuity, intraocular pressure (IOP) and optic disc assessment were performed preoperatively and postoperatively at 1 day, 1 week, and 1, 3, 6, and 12 months. We determined the rates of IOP reduction, surgical success and complications.

Results: Mean postoperative IOP was 13,26 ± 2,52 mmHg in group 1 (without T-Flux) and 14,2 ± 2,33 mmHg in group 2 (with T-Flux), with pressure reduction of 31% in group 1 and of 27% in group 2 after one year follow-up. Pressures ≦ 15 mmHg were 67,5% in group 1 and 70,2% in group 2 without treatment. One eye in group 1 was converted to standard trabeculectomy owing to perforation of the trabeculo-Descemet's membrane during scleral flap performance.

Conclusion: Statistically significant drop of IOP with few postoperative complications was achieved with combined phacoemulsification and non penetrating sclerectomy with and without T-Flux implantation. No postoperative complications were observed in this study. Success rates were comparable in both groups.

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P557 EVALUATION OF DOUBLE-MIRROR GONIO LENS FOR GONIOSYNECHIALYSIS COMPARING WITH THE CONVENTIONAL GONIOPRISM

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Purpose: To evaluate the usefulness of double-mirror gonio lens (dmG; Mori upright surgical gonio lens, Ocular Instruments, Inc., Bellevue, WA, USA) for goniosynechialysis (GSL), comparing with the conventional Swan-Jacob gonioprism (SJG; Ocular Instruments, Inc.).

Design: Retrospective, consecutive, comparative study.

Participants and controls: Two consecutive case series of 20 uncontrollable primary angle closure/glaucoma (PAC/G) in the year of 2001 and 2007 were enrolled to this study at the Glaucoma Clinic in Kyoto Prefectural University of Medicine, Kyoto Japan. The other consecutive series of 20 cataract extraction surgery in the same time period (in the year of 2001 and 2007) were also enrolled as controls.

Methods: Written informed consents were obtained before the surgery for all patients, and all the surgery were performed by one surgeon (K.M). Surgical procedures for GSL were as follows: 1) after viscoelastic material (Healon, Advanced Medical Optics, Inc., Santa Ana, CA, USA) was injected into the anterior chamber, SJG (n = 20, in the operation period of 2001) or dmG (n = 20, in 2007) was placed on the surface of the cornea. 2) Goniosynechialysis was performed with spatula toward the peripheral anterior synechia

(PAS). 3) Phacoemulcification and aspiration were performed using Alcon Infinity vision system (Alcon Lab, Inc., Ft Worth, TX, USA). 4) Intraocular lens (Acrysof /IQ, Alcon Lab, Inc.) was implanted through Monarch II IOL delivery system. Total operation time was recorded and compared between the two groups.
Main outcome measure: Surgical outcome was assessed in terms of intraocular pressure (IOP) change, complication rate, and total operation time. Statistical difference was evaluated using the Mann-Whitney U analysis.
Results: In both groups, GSL was performed without any complications, and IOP was well-controlled between 16 to 19 mmHg after one month. In SJG group, patients had to keep the head and the eye ball largely tilted, however, there were some area in the upper and lower quadrants where angle structure could not be observed. On the other hand, in dmG group, whole angle structure could be observed without tilting the head, and GSL was performed even in the upper and lower quadrants. The operation time of SJG and dmG groups were 47.7 ± 10.7 and 26.6 ± 6.4 (mean ± SD) minutes, respectively, while simple cataract surgery took 20.8 ± 5.8 and 17.3 ± 4.2 minutes in the year of 2001 and 2007 respectively. The operation time of dmG group is significantly shorter than that of SJG group ($p = 0.0004$), although there is no differences between the time of cataract surgery in the year of 2001 and 2007.
Conclusions: Double-mirror gonio lens is more useful than conventional gonioprism in performing GSL in terms of not only the shorter operation time, but also the easier surgical procedure.
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P558 PHACOEMULSIFICATION COMBINED WITH NONPENETRATING DEEP SCLERECTOMY IN THE PATIENTS HAVING BOTH PSEUDOEXFOLIATIVE GLAUCOMA AND CATARACT: EFFICACY AND SAFETY
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Purpose: To evaluate the efficacy and safety of combined phacoemulsification-nonpenetrating deep sclerectomy surgery for the patients having both pseudoexfoliative glaucoma and cataract.
Design: A randomized prospective study.
Participants: Twenty-seven eyes from 24 patients with pseudoexfoliative glaucoma and cataract that underwent phacoemulsification from clear corneal incision combined with nonpenetrating deep sclerectomy procedure between years 2006-2008 were included in the study.
Material and methods: Twenty-seven eyes from 24 patients with pseudoexfoliative glaucoma and cataract that underwent phacoemulsification from clear corneal incision combined with nonpenetrating deep sclerectomy procedure between years 2006-2008 were included in this prospective study. The patients' visual acuity taken with Snellen chart, intraocular pressure(IOP) measuerd with Goldmann applanation tonometry and number of anti-glaucoma medications used were recorded in both pre- and postoperative periods. The results were evaluated.
Main outcome measures: Visual acuity, intraocular pressure and number of anti-glaucoma medications used.
Results: The mean age of the patients included in this study was 68.8 ± 9.8 years (51-85). No patients had any complications during or after the operation. The mean follow-up period was 12 ± 4,2 months. Preoperative mean visual acuity was 0.14 ± 0.1 and postoperative final mean visual acuity was 0.42 ± 0.34. Preoperative mean IOP was 22.0 ± 8.12 mmHg and found to be 14.4 ± 3.49 mmHg at the last postoperative visit.The number of glaucoma medications used was 1.7 ± 1.26 in the preoperative period and we found that this was 0.17 ± 0.38 in the postoperative visits. The increase in the visual acuity,decrease in the IOP and number of the anti-glaucoma medications in the postoperative period was found to be statistically significant when compared to the preoperative values ($p < 0.001$).
Conclusion: Combined phacoemulsification-nonpenetrating deep sclerectomy procedure was found to be successful in the patients having both pseudoexfoliative glaucoma and cataract to control IOP and to increase visual acuity. The limited increase of visual acuity in some patients because of the advanced glaucoma points out rapid progression of pseudoexfoliative glaucoma.
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P559 DEVELOPMENT OF PTOSIS AFTER PHACOEMULSIFICATION WITH TRABECULECTOMY COMPARED TO EXTRACAPSULAR CATARACT EXTRACTION
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Purpose: To evaluate the incidence and development of ptosis in patients after phacoemulsification with trabeculectomy in comparison to patients who underwent extracapsular cataract extraction.
Design: Retrospective non-randomized case series.
Methods: Retrospective study involving 84 patients (85 separate eyes) recruited at the National University Hospital in Singapore, who underwent either phacoemulsification surgery with trabeculectomy between October 2006 and September 2007 or extracapsular cataract extraction (ECCE). Bleb-measurements of patients who underwent cataract surgery with trabeculectomy were taken 6 months post-operatively using anterior-segment imaging, including measure-

ments of the bleb height as well as the total are of the bleb. The patients were examined in a follow-up period of a mean of 13.4 months after the surgery. Palpebral aperture, marginal reflex distance and levator function were assessed and ptosis was defined as a difference in the marginal reflex distance of 2 mm in unilateral cases or a marginal reflex distance of less than 2 mm in bilateral cases.

Results: Mean age of the subjects in the phacoemulsification with trabeculectomy group was 66.79 years, with a majority of 77.5% being Chinese and 61.2% male. The mean follow-up period was 14.8 months. Out of 49 eyes, 8 eyes (16.3%) could be identified with unilateral ptosis (same side as surgery) as well as 3 patients with bilateral ptosis. However, in all bilateral-cases, phacoemulsification-trabeculectomy had been performed before the study period in the fellow eye. Therefore, only the eye that was operated during study period was included. Mean age of the patients in the ECCE-group was 72.8 years with a majority of 58.3% being Chinese and 50% male. The mean follow-up period included 11.6 months. Out of 36 eyes, 5 eyes were diagnosed having a unilateral ptosis, represented by 13. 9%, however no patients presenting with bilateral ptosis. Incidence of unilateral ptosis in the phacoemulsification-trabeculectomy group was 16.3% compared to 13.9% in the ECCE-group which was not statistically significant (p = 0.239). Looking at the group of patients who underwent phacoemulsification with trabeculectomy, the bleb height was measured using anterior-segment imaging and showed a mean of 1.381 mm in 38 eyes (out of a total of 49 eyes) who did not present with ptosis. Eleven eyes with ptosis showed a mean bleb-height of 1.474 mm, p-value being 0.607. Measurements of the total area of the bleb showed a mean of 5.941 mm in 38 eyes without ptosis and 4.8 mm in 11 with ptosis with a p-value of 0.157.

Conclusion: The number of patients involved in this study might not be as large as desirable, but the study shows that the incidence of ptosis in patients undergoing cataract-surgery with trabeculectomy is not significantly higher than patients undergoing ECCE. Measurements of the bleb height show that there is a trend towards higher bleb heights in patients presenting with ptosis and a larger total area of the bleb in patients without ptosis, both not statistically significant.

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P560 USE OF BIODEGRADABLE COLLAGEN MATRIX IMPLANT FOR PHACOTRABECULECTOMY SURGERY IN PRIMARY GLAUCOMA: INITIAL RESULTS OF A CASE-CONTROL STUDY

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Objective: To assess the safety and efficacy of biodegradable collagen matrix implant in glaucoma patients undergoing phacotrabeculectomy surgery.

Design: Case-control study.

Participants: Patients with cataract and primary glaucoma with failed medical and/or laser treatment requiring phacotrabeculectomy surgery.

Methods: Consecutive patients who were eligible underwent phacotrabeculectomy with intra-operative use of biodegradable collagen implant placed over the sclera flap. The control arm consisted of patients who underwent phacotrabeculectomy augmented with Mitomycin C (MMC). The surgical technique and post-operative regimens were standardized in both arms. Participants were reviewed at postoperative days 1, 7, 14, and 90, and underwent slit lamp examination, intra-ocular pressure (IOP) measurement, bleb photography and anterior segment OCT imaging of the bleb. Complications related to the surgical procedure were documented.

Main outcome measures: Intraocular pressure (IOP) reduction and safety based on the incidence of complications.

Results: Of the 40 subjects (19 POAG and 21 PACG) recruited into the study, 27 were enrolled into the collagen implant arm and 13 into the control arm. From a mean baseline IOP of 17.1 ± 4.1 mmHg (95% confidence interval [CI], 15.6-18.7) in the collagen implant arm and 22.2 ± 6.8 mmHg (95% CI, 18.5-25.9) (p = 0.006) in the MMC arm, the post-operative IOP at 3 months was 15.2 ± 4.1 (95% CI, 13.7-16.8) and 13.5 ± 5.2 mmHg (95% CI, 10.6-16.4) (p = 0.001) respectively. Mean change in IOP at 3 months, after adjusting for age, gender, baseline IOP difference and covariate total medications, was greater in the MMC group (p = 0.009). By 3 months, there were more subjects in the collagen implant arm that required additional interventions such as needling with 5FU (29% v 7%, p = 0.2). Twenty-two percent of subjects in the collagen implant arm required medications to control IOP in comparison to 7% in the MMC arm (p = 0.7). No postoperative complications were reported in either group.

Conclusions: At 3 months, phacotrabeculectomy with intra-operative biodegradable collagen implant was associated with lower IOP reduction compared to phacotrabeculectomy with MMC. No safety concerns were recorded in the collagen implant arm at 3 months.

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P561 SIMULTANEOUS MICROINVASIVE NON-PENETRATING DEEP SCLERECTOMY AND CATARACT PHACOEMULSIFICATION WITH FLEXIBLE IOL IMPLANTATION USING A SINGLE SCLERAL LIMBAL ACCESS (MNPDS+PHCE+IOL)

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Purpose: To determine an efficacy of a combined simultaneous operation by mNPDS+PhCE+IOL method.
Material and Methods: The operation was performed in 75 eyes of patients with cataract and open-angle glaucoma. The average age: 75 ± 8.2 years. Standard, ophthalmic examinations and ultrasound biomicroscopy (UBM) were carried out pre- and post-operatively. BCVA preoperatively averaged 0.21 ± 0.08, mean intraocular pressure value (IOP) in hypotensive regimen, at the moment of surgery was 23.4 ± 0.4 mmHg. All patients underwent a complex preoperative medication.
Surgical technique: Anterior capsulorhexis was performed through paracentesis after local anesthesia. A 3.0 mm conjunctival incision was carried out along limbus. Scleral incision to 1/3 of its thickness was placed at limbus to form semi-oval scleral peak of 2.5 x 2.0 mm. Scleral limbal tunnel was formed penetrating into clear corneal layers up to 1.0-1.5 mm along the entire incision. Deep layers of scleral tissue and external wall of the Schlemm's canal were removed to 2/3 of average depth volume set by dimensions of superficial scleral flap. Under the external scleral flap over the zone of the denuded Descemet's membrane we penetrated into anterior chamber (2.20-2.75 mm depending on IOL types). Then all steps of phacoemulsification were performed and a flexible IOL was implanted. Superficial flap was put back and the conjunctiva was shifted to the zone of surgical intervention with a buried purse-string conjunctival suture at limbus.
Results: The average BCVA was 0.79 ± 0.06 one month later, 0.9 ± 0.07 - 3 years later, the average IOP 15.6 ± 1.26 and 15.15 ± 1.39 respectively. Transitory hypertension and a resistant loss of hypotensive effect were not noted. Descemetogoniopuncture (DGP) was performed in 4 cases, β-blocker was prescribed in 3 cases. The IOP less than 21 mmHg without additional hypotensive treatment remained 3 years later in 92% of cases. Complications: posterior capsule rupture - 1 case, insignificant hemorrhages - 5, corneal edema - 2, exudative reaction - 4, local flat choroidal detachment - 1 case, that is less than in the literature. In all cases, a flat filtering bleb was formed in postoperative follow-up. Maintenance of the created additional outflow pathway was confirmed by UBM data in follow-up up to 3 years.
Conclusion: Suggested method of simultaneous surgical treatment of cataract and open angle glaucoma - mNPDS+PhCE+IOL using a single scleral limbal access is an efficient, safe, less traumatic intervention, that simultaneously improves optical and functional results and decrease quantity of complications in surgery of this combined pathology.
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P562 EFFECT OF SCLERAL FLAP SIZE ON INTRAOCULAR PRESSURE IN PHACOTRABECULECTOMY

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Purpose: To study effect of size of scleral flap in trabeculectomy combined with phacoemulsification (phacotrabeculectomy) on outcome of intraocular pressure (IOP).
Design: Prospective comparative surgical case series.
Participants: Fifty-seven eyes of 57 patients having cataract and primary open-angle glaucoma or primary angle-closure glaucoma.
Methods: Fifty-seven consecutive patients who underwent phacotrabeculectomy where prospectively studied for postoperative IOP control. The patients (group A) who selected foldable intraocular lens, their triangular trabeculectomy flap was sized 3 x 3 x 3 mm. In patients (group B) opting for non foldable intraocular lens, their triangular flap was sized 5 x 4 x 4 mm.
Main outcome measures: Postoperative IOP control.
Results: Group A had 22 eyes. Mean pre and postoperative IOP was 26.27 mmHg and 14.22 mmHg respectively. Group B had 35 eyes. Mean pre and postoperative IOP was 24.57 mmHg and 12.5 mmHg respectively. There was no statistically significant difference for IOP reduction among both groups.
Conclusion: IOP reduction is not affected by size of the flap in trabeculectomy with phacoemulsification.
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P563 COMBINED DEEP SCLERECTOMY AND PHACOEMULSIFICATION WITH PCIOL FOR COEXISTING CATARACT AND GLAUCOMA: TONOMETRIC AND PERIMETRIC TEN YEARS FOLLOW-UP OF 140 CONSECUTIVE CASES

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Purpose: To describe the ten years results of intraocular pressure control and visual field in patients operated with combined phacoemulsification, IOL implant and deep sclerectomy.
Type of study: Prospective, uncontrolled open series.
Materials and Methods: One hundred forty consecutive cases of coexisting uncontrolled glaucoma and significant cataract underwent combined surgery with superior deep sclerectomy and temporal approach phacoemulsification with posterior chamber injectable IOL implant. Eyes with more than 12 months of follow-up were included for analysis. Principal outcomes were: mean IOP and visual field mean indexes (MD and PSD), secondary outcomes were visual acuity, number of IOP-lowering drugs and failure rate. Failure was defined as IOP > 18 mmHg or confirmed visual field progression. Statistical analysis was performed by two-tailed Student's Test for numeric variables and with chi-square test for non parametric variables.
Results: Mean follow up was 74 months (12 to 123). One hundred twenty-seven patients (91%) completed at least 12 months of follow-up, 8 died or were lost to follow-up. Mean IOP preoperatively was 25,42 ± 6,31 mmHg, it was 13,52 ± 3,1 mmHg at 1 year, 14,06 ± 2,81 mmHg at 2 years, 14,11 ± 3,53 mmHg at 4 years, 14,12 ± 2,90 mmHg at 6 years, 14,13 ± 2,17 at 8 years, 14,00 ± 2,37 at 10 years (11 patients). Visual field mean MD at base line was -19,39 ± 8,23, mean PSD was 7,18 ± 3,16. At 3 years mean MD was -17,56 ± 9,01 (p = 0,02) and mean PSD was 6,49 ± 4.66 (n.s.); at 5 years mean MD was still better than baseline-17,71 ± 10,01 (n.s.), at 8 yrs mean MD was -16,87 ± 10,75 (n.s.). Mean visual acuity improved from baseline 0,29 ± 0,16 to 0,71 ± 0,34 at 8 years (p < 0,001). Mean number of IOP lowering drugs decreased significantly from 2,8 ± 0,8 at baseline, to 0,85 ± 0,94 at last follow-up (p < 0,001). Tonometric failure rate (IOP > 18) was 7% ; perimetric failure rate (damage progression) was 5%; 45 cases (32,15%) received YAG laser goniopuncture, 55 cases (39,3%) received 5FU injections; 6 cases (4,3%) needed further antiglaucomatous surgery, 3 cases (2,15%) received selective trabeculoplasty (SLT).
Conclusions: In our series combined deep sclerectomy and phacoemulsification with PCIOL proved to be highly effective for long-term IOP control with 88% success rate, a mean reduction of almost 42% at 8 years and visual field mean MD that 8 years after surgery was still better than baseline although not significantly; with a very safe post operative course, low rate of complications and a very significant reduction of IOP lowering drugs.
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P564 INTERMEDIATE-TERM RESULTS: EFFECTS OF SURGICAL TECHNIQUE: PHACOTRABECULECTOMY VS PHACOEMULSIFICATION AND PRIMARY AHMED VALVE ON INTRAOCULAR PRESSURE IN MEXICAN PATIENTS WITH OPEN-ANGLE GLAUCOMA

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Purpose: To evaluate the results of primary combined phacoemulsification and trabeculectomy *vs* primary combined phacoemulsification and Ahmed glaucoma valve implant without a tube-covering patch in adult Mexican patients with primary, pseudoexfoliative or pigmentary open angle glaucoma.
Design: Retrospective case series.
Participants: Charts of 251 patients over 18 years of age operated with either technique between January 2002 and June 2008 were analyzed. Group 1 comprised of 210 eyes of 192 patients operated with primary combined phaco-trabeculectomy and group 2 comprised of 60 eyes of 59 patients operated with phacoemulsification combined with primary Ahmed Glaucoma Valve implantation during the same period. Target IOPs were determined for each patient depending on cup/disc ratio. Success was defined as an IOP lower or at target, and any IOP over target at any time-point was defined as failure if medications could not reach target or if additional procedures to lower IOP were needed.
Results: Mean preoperative IOP was 17.62 mmHg in group 1 and 17.78 in group 2, and lowered to, respectively, 10.06 and 8.95 by day 1, 12.26 and 11.90 by year 1, 10.75 and 10.71 by year 5. Survival rates were 94.8% *vs* 91% at 6 months, 87.2% *vs* 91% at 12 months, 81.9% *vs* 91% at 24 months, 77.9% *vs* 84.5% at 36, 48 and 72 months in group-1 *vs* group-2 eyes, a not statistically significant difference. Mean survival time for phaco-trabeculectomy was 59.9 months, and 63.6 for phaco-Ahmed valve, also a not significant difference. The number of medications needed to control IOP during the full follow-up period are similar at all time-points, except in month 6 group-1 patients needed 0.92 *vs* 0.58 medications in group 2 (p = 0.023), and in month 12 group 1 needed 1.41 medications *vs* 0.83 in group 2 (p = 0.002). Transient bleb leaks were more frequent in group 1 eyes (33 eyes, 15.7% *vs* 0%, p < 0.001) and transient choroidal detachments were more frequent in group 2 eyes (7 eyes, 3.3% in group 1 *vs* 8 eyes, 13.3% in group 2, p = 0.007).
Conclusion: Mid-term results of combined phacoemulsification with trabeculectomy and results of combined phacoemulsification with Ahmed Valve glaucoma implants are comparable, regarding IOP control, and favoring combination with AGV for medications needed up to 3rd year of follow-up.

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P565 COMPARISON OF THE SURGICAL OUTCOMES OF SINGLE SITE PHACOTRABECULECTOMY WITHOUT MITOMYCIN C IN POAG AND PACG

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Purpose: To compare the surgical outcomes of single site phaco trabeculectomy without Mitomycin C in primary angle-closure glaucoma (PACG) and primary open-angle glaucoma (POAG).
Design: Retrospective review.
Particpants: Forty-seven eyes of 39 PACG patients and 45 eyes of 33 POAG patients were included.
Intervention: Patients underwent single-site phaco trabeculectomy without MMC with a minimum post-operative follow-up of 12 months. Preoperative and post operative data between the two groups were analysed.
Results: The mean follow-up was 41.35 ± 18.13 months. The average IOP reduction in PACG group was 31.25 ± 34.49%. The average IOP reduction in POAG group was 21.14 ± 25.69% (p = 0.021). The mean number of medications at final follow-up in PACG group was 0.26 ± 0.57 and in POAG group was 0.60 ± 0.863 (p = 0.026).
Conclusion: The surgical outcomes of single site phaco trabeculectomy without MMC are better in PACG as compared to POAG.
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12.16. Surgical treatment: Vitrectomy

P566 RESULTS OF COMBINED VITRECTOMY, PHACOEMULSIFICATION AND POSTERIOR APPROACH ZONULO-HYALOIDO-IRIDECTOMY (VPPI) FOR CATARACT SURGERY IN EYES WITH EXTREMELY SHALLOW ANTERIOR CHAMBERS

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Objective: To present the medium term results of initial cases operated with an innovative technique of combined core vitrectomy, phacoemulsification and posterior approach zonulo-hyaloido-iridectomy (VPPI) for performing safe cataract surgery in very small eyes, with extremely shallow anterior chambers, and to prevent and /or treat recurrent post-operative aqueous misdirection.
Design: A retrospective non-comparative interventional study of consecutive cases.
Participants: Nine eyes of 9 consecutive patients presented with small axial lengths, bulky cataracts and extremely shallow anterior chambers. All eyes had angle-closure glaucoma, three of which had a predominant phacomorphic component, one had postoperative aqueous misdirection and one eye was nanophthalmic. All included patients had a minimum of one year's regular follow-up details available.
Methods: A combined single-port core vitrectomy, phacoemulsification with intraocular lens implant with Lewiky anterior chamber maintainer was done. A posterior approach zonulo-hyaloido-iridectomy at 12 o'clock was then performed to prevent post-operative aqueous misdirection.
Outcome measures: Pre-operative and post-operative visual acuities, intraocular pressures and number of glaucoma medications were assesses and intra-operative and post-operative complications, including any aqueous misdirection was recorded.
Results: The mean age at surgery was 68 years. The mean axial length was 19.79 mm (range = 15.85 to 21.68 mm), the mean anterior chamber depth was 1.78 mm and the mean lens thickness was 4.81 mm. The mean follow-up was 22.28 months (range 12-48 months). At the last follow up visit there was an improvement of a mean of 1.44 Snellen lines. No eye had reduced vision. The mean pre-op IOP was 29.22 mmHg with mean number of topical medications being 4.33 and 7 patients were on oral acetazolamide. The mean post-op IOP

on the last visit was 14.67 mmHg with mean number of topical medications being 0.67 and only 1 patient requiring oral acetazolamide. There were no intraoperative complications. One patient developed transient vitreous haemorrhage which resolved spontaneously, and one patient required mitomycin-c augmented trabeculectomy. One patient developed an inflammatory membrane over the zonulo-hyaloido-iridectomy, which did not respond well to Nd:YAG iridotomy, and required a further vitrectomy with capsulotomy.

Conclusion: VPPI is an effective technique in safe removal of bulky cataracts in small eyes with extremely shallow anterior chambers and in preventing recurrent post-operative aqueous misdirection in high risk cases although if the zonulo-hyaloido-iridectomy gets blocked it may require further surgical intervention.

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12.20. Surgical treatment: Other

see also P342

P567 COLLAGENOPLASTY OF THE POSTERIOR SEGMENT OF THE EYEBALL IN THE TREATMENT OF GLAUCOMATOUS NEUROPATHY

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Purpose: To evaluate the results of glaucoma surgery - nonpenetrating deep sclerectomy (NPDS) combined with posterior collagenoplasty with the devices from collagen type I (Xenoplast). To investigate the effects of posterior collagenoplasty in eyes with advanced glaucoma previously subjected to glaucoma surgery.

Design: Retrospective analysis.

Participants and controls: First group: 39 patients (39 eyes) with advanced glaucoma operated by NPDS combined with posterior collagenoplasty with Xenoplast (rectangular plates 8.0 x 15.0 x 1.0 mm). NPDS was performed in upper-internal meridian. In other three oblique meridians after conjunctival incisions in 8 mm from limbus and formation of subtenone channels Xenoplast devices were moved towards the area around the optic nerve. Second group: 22 patients (22 eyes) were subjected to posterior subtenone implantation of Xenoplast in long-term period after glaucoma surgery. Patients of this group had surgically normalized IOP. Control: Ten patients (10 eyes) - NPDS without Xenoplast implantation into subtenon space to the posterior segment of the eyeball. In 1st and control group IOP level before surgery was 28,5-35,5 mmHg on maximal medications.

Methods: Clinical investigation included: vision acuity, computer perimetry, tonometry, optical coherent tomography (OCT), ultrasonic investigation of the posterior eye segment.

Main outcome measure: In 1st and control group mean post-op IOP was 13,2 ± 0,1 mmHg. In 1st and 2nd group we revealed the decrease of visual field defects on 6%-10%. Visual acuity improved on 0.123 in average. Optic disc excavation decreased on 0,11 ± 0,01 by OCT data. Nerve fibers thickness increased from 41,13 ± 0,02 μm to 43,31 ± 0,02 μm. In control group in spite of IOP compensation we did not found the positive changes in visual functions and morphometrical OCT data.

Results: There was no case of inflammatory or rejection response to implanted Xenoplast device. In 1st and control groups during the early post-op period in 17% of cases the flat choroidal detachment occurred, resolved on medications.

Conclusions: NPDS combined with posterior collagenoplasty and collagenoplasty in long-time period after glaucoma surgery arouse the improvement of visual functions and morphometrical parameters of the optic nerve and retinal nerve fibers layer thickness.

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P568 ANTERIOR SEGMENT RECONSTRUCTION IN THE TREATMENT OF PROBLEMATIC CASES OF SECONDARY GLAUCOMA WITH ORGANIC ANGLE BLOCK

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Purpose: To introduce the technology and evaluate the results of treatment of problematic cases of secondary glaucoma with organic angle block.

Patients and Methods: In this retrospective study 38 eyes of 31 patients with various forms of glaucoma with organic angle block were enrolled. Mean age of patients was 48.4 ± 11.6 years. There were 21 men and 10 women. All the patients were on antiglaucoma medications. Laser iridotomy was performed on 5 eyes and filtering surgery - on 6 eyes before operation. Mean preoperative IOP was 39.6 mmHg (range, 29 to 62 mmHg), mean visual acuity was 0.24 (range, light perception to 0.6). All the patients underwent anterior segment reconstruction including phacoemulsification, IOL implantation, reconstruction of the anterior chamber topography, controlled goniosynechialysis , and widening of the anterior chamber angle with sutures.

Results: Patients were observed on day 3, months 1, 3, 6,

12, 18 after surgery. Mean follow up was 17.4 ± 4.9 months. Medications were used after surgery in 8 eyes, 4 of them later underwent glaucoma surgery of other types. Changes of IOP and visual acuity were as follows. On day 3 after surgery mean IOP was 20.1 ± 3.2 mmHg, mean visual acuity 0.35 ± 0.11; one month - 19.4 ± 2.6 and 0.44 ± 0.18; three months - 18.3 ± 3.4, 0.53 ± 0.17; six months - 19.8 ± 2.7, 0.55 ± 0.14; one year - 20.52 ± 2.6, 0.48 ± 0.15, 18 months 20.48 ± 3.4, 0.53 ± 0.2 respectively.
Conclusion: The introduced technology provides high hypotensive effect and visual acuity improvement in patients with secondary glaucoma complicated by organic angle block.

14. COSTING STUDIES; PHARMACOECONOMICS

P569 A COST-EFFECTIVENESS ANALYSIS OF NON-PENETRATING GLAUCOMA SURGERY WITHIN PUBLIC AND SUPPLEMENTARY HEALTH SYSTEMS IN BRAZIL COMPARED TO MEDICAL TREATMENT

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Purpose: To assess the cost-effectiveness of non-penetrating deep sclerectomy (NPDS) in both public (SUS) and supplementary private (SS) services in Brazil and compare it to medical treatment up to 5 years of follow-up.
Design: Cost-effectiveness analysis.
Participants: A consecutive retrospective study of 228 operated eyes was performed. All eyes were followed for 5 years.
Methods: The authors used the same data to calculate the direct costs related to NPDS in SUS and in SS. This result was then compared to the cost-effectiveness of medical therapy using prostaglandin analogues alone and in combination with Timolol 0.5% or fixed combination of Timolol 0.5%/Dorzolamide.
Main outcome measure: Cost-effectiveness was defined as cost (US dollars) for 1% reduction in IOP in 5 years
Results: Cost to achieve a reduction of 1% in IOP in 5 years was US$ 16.21 for NPDS in SUS and US$ 34.89 in SS. The same cost for medications varied from US$ 33.32 to US$ 73.78. NPDS was the most cost-effective therapy for patients in SUS and the second most in SS. In SS, the most cost-effective therapy was the combination of bimatoprost (5-ml bottle) and Timolol 0.5%. Performing NPDS can lead to an economy up to 78.02% and 52.71% in SUS and SS, respectively.
Conclusion: NPDS can provide to the Brazilian Health System, both pubic and supplementary, a major economy when compared to studied medications in 5 years.
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P570 A NOVEL APPROACH TO ESTABLISH AT WHICH IOP TO START TREATMENT FOR OCULAR HYPERTENSION

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Objective: To evaluate the cost-effectiveness of pressure lowering therapy in ocular hypertension depending on the initial intraocular pressure.
Design: A validated computer model simulating the disease progression of individual patients.
Methods: Current knowledge of ocular hypertension and glaucoma disease progression as well as treatment effectiveness were synthesized in a computer model that simulated the disease progression of individual (virtual) patients. The model was debugged and validated. Costs were linked to treatment and disease severity of the simulated patient, and utility was linked to disease severity. The following treatment strategies were evaluated: 1) treat all patients (target pressure ≤ 21 mmHg), versus 2) monitor all patients (visit every three years) and start treatment only when conversion has been observed. Both strategies were simulated in OHT-populations without additional risk factors and an untreated IOP of 22 mmHg, 24 mmHg, 26 mmHg, 28 mmHg and 30 mmHg. Univariate and multivariate sensitivity analyses were performed to account for the uncertainty surrounding the model's parameter estimates.
Main outcomes measures: incremental discounted total costs and quality-adjusted life-years (Qaly's) of a 'treat all' strategy versus a 'treat only converted' strategy. Outcomes represented a lifelong horizon.
Results: The average lifespan of patients in the model was 25.6 years. Treating all patients with ocular hypertension, regardless of their IOP, resulted in health gains compared to monitoring patients and treating only converted patients. The incremental Qaly's ranged from 0.17 in patients with an IOP of 22 mmHg to 0.77 in patients with an IOP of 30 mmHg. The years of blindness prevented ranged from 0.04 to 0.58

respectively. Treating all patients was associated with incremental costs up to € 1,400/patient if baseline IOP was below 24 mmHg (€ 100 = US$ 120). In this subgroup the cost-utility was estimated at € 8,131/Qaly. In patients with a baseline IOP higher than 24 mmHg, treating all patients was expected to be cost-saving. The additional costs for medications and ophthalmologist consultations incurred by treating all patients were compensated by major cost savings in care for low-vision and blindness. A univariate sensitivity analysis showed that treating all patients remained cost-effective (€ 16,000/Qaly to € 2,500/Qaly) if costs for blindness would only be relevant at the severest level of visual field loss. Multivariate sensitivity analyses indicated that the model outcomes were robust.

Conclusions: it is cost-effective to start treatment for ocular hypertension at IOP's higher than 22 mmHg, even in patients without increased risk for conversion.

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15. MISCELLNAEOUS

P571 GLAUCOMA TYPES IN OPHTHALMOLOGY CLINIC -AL AIN HOSPITAL - UAE: HOSPITAL BASED STUDY

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Purpose: To determine frequency distribution of glaucoma and glaucoma suspect cases among patients attending ophthalmology clinic in Al Ain Hospital, UAE.

Design: Systematic, chart review, cross-sectional study.

Participants: Adult patients attending general ophthalmology clinic in Al Ain Hospital – Eastern medical region – UAE, between April and December 2008 on one visit during that period.

Methods: All patients were subjected to clinical evaluation including personal, family and past history, measuring of visual acuity and BCVA, applanation tonometry, slit lamp examination of the anterior segment, gonioscopy, fundus examination ± diurnal variation, disc photography, automated visual field examination.

Main outcome measures: Frequency distribution of various types of glaucoma and glaucoma-suspect cases. Other outcome measures include mean age, sex, visual acuity, IOP, legal blindness.

Results: Five hundred patients were included, 282 females (56.4%) and 218 males (43.6%), mean age is 51.1 ± 12.6 for both sexes. Nationality: 49% UAE, 15.6% Omani, 10% Asian, 8% North African, 5% black African, 3.8% Palestine, 2.4% Yemen, 6.2% others. Mean visual acuity was 0.32 ± 0.02. Mean IOP 16.25 ± 0.2 for the left eye and 16.27 ± 0.2 for the right eye. Glaucoma or glaucoma-suspect were diagnosed in 246 eyes (24.6%). Glaucoma-suspect was diagnosed in120 eyes (12%). Glaucoma was diagnosed in 126 eyes (12.6%). Glaucoma cases were distributed as follows: primary angle-closure glaucoma and primary angle closure in 54 eyes (5.4%), primary open-angle glaucoma in 60 eyes (6%), secondary glaucoma in 12 eyes (1.2%). Glaucoma-suspect cases are distributed as follows: PAC-suspect 81 eyes (8.1%) , IOP-suspect 22 eyes (2.2%), optic-disc-suspect 13 eyes (1.3%) , and visual-field-suspect 4 eyes (0.4%). Out of 126 glaucoma eyes 67 eyes (53.2%) are old cases and 59 eyes (46.8%) are newly diagnosed. Out of 120 glaucoma-suspect eyes 13 eyes (10.8%) are old and 107 (89.2%) are newly diagnosed. Legal blindness: 78 eyes (7.8%) were legally blind. Glaucoma constituted 33.3% of legal blindness causes followed by cataract 19.2% then cornea 12.8%, Diabetic retinopathy 9%, other retinal and optic disc causes 11.5%, and other causes 14.1%.

Conclusion: Glaucoma or glaucoma-suspects were diagnosed in one of every four patients in our study. Glaucoma and glaucoma-suspect were equally distributed. Among glaucoma cases, open-angle and closed-angle glaucoma were nearly equally distributed, with open-angle glaucoma slightly higher. Glaucoma is a major cause of legal blindness in our study. Patient education and public awareness of glaucoma are recommended as well as Population based surveys.

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P572 DRIVERS LICENSE AND LEGAL BLINDNESS AS MILESTONES FOR PROGRESSIVE EYE DISEASE

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Purpose: As the population ages, incidence of age-related eye conditions are expected to increase. This can cause

higher rates of loss of driver's licenses and subsequent loss of independence. The definition of visual impairment and cut-offs for age vary widely. Thus definitions may differ across countries for driver's license requirements and disability status. Our purpose was to review the requirements for holding a driver's license and rules for obtaining disability pension due to low vision. Results are attempting to assess possibilities of using a milestone approach to describe progressive eye disease.

Design: Desk research including an Internet search for government and research reports, websites, and journal articles was done to review rules and requirements in six countries: Germany, Spain, Italy, France, UK, and US. Linguistic experts assisted the review to include relevant non-English documents.

Participants: None.

Methods: National findings and inter-country differences were reviewed, discussed and verified with ophthalmology specialists from each country for visual acuity and visual field requirements, and the definition of legal blindness.

Results: Visual acuity (VA) limits are present in all driver's license regulations. In most countries the VA limit is 0.5. Visual field (VF) limits are included in some drivers' licence regulations. In Europe VF requirements typically follow the EU standard of a VF value of no less than 120°. In the United States, VF requirements are typically between 110°-140°. Some countries distinguish between being partially sighted and blind within their definition of legal blindness, in others there is only one limit. VA limits for being partially sighted are usually set to 0.1 or lower, but can be higher if combined with VF limits. VF thresholds have been defined at limits between 10°-20° in some countries. VA limits for blindness have been definedat around 0.05 and 0.02.

Conclusions: In a clinical setting a drivers' licence milestone is a best-corrected VA of less than 0.5 or a VF of less than 120°, which is consistent in most countries. Legal blindness is more difficult to define as the visual requirements vary or involve a higher degree of assessment. Future research is needed to quantify the burden and distribution of the milestones in terms of societal costs, lack of personal freedom or social contact, and the dependency on others.

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P573 EMPOWERING AND TRAINING RURAL AND SEMI-URBAN OPHTHALMOLOGISTS IN GLAUCOMA CARE-IMPACT OF A MOBILE PROJECT – 'NAYANA'

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Background: 'Case detection' by ophthalmologists in the population at risk, is the preferred approach to tackle Glaucoma blindness. Large population-based surveys of glaucoma in south India have demonstrated that diagnosis of glaucoma cases, have been missed by ophthalmologists who had previously examined them. Lack of access to equipment and training are factors limiting the doctor's ability. 'Nayana' is a project that aims at empowering rural ophthalmologists in Karnataka in South India, with equipment and training to diagnose and manage glaucoma. It is a mobile van, equipped with automated perimeter (SAP), Applanation Tonometer (AT), Slitlamp Biomicroscope, YAG laser, Diode Laser, Fundus Camera BScan, and Ultrasound Biomicroscope (UBM). The van travels on a fixed calendar each month to 24 locations in 13 districts. Participating ophthalmologists, treat their own patients on the van, and are given hands on training by the consultant on board. The project targets both diabetic retinopathy and glaucoma.

Objective: To evaluate the impact of 'Nayana' on the self-reported Glaucoma practise patterns of participating ophthalmologists.

Design: Prospective qualitative comparative study.

Participants: Fifty-nine doctors who answered the pre- and post-project questionnaires were the source for the data.

Methods: Pre-project questionnaire was administered to document practise patterns and their training with respect to, AT, Gonioscopy, 78/ 60D examination, YAG laser, ability to interpret SAP printouts, and perform UBM. Thirty months post project, the ability of the same doctors to perform the procedures was assessed by the consultant , and they answered a questionnaire. McNemar test of change was used to assess change.

Main outcome measures: Change in ability to use standard diagnostic and treatment modalities.

Results: Mean age of doctors was 42.03 ± 8.91 yrs. Before the project, 37 (62.7%) had access to 78/60D lens, 25 (42.4%) AT, 8 (13.6%) to SAP, 10 (16.9%) to YAG laser, 34 (57.6%) to gonioscopes. None had access to UBM. Pre project, 33 (55.9%) were performing 78/60D assessment, 30 (50.8%) could perform AT, 33 (55.9%) could interpret SAP, 25 (42.4%) could perform YAG, 9 (15.2%) had done UBM, and 33 (55.9%) could do gonioscopy. After 30 months of training, there was a significant change in the number of doctors able to perform these procedures: 78D- 47 (79.7%) ($p = 0.035$), AT- 48 (81.4%)($p = 0.003$), SAP- 45 (76.3%)($p = 0.007$), YAG- 49 (83.3%)($p < 0.001$), gonio 49 (83.1%)($p = 0.037$).

Conclusion: In a large developing country with limited resources like India, cooperative sharing of equipment and training the local doctors is an effective strategy to tackle glaucoma blindness. It improves practise patterns of local ophthalmologists.

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P575 KNOWLEDGE AND PERCEPTION OF GLAUCOMA AMONG RESIDENT DOCTORS AND NURSES IN EBONYI STATE UNIVERSITY TEACHING HOSPITAL (EBSUTH), ABAKALIKI, NIGERIA
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Purpose: To determine the knowledge and perception of glaucoma among resident doctors and nurses in EBSUTH, Abakaliki.
Design: Observational, cross-sectional study.
Participants: Twenty-five doctors and 24 nurses were randomly selected for the study.
Methods: Subjects were randomly selected from three clinical departments of EBSUTH, Abakaliki. They were those present at their duty posts at the time the questionnaire survey was carried out and who willingly participated.
Main outcome measures: Knowledge of glaucoma.
Results: While 93.9% of study population has heard of glaucoma and 79.6% knew it may result in blindness if left untreated, 51% of the participants did not know the disease could be inherited. Of the participants, 36.7% were not aware that glaucoma may be symptomless in early stages. Only 24.5% knew that it is more severe in blacks than in Caucasians. Although 75.5% knew the disease may be related to raised intraocular pressure ($p = 0.003$), less than half (44.9%) were aware that it is commonly seen in persons above 40 years of age. While the majority (77.6%) of the population knew someone suffering from glaucoma, 53.1% of respondents believed that the cost of glaucoma treatment is high. Doctors had better knowledge than nurses ($p = 0.006$). More than half (62.3%) believed the etiology of glaucoma may be related to infectious causes and 24.5% thought it may be due to spiritual causes (witches). Hospital staff, Medical schools and friends were the major sources of information on glaucoma in 30.6%, 28.6% and 14.3% respectively.
Conclusion: There is lack of adequate knowledge about glaucoma among the participants even though majority has heard about it. Recommendation: Education of doctors and nurses on glaucoma will promote better knowledge of the disease. With this, awareness of the disease in the communities could be raised.
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P576 FIRST WORLD GLAUCOMA DAY 2008 – THE ANTIGUA AND BARBUDA EXPERIENCE
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Purpose: To describe the extensive events which could be organized for World Glaucoma Day in a small country, Antigua and Barbuda, population 85,000, of predominantly African descent, with a high glaucoma prevalence rate, through community, media, and governmental efforts.
Methods: An extensive campaign to increase awareness of and to detect glaucoma was mounted through the cooperation of the Antigua and Barbuda glaucoma support group (30 members), government officials, and the media.
Results: Collaborations with other groups, such as the Lions Club and the Boy Scouts Association, a March for Sight led by Antigua's Prime Minister, issuance of a commemorative postage stamp, posters, public service announcements, cellular network text messages, public lectures and free screening clinics manned by volunteer optometrists, ophthalmologists, pediatricians and student nurses led to a large number of persons with glaucoma being detected.
Conclusions: 1) It is possible to do a lot with a little. 2) Small close-knit groups have the power to magnify the 'epidemic potential of a message or idea'. 3) Since early detection and treatment are key to halting glaucoma's irreversible blindness, increasing public awareness is urgently needed. The authors believe that small glaucoma patient support groups can be the impetus for the change that is needed. 4) Our goal is to make Antigua and Barbuda the first nation in the world with no undetected glaucoma.

P576.1 RISK FACTORS FOR POOR FOLLOW-UP AMONG PATIENTS WITH GLAUCOMA IN A COUNTY HOSPITAL POPULATION
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Objective: To identify factors associated with poor follow-up among glaucoma patients at San Francisco General Hospital (SFGH).
Design: One-to-one, matched, case-control study.
Participants: One hundred thirty patients diagnosed with glaucoma or designated glaucoma suspect at SFGH. Cases (poor follow-up) and controls (good follow-up) were determined based on the number of and maximum intervals between FGEs attended in the preceding year as found in patient medical records.
Methods: Data regarding various predictors of follow-up compliance were collected by oral questionnaire. Variables of interest included English language fluency, knowledge of glaucoma, race/ethnicity, education level, and disease severity.
Main outcome measure: Independent predictors of poor FGE attendance in a county hospital population, as deter-

mined by odds ratios from stepwise multivariate logistic regression analyses.
Results: Factors that independently predicted poor FGE attendance included: lack of English fluency (Adj. OR 7.11, 1.37-36.83), having symptomatic glaucoma upon initial diagnosis (Adj. OR 10.42, 1.89-57.65), not knowing that glaucoma causes optic nerve damage (Adj. OR 8.62, 2.39-13.43), and lack of glaucoma education from pamphlets/posters (Adj. OR 6.76, 1.53-15.04) and from family/friends (Adj. OR 4.91, 1.12-29.32). Notable factors not significantly associated with FGE attendance included race/ethnicity, education level, and disease severity.
Conclusions: Patients lacking English fluency and with less knowledge and education about glaucoma are significantly more likely to have poor longitudinal follow-up for their glaucoma. Patients with symptomatic glaucoma at the time of diagnosis were also more likely to have poor glaucoma follow-up. Meanwhile, other factors traditionally believed to influence follow-up, such as race/ethnicity, education level, and disease severity, were not significantly associated with poor follow-up upon multivariate logistic regression. These findings suggest that improving patient knowledge about the effects of glaucoma and providing supplementary sources of information on disease may improve longitudinal follow-up for glaucoma. Moreover, patients lacking English fluency or with symptomatic glaucoma on initial diagnosis should receive individualized counseling and education in order to minimize disparities in glaucoma management in underserved populations.
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P576.2 BARRIERS AND ETHNIC DISPARITIES ASSOCIATED WITH POOR FOLLOW-UP IN PATIENTS WITH GLAUCOMA IN A COUNTY HOSPITAL POPULATION

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Objective: To identify reasons for poor longitudinal glaucoma follow-up and investigate ethnic disparities in barriers to follow-up among glaucoma patients at San Francisco General Hospital.
Design: One-to-one, matched, case-control study.
Participants: One hundred thirty patients diagnosed with glaucoma or designated glaucoma suspect at SFGH. Cases (poor follow-up) and controls (good follow-up) were determined based on the number of and maximum intervals between FGEs attended in the preceding year as found in patient medical records.
Methods: Data regarding 'significant barriers' patients faced in attending FGEs were collected by oral questionnaire. Information regarding patients' race/ethnicity was obtained from medical records.
Main outcome measure: Significant barriers faced by glaucoma patients in attending regular FGEs at an urban county hospital.
Results: Subjects altogether reported a total of 380 significant barriers for a mean of 2.9 barriers per subject. The most prevalent barrier reported was long waiting times in clinic (80.8%), with patients reporting mean wait times of 2.5 hours (SD 1.4 hours). The following were cited as the most important barriers to follow-up: long waiting times in clinic (23.8%), other medical or physical conditions (12.3%), and additional waiting times and difficulties associated with obtaining language interpreters (10.0%). Interestingly, excluding long waiting times, Caucasian and Asian/Pacific Islander patients both reported "other medical or physical conditions" as their next most important barrier to follow-up (20% and 19%), particularly orthopedic and mobility issues. Meanwhile, Latino subjects viewed additional waiting times and difficulties associated with interpreters (26%) as their most significant barrier, while Black patients disproportionately faced barriers related to appointment scheduling and work responsibilities (25%). Finances and lack of awareness regarding the importance of follow-up were only rarely mentioned as a barrier.
Conclusions: In medically underserved patient populations, health care providers may attribute poor follow-up among glaucoma patients to financial, socio-economic, and cultural challenges faced by many patients. However, upon systematic investigation, patients viewed organizational aspects of the health care delivery system, such as long waiting times, inconveniences related to obtaining interpreters, and scheduling difficulties, as their most significant barriers to attending follow-up appointments. Certain barriers to follow-up also disproportionately affect particular ethnic groups. Strategies to improve glaucoma follow-up should focus on making structural improvements to the health care delivery system and considering patient- and ethnicity-specific barriers to follow-up.
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P577 COMPARISON OF DIAGNOSTIC ABILITY OF MOORFIELDS REGRESSION ANALYSIS AND GLAUCOMA PROBABILITY SCORE USING HRT 3

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Purpose: To compare the diagnostic performance of Glaucoma Probability Score(GPS) with that of Moorfields Regression Analysis (MRA) using HRT 3.
Design: Cross-sectional observational study.
Participants: The study included 110 eyes of normal subjects and 87 eyes of subjects with early to moderate primary open-angle glaucoma.
Methods: All participants underwent imaging of the optic nerve head with the Heidelberg Retina Tomograph version 3.0. The images were analysed with MRA using a contour line drawn by a single operator and operator independent GPS.
Main outcome measures: The sensitivity and specificity were evaluated for overall MRA and GPS classifications using most specific (borderline results included as test negatives) and least specific criteria(borderline results included as test positives). The diagnostic accuracy with respect to the disc size was also evaluated. The receiver operating characteristic(ROC) curves between normal and glaucomatous subjects were plotted for the stereometric parameters of both the software versions. Agreement between MRA and GPS classifications was quantified using agreement coefficient k.
Results: The mean age of normal subjects was 44.49 ± 8.58 yrs and glaucoma subjects was 55.15 ± 10.97 yrs. The average mean deviation for visual fileds for normal subjects was -2.88 ± 1.42 db and for glaucoma subjects was -5.75 ± 3.17 db ($p < 0.005$). Among 110 normal subjects, global MRA was outside normal limits (ONL) for 1 eye whereas global GPS was ONL for 34 eyes. With MRA sensitivity and specificity were 27.58% and 99.1% (most specific criteria) and 48.27% and 99.1% (least specific criteria). With GPS sensitivity and specificity were 75.29% and 69.09% (most specific criteria) and 92.94% and 31.81% (least specific criteria). The sensitivity increased with increasing disc size for both MRA and GPS. The specificity remained similar for varying disc sizes for MRA whereas the same decreased for GPS with increasing disc size. The individual stereometric parameters with the best discrimination were vertical cup disc ratio (AUROC = 0.811) for MRA and cup size measure (AUROC = 0.662) for GPS. The agreement coefficient(k) for the overall MRA and GPS classifications was 0.1.
Conclusions: There was a poor agreement between the overall MRA and GPS classifications. GPS had a higher sensitivity and lower specificity as compared to MRA. The sensitivity of both MRA and GPS increased with increasing disc size. One third of normal eyes were categorized as glaucomatous using GPS.
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P578 RETINAL VASCULAR CALIBER AND GLAUCOMA SUBTYPES IN ASIANS

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Purpose: To determine the relationship of retinal vascular caliber with glaucoma subtypes in Asians.
Design: This was a cross-sectional hospital-based study of 411 persons with glaucoma, who were prospectively recruited and underwent dilated digital retinal photography and standardized clinical assessment.
Participants: Primary open-angle glaucoma (POAG) patients with a mean intraocular pressure (IOP) without treatment that was consistently less than 21 mmHg on diurnal testing were classified as normal tension glaucoma (NTG), and those with higher IOP were classified as high tension glaucoma (HTG). Primary angle closure glaucoma (PACG) subjects had at least 180 degrees of angle closure on gonioscopy.
Methods: Retinal vascular caliber was measured by a computer-assisted software in a zone 0.5 to 1.0 disc diameter away from optic disc, and summarized as average retinal arteriolar and venular caliber of that eye. Right eye retinal vascular caliber was used for analyses
Results: Two hundred seventy-six POAG subjects (138 HTG and 138 NTG subjects) and 135 PACG subjects were studied. Retinal venular caliber was narrower in persons with POAG (age, gender adjusted 205.2 ± 1.6 µm) compared to PACG (214.1 ± 2.2 µm) ($p = 0.001$). Within the POAG group, there was no difference in venular caliber between HTG (204.1 ± 2.2 µm) and NTG (206.2 ± 2.1 µm). After adjusting for age, gender, axial length, hypertension and diabetes, persons with POAG (odds ratio [OR] 3.1, 95% CI, 1.6, 6.2, narrowest vs widest venular caliber) had narrower venular caliber than persons with PACG. Persons with either HTG (OR 4.4, 95% CI, 2.0, 9.7) or NTG (OR 2.4, 95% CI, 1.1, 5.1) had narrower venular caliber than persons with PACG. Retinal arteriolar caliber did not differ between glaucoma subtypes.

Conclusions: POAG eyes have narrower retinal venular caliber than PACG. This supports the greater contribution of microvascular processes in POAG as compared to PACG. An assessment of retinal vascular caliber may provide further insights into the 'vascular etiology' of glaucoma subtypes.

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P579 DOES PROSTAGLANDIN ANALOGUE CLINICAL TRIAL SPONSORSHIP BIAS THE MEASURED IOP READINGS?

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Purpose: To determine if sponsorship of prostaglandin analogue (PGA) clinical trials (by parent company, competing company, non-industry source) has an impact on intraocular pressure (IOP) outcomes.

Design: Cohort study.

Participants: All randomized clinical trials of prostaglandin clinical trials.

Methods: A PubMed search was performed on August 8, 2008 for 'Latanoprost OR Xalatan', 'Bimatoprost OR Lumigan', 'Travoprost OR Travatan', with limits to humans, clinical trials and English. Four hundred seventy-three articles were retrieved and reviewed for the following inclusion criteria: randomized controlled trial (RCT), open angle glaucoma, monotherapy with PGA, baseline IOP > 21 mmHg, washout period, minimum 1 month follow-up. IOP measurements at baseline, 1 month and 3 months were extracted from the articles. Each article was reviewed by 2 reviewers. Discrepancies between reviewers were resolved by the article being reviewed by a third reviewer. The PGA IOP results were categorized as being sponsored by the Parent company, Competing Company, or Non-industry.

Main outcome measures: The mean IOPs, and change in IOP from baseline, for each group, were compared and analyzed for statistically significant differences. Statistical analyses were performed with SAS v9.2.

Results: The initial search resulted in 473 articles of which 58 met the inclusion criteria. Latanoprost, Bimatoprost and Travoprost were investigated in 43, 8 and 7 studies respectively. Only Latanoprost studies were analyzed because of the low number of studies that met inclusion criteria for Bimatoprost and Travoprost. Thirty-four of the 43 studies investigating Latanoprost provided 1 month data and were used for analysis. 14 of these studies were sponsored by the parent company (Pfizer/Pharmacia), 5 by a competing company (Allergan, Alcon), and 15 by non-industry sources. The mean baseline IOP between these 3 groups was not significantly different ($p = 0.48$). The mean IOP achieved at 1 month was not significantly different between the 3 groups ($p = 0.65$). The mean change in IOP from baseline to 1 month was not different between the 3 groups ($p = 0.35$).

Conclusions: Pharmaceutical company sponsorship of RCTs for prostaglandin analogues did not bias IOP outcomes at one month. There was no evidence of short-term bias in the IOP measurements.

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P580 STERILE SINGLE USE COVER FOR THE G-PROBE TRANSSCLERAL CYCLODIODE

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Purpose: The Gprobe contact transscleral diode cyclophotocoagulation (TSCPC) device is designated as single use. Despite this, it maintains its mechanical utility for multiple cycles of and up to 55% of ophthalmologists report reuse. Sterilization between patients is a significant concern. Proposed sterilization techniques include alcohol wipe, ethylene oxide and 70% alcohol flush, however, each have limitations. A potential solution is to cover the Gprobe footplate with a single use, disposable membrane barrier. The current study evaluates one such barrier device in 5 key areas: (I) Laser energy transmission, (II) Sterility of footplate, (III) Robustness of Gprobe cover, (IV) Clinical efficacy of Gprobe covered TSCPC and (V) Safety of Gprobe cover for repetitive use.

Design: Prospective observational study.

Methods: Diode laser output with and without the G-probe cover both before and after TSCPC (18 shots at 2000 mW for 2000 mS) on cadaver eyes was measured with a Nova 2 (Ophir Optronics Ltd., Jerusalem, Israel) laser output meter (5 shots at 2000 mW for 9000 mS). Qualitative analyses of the laser aiming beam were made prior to each trial in the barrier and non-barrier state and photographs were taken. After each treatment the G-probe cover was examined for microperforations and the footplate for debris and/or damage. Twenty cycles were performed. Microbiology was taken on the cadaver eye and the probe footplate prior to and after the treatment cycles, microbial profiles were compared. Histological analysis post G-probe covered TSCPC was performed on a cadaver eye. Laser output data was analyzed with repeated measures ANOVA.

Measures: Mean and standard deviation of laser output in no-barrier, barrier pre TSCPC and post TSCPC state.
Results: Qualitatively, laser focus dispersion was minimized by the G-probe cover. The mean laser output was measured was significantly higher in the barrier state ($df = 2$, $F = 36.26$, $p < 0.01$). Laser output varied significantly from no-barrier to barrier t (Huynh-Feldt, $df = 1.757$, $F = 5.47$, $p < 0.01$). No perforations in the G-probe cover were evident on any trial and no debris or damage was detected on the G-probe. Ciliary body pathology was consistent with previous reports of TSCPC in cadaver eyes 7, 8. Microbial segregation of the cadaver eye and the G-probe footplate was maintained by the barrier.
Conclusions: The Gprobe barrier may alter the focus and intensity of laser energy in TSCPC, however it produces the desired pathologic effect. Additionally, it is a robust device that maintains microbial segregation of the device from the patient and does not damage the footplate over multiple cycles of TSCPC. Barrier technology is a viable alternative to standard sterilization techniques, but does require further investigation.

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CASE REPORT

CR1 A CASE OF PRIMARY OPEN-ANGLE GLAUCOMA WITH ABNORMAL INTRAOCULAR PRESSURE ELEVATION BY STEROID SUPPOSITORY

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Objective: To report a case of primary open-angle glaucoma (POAG) showing abnormal intraocular pressure (IOP) elevation in a long-term use of steroid suppository for the treatment of anal hemorrhoid.
Design: Case report.
Methods: The patient was a 57-year-old male with advanced stage of POAG. MD value was -14.08 dB in his right eye and -17.3 ± 7 dB in his left eye, respectively. The IOP ranged between 13 mmHg to 17 mmHg for about 5 years with eye drops of dorzolamide hydrochloride 3 times daily, latanoprost 1 evening dose daily and levobunolol hydrochloride twice daily. On February 2, 2009, IOP was suddenly elevated to 25 mmHg in both eyes. Slit lamp microscopy showed neither inflammation nor exfoliation material.
Main outcome measure: Clinical course.
Results: Patient had a 2-month history of taking steroid suppository every other day to relieve pain for anal hemorrhoid. One week later, IOP returned to 19 mmHg in right eye and 17 mmHg in left eye after discontinuation of the drug.
Conclusions: Anal hemorrhoid is a very common disease in Japan because of the life style (squat toilets and Japanese-style sitting being quite different from Europe and other countries). We need to take into account this side effect of steroid suppository on the IOP elevation in the glaucoma clinics especially for Japanese.
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GLAUCOMA SOCIETY SYMPOSIUM ABSTRACTS

GS01 GLAUCOMA IN THE ARAB WORLD

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Description: Glaucoma is becoming one of the major global causes of blindness, with a particular impact on our patients in the Arab world. The relatively high cost of medications; poor compliance, consanguinity, and the lack of public awareness of the disease have contributed to the late presentation in the majority of our patients. This symposium will focus on the epidemiology, genetics, as well as the common glaucomas in the Arab world like the secondary and congenital glaucomas. As most of our patients present late, a particular emphasis will be given to the glaucoma as a surgical disease.
Speakers and Topics: Fathi Al Sayyad: Glaucoma in our world: Glaucoma as a surgical disease; Magdi Helal: Epidemiology. The magnitude of the problem in the Arab world; Mohamed Bel Meki: Genetic Aspects; Moustafa Yaqub: congenital glaucoma in the Arab countries; Hazem El Hamzawy: The scope of secondary glaucomas; Sherif Gohar: Non penetrating surgery Vs Trabeculectomy in our region.

GS02 GLAUCOMA MANAGEMENT IN INDIA: CASE PRESENTATIONS AND PANEL DISCUSSION

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Description: The expert panel will discuss a series of interesting cases that represent diagnostic or therapeutic challenges. The emphasis will be on their management in an Indian scenario. This will be followed by a structured panel discussion that will address some of the diagnostic and therapeutic challenges in managing glaucoma in the developing world.

GS03 COMPREHENSIVE GLAUCOMA MANAGEMENT – EVIDENCE-BASED APPROACH

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Background: The recent series of large, multicenter, randomized clinical trials have shown that in many cases glaucoma progression occurs despite maintaining target IOP. It is still unknown whether manipulation of blood flow risk factors might prevent glaucoma progression.
Purpose: To evaluate if baseline ocular blood flow parameters are predictive of glaucomatous progression as determined by visual field and/or structural changes.
Design: Prospective, randomized, double-masked study.
Participants: Thirty OAG patients.
Methods: IOP, arterial blood pressure, ocular and diastolic perfusion pressures, color Doppler imaging, pulsatile ocular blood flow analysis, scanning laser polarimetry and Humphrey visual field examination were measured at baseline and 1, 6, 12, 18 months after randomization.
Main outcome measures: Worsening in structural and/or functional values greater than the statistical variation of the technique, sustained in 2 or more consecutive tests were considered glaucoma progression.
Results: Thirteen (43.3%) patients exhibited characteristics of glaucoma progression after 18 months. Patients with glaucoma progression had higher nerve fiber index (NFI), lower systolic blood pressure, lower ocular perfusion and diastolic perfusion pressures, higher ophthalmic and central retinal artery vascular resistance and lower pulse volume ($p < 0.05$; t test). The odds of higher NFI at final 18 months visit was 13.82 times greater [95% CI 1.32-143.76] in patients with baseline vascular resistance index ·0.67 in the central retinal artery ($p = 0.028$).
Conclusions: Our results show that the structural changes consistent with glaucoma progression correlate with non-IOP dependant risk factors. Increased resistance to flow in small retrobulbar vessels supplying the optic nerve is probably related to glaucoma progression. Large group studies with longer follow-up, standardization of measurement techniques for glaucoma progression and ocular blood flow parameters are required to elicit a clear understanding of vascular risk factors in glaucoma progression.
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GS04 JOINT VIDEO-SYMPOSIUM OF THE ARGENTINE AND BRAZILIAN GLAUCOMA SOCIETIES, WITH THE PERUVIAN AND ECUATORIAL SOCIETIES AND THE SPONSORSHIP OF THE LATIN AMERICAN AND THE PAN AMERICAN GLAUCOMA SOCIETIES

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Description: Video-symposium of glaucoma surgery, its types, its complications and possible solutions to different situations. Presented in 5-minute videos and with public discussion.
Coordinators: Carlos Akira Omi MD, Brazilian Glaucoma Society (SBrG), Alejo Peyret MD, Argentine Glaucoma Society (AsAG).
Speakers and Topics: Virginia Zanutigh: Postoperative complication: getting the iris off from the trabeculectomy's ostium (AsAG); Jorge Lynch: Transconjuctival use of MMC in late postop needling (AsAG); Javier Casiraghi, Marcos Geria, Pablo Nahum: Bleb repair in late onset Seidel (AsAG); Ignacio Lischinsky: Reactivation of failed trabeculectomy after Ahmed GDD implantation (AsAG); Emílio Suzuki: Intra- operative glaucoma surgery complication: suprachoroidal hemorrhage (SBrG); Ralph Cohen: Choroidal detachment after trabeculectomy (SBrG); Marcelo Jordão da Silva: New surgical approaches for Primary Congenital Glaucoma (SBrG); Ivan Maynart Tavares: Glaucoma drainage devices after retinal surgery (SBrG); Alberto Dios MD: Trabeculectomy's complications (Peruvian Glaucoma Society (SPG)); Carlos Chacón: Scleral tunnel and Ahmed implants in multioperated patients (Ecuatorian Glaucoma Society (SEG)); Paul Palmberg: Solving surgical problems by 'micro-zorro' (Pan American Glaucoma Society (PAGS)); Francisco Fantes: Glaucoma surgery with the 'ExPress' implant (PAGS); Rodolfo Pérez Grossmann: Bleb complications: how to solve them (Latin American Glaucoma Society (LAGS)); Eugenio Maul: How to manage oversized blebs (LAGS).

GS05 THE IMPACT OF THE GLAUCOMA MEDICATION ON THE BIOMECHANICAL PROPERTIES OF THE CORNEA

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Purpose: The aim of this study was to evaluate the biomechanical properties of the cornea in primary open-angle glaucoma (POAG) eyes measured by the Ocular Response Analyzer (ORA) before and after use of the antihypertensive drugs. The healthy individuals were studied as a control group.
Methods: This prospective, comparative clinical trial included 160 eyes, normal (n = 80) and POAG (n = 105). POAG eyes were divided into four groups depending on the type of medication which had been used prostaglandine analogues (PGA), betablockers (BB), inhibitor carboanhydrase (ICA) and combine therapy.
Main outcome measures: The main outcome measures were intraocular pressure (IOP), hysteresis (CH), corneal resistance factor (CRF) and central corneal thickness (CCT). The mean follow-up time was 24 months.
Results: The hysteresis (CH) in the primary open-angle glaucoma group did not change significantly, the mean change in CH was 2.2 mmHg, 1.9 mmHg, 1.8 mmHg and 2.3 mmHg in the PGA, BE, ICA, and combined-therapy groups. The mean CCT were lower in the POAG than in the control group. The other outcome measures were not statistically significant.
Conclusion: The biomechanical measures of the cornea in POAG are not significantly influenced by the long term use of antihypertensive therapy.
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GS06 EFFICACY AND SAFETY OF FIXED GLAUCOMA COMBINATION THERAPY

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Introduction: Most glaucoma patients begin therapy with a single IOP-lowering medication. If the target pressure is not reached even on the most effective monotherapy, a second IOP-lowering medication with a complementary mechanism of action should be added. Whenever multiple drugs are administered, fixed combination products are preferred over separate administration of the component medications.
Purpose: To evaluate the effect on IOP lowering and safety of latanoprost and timolol fixed combination (LTFC) switched from monotherapy or combination therapy.
Materials and Methods: Retrospective, 77 patients with POAG and OH data analysis. Reasons for changing therapy were not sufficient treatment to reach the target IOP, complicated dosing schedule and side effects. IOP was measured before switching to LTFC and after 1 and 3 months of therapy.
Results: Mean IOP before switching was 19.0 ± 4.4 mmHg, and after 3 months LTFC therapy was 15.8 ± 2.6 mmHg or 16.7% reduction. Nineteen patients switched from beta-blockers to LTFC, IOP decrease was the most significant: from 22.4 ± 5.7 mmHg to 15.9 ± 2.1 mmHg. In 13 patients switched from latanoprost monotherapy IOP decreased 4 mmHg after 3 months of treatment with LTFC. This combination therapy was well tolerated: only 6.5%patients had to discontinue treatment due to side effects.
Conclusions: The study reflects the real life situation and shows efficacy and safety of LTFC especially when switched from beta-blockers or latanoprost monotherapy.

GS07 EXFOLIATION SYNDROME AMONG PATIENTS SCHEDULED FOR CATARACT AND GLAUCOMA SURGERY AT VILNIUS UNIVERSITY HOSPITAL

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Purpose: To evaluate the frequency of exfoliation syndrome (EXS) among glaucoma and cataract patients scheduled for surgery.
Design: Case series study.
Participants: In total, 606 consecutive and otherwise unselected patients scheduled for cataract and glaucoma surgery at Vilnius University hospital. The patients were divided to two groups: 430 patients (group A) scheduled for cataract surgery, and 176 patients (group B) scheduled for glaucoma surgery.
Methods or testing: Slit lamp biomicroscopy after pupillary dilatation.
Main outcome measure: Presence of exfoliation material in the anterior segment of the eye.
Results: EXS was detected in 53.8% (326 out of 606 patients): 48.6% in group A and 665% in group B. The prevalence of EXS had a tendency to increase with patient's age. The highest percentage of EXS in group A was found at the age older than 70 years (58.1%), and in group B at 61-70 years of age (76.9%). The youngest patient with EXS in group B was 37 years old.
Conclusions: 1. The prevalence of EXS among Lithuanian patients with cataract and glaucoma is relatively high; 2. EXS occurred more often and in younger patients in the glaucoma surgery group.
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GS08 CENTRAL CORNEAL THICKNESS IN PSEUDOEXFOLIATION GLAUCOMA PATIENTS, REFERRED FOR GLAUCOMA SURGERY

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Purpose: To evaluate central corneal thickness (CCT) in advanced and moderate pseudoexfoliation glaucoma (PEXG) patients, referred for glaucoma surgery.
Design: Retrospective.
Participants: PEXG patients, referred for glaucoma surgery, without previous ophthalmic surgery.
Methods: One hundred case histories of (PEXG) patients, referred for glaucoma surgery between September 2008 and April 2009, were randomly selected from outpatient department. All patients had no previous ophthalmic surgery and were on glaucoma medication. All patients had standard ophthalmological examination and ultrasound pachymetry (Quantel Medical B VI, France). Patients were divided into three groups according to CCT values. Group I: ≤ 512 μm; Group II: 513-587 μm; Group III: ≥ 588 and each of them into three subgroups according to glaucomatous damage (early, moderate, advanced).
Outcome measures: CCT and stage of glaucomatous damage.
Results: Average CCT for all (100) patients was 521.8 μm. Average CCT in group I (45 patients), II (47 patients) and III (8 patients) was, respectively, 489.4 μm; 540,7 μm; 592.7 μm. There was no significant difference in the incidence of advanced glaucoma (68.8% and 65.9%) among patients of group I and II.
Conclusions: Forty-five percent (45) of PEXG patients, referred for glaucoma surgery, had thin corneas (≤512 μm). Overall incidence of advanced glaucoma damage in this cohort of PEXG patients was 68% (68 patients) and did not differ significantly among patients with thin and with average thickness corneas.
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GS11 CANADIAN GLAUCOMA SOCIETY SYMPOSIUM: A TWO-HOUR INFORMATION SESSION WITH PATIENT RECALL HAS LIMITED IMPACT ON PERSISTENCY

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Objective: A major challenge in glaucoma treatment is to improve persistency. A two-hour information session was initiated in 2005 and offered to all patients using drops. The session included a power point presentation and videos. Patients were later contacted at 1, 4 and 10-month to determine if they had concerns and to stress the importance of using antiglaucoma drops. We studied the effect of this intervention on persistency.
Design: We reviewed pharmacy records, obtained from the RAMQ (a government drug insurance program) of the patients of one of the authors.
Participants: All patients of one of the author using glaucoma drops were analysed. These patients were unaware of this procedure.
Methods: Patients having undergone glaucoma procedures were censored. One cc of a B.I.D. and DIE drug was assumed to last 12 and 24 days, respectively. Between 2002 and 2007 we analysed the persistency of those who attended the session and those who did not; of patients before and after the session; and of all the patients, irrespective of their attendance at a session.
Main outcome measure: Change in persistency.
Results: The database contained approximately 1600. Their overall persistency rate was 67.5%. Three hundred forty-two of these patients attended a session between 2005 and 2006. A significant increase in overall persistency was noted but was less than 4%. There was an improvement in beta blocker but not in prostaglandins persistency. Patients attending the session had a significantly better persistency than those who did not. There was no significant difference, however, in their per-

sistency rates before and following an information session.
Conclusion: Patients more concerned with their health chose to attend the session. They had a better persistency rate than those not attending. However, it did not change their persistency following the session. Beta blocker persistency was improved. This intervention had a limited impact on persistency.
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GS12 CANADIAN GLAUCOMA SOCIETY SYMPOSIUM: GLAUCOMA LASER AND SURGICAL PROCEDURE RATES IN CANADA: A LONG-TERM PROFILE

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Objective: New laser and surgical techniques have had a significant effect on glaucoma therapy. A precise understanding of how these developments are affecting overall glaucoma management is fundamental to health services planning. The objective of this study was to synthesize Canadian national and provincial data regarding glaucoma laser and surgical procedure rates from 1992 to 2006.
Methods: Canadian provincial health insurance databases, which cover virtually all surgical procedures provided domestically to Canadians, were accessed to ascertain yearly total glaucoma procedure numbers. To estimate the number of individuals with glaucoma, an age-stratified glaucoma prevalence model was applied to population census data.
Results: Laser trabeculoplasty rates have dramatically increased since 2001, with the national Canadian rate more than doubling. However, the magnitude of this increase has varied widely across regions. Trabeculectomy surgery rates slowly increased from 1992 to 1995, then declined by 29% nationally between 1995 and 2006. Glaucoma drainage device implantation increased 13-fold nationally between 1992 and 2006. By 2006 glaucoma drainage device implantation accounted for 11% of incisional glaucoma surgeries in Canada.
Conclusions: In Canada, laser trabeculoplasty rates have risen significantly over recent years. Trabeculectomy rates have declined while glaucoma drainage device implantation is playing an increasingly important role in glaucoma management in this country.
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GS13 CANADIAN GLAUCOMA SOCIETY: CANADIAN OPHTHALMOLOGICAL SOCIETY CLINICAL PRACTICE GUIDELINES FOR THE MANAGEMENT OF GLAUCOMA IN THE ADULT EYE

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Description: The purpose of this presentation is to outline the Clinical Practice Guidelines of the Canadian Ophthalmological Society (COS) for the management of glaucoma in the adult eye. The objective of this document is to provide guidance to Canadian ophthalmologists. Other health care providers may also find this information helpful in the care of their patients. A volunteer expert committee of nine COS members, from across Canada and with representation from the Canadian Glaucoma Society, were selected and asked to disclose any and all relationships with pharmaceutical and medical device manufacturers in the past 24 months. An English-language literature search for the years 1997 to 2008 was conducted using Pub Med, EMBASE, the Cochrane Library, the National Guideline Clearing House and the United States Preventative Services Task Force databases. This was supplemented with hand searches of the tables of contents in recent issues of major ophthalmology and glaucoma journals to locate seminal papers published before 1997. The expert committee members were paired as primary and secondary authors for the initial drafts of the major sections: Introduction (definitions, classifications, epidemiology and screening); Diagnosis (history, risk factors and clinical examination); Role of Diagnostic Tests (perimetry, disc imaging and other); Open-angle glaucomas (suspects, normal pressure, pseudoexfoliation and pigmentary glaucomas); Angle-closure glaucomas (suspect, primary and secondary types); Treatment goals (target pressures, quality of life issues); Therapeutic choices (medicines, laser, surgery, patient education and compliance); and Progression (determinations and follow-up guidelines). All members of the expert committee were then given several opportunities to comment on any and all sections of the guide-

lines. Recommendations formulated and highlighted in the text were assigned a level of evidence based on criteria outlined by the Canadian Medical Association Handbook on Clinical Practice Guidelines and as specified in the six domains of the Appraisal of Guidelines Research and Evaluation (AGREE) Instrument. A separate and independent steering committee was tasked with ensuring the entire document and its recommendations were consistent with these criteria. A complete draft version was sent to several external reviewers consisting of comprehensive ophthalmologists, glaucoma sub-specialists and optometrists from across Canada and the United States. Revisions were made by the exert committee as appropriate. Canada is a large country with 13 separate health administrations (10 provinces and 3 territories) and some differences between them in terms of human and material resources, funding and practice patterns. Recognizing this diversity, it is hoped that this document will be accepted as a useful tool by Canadian ophthalmologists in the care of their patients. It may also be applicable as a guide to ophthalmologists in other countries.

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GS14 CZECH GLAUCOMA SOCIETY: A CATARACT SURGERY IN THE TREATMENT OF THE ANGLE-CLOSURE GLAUCOMA

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Objective: To evaluate the results of cataract surgery-phacoemulsification and intraocular lens (IOL) implantation of angle-closure glaucoma patients with an early or significant cataract, to assess the impact on visual acuity, intraocular pressure (IOP), visual field and the quality of life.

Material and Methods: Thirty-five eyes of angle-closure glaucoma patients undergoing their first laser iridotomy or surgical iridectomy were examined before the cataract surgery and 3 times after the surgery in a two-year period. Visual acuity, intraocular pressure, angle width, angle chamber depth, visual field were analyzed.

Findings: The visual acuity of nearly all observed patients was improved by 4 lines on average, the intraocular pressure decreased from 20 mmHg (± 5 mmHg) to 15 mmHg (± 4 mmHg), the central anterior chamber depth increased 1.37 x and the angle width increased 1.57 x, the contrast sensitivity improved in 32 eyes, 3 patients have no improvement (diabetic patients after laser therapy of retina). The quality of life improved especially by the progression of the visual acuity, contrast sensitivity and by the reduction of the antiglaucoma treatment.

Conclusions: Clear lens / cataract extraction has become a method of choice in modern surgery of angle-closure glaucoma patients. Our results show improvement of all parameters – IOP, anterior chamber depth and angle width in addition to the improvement of the quality of life of patients with angle closure glaucoma. There are good results in the early as well as the late stage of the illness. These patients should be sent as early as possible for the operation.

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GS15 CZECH GLAUCOMA SOCIETY: ELEVATED INTRAOCULAR PRESSURE IN THYROID-ASSOCIATED OPHTHALMOPATHY

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Objective: To demonstrate the mechanism of elevated intraocular pressure (IOP) in thyroid-associated ophthalmopathy (TAO) and to recommend adequate therapy in various cases.

Main Message: Elevated IOP in thyroid ophthalmopathy has been postulated to be caused by a variety of mechanisms. Enlarged extraocular muscles and orbital congestion due to the proliferation of intraorbital connective tissue compromise orbital venous outflow, resulting in elevated episcleral venous pressure and, subsequently, in decreased aqueous outflow facility. Also increased mucopolysaccharide deposition within the outflow system is hypothesized. The other mechanism is compression of the eyeball by enlarged extraocular muscles. Fibrotic extraocular muscles (in particular the inferior rectus) may indent the globe in a certain position of gaze and elevate the IOP in that field of gaze. The presented case reports demonstrate the principles of various successful therapies of elevated IOP in such patients.

Conclusion: In most cases, elevated IOP in thyroid ophthalmopathy can be controlled by prompt and effective treatment of TAO by methylprednisolone or other immunosuppressive drugs and topical antiglaucoma therapy, in more difficult cases orbital decompression is necessary. In advanced cases with fibrotic extraocular muscles, strabismus surgery is indicated.

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GS16 CZECH GLAUCOMA SOCIETY: FIRST EXPERIENCE WITH MINIATURE GLAUCOMA DRAINAGE DEVICES

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Purpose: To compare the efficacy of first 3 Ex-Press implants with first 3 GMS implants at the minimal follow-up of 6 months.
Design: Interventional case series.
Participants: Six eyes of 6 patients with OAG, with uncontrolled IOP. Three of them underwent Ex-Press implantation under a scleral flap, 3 of them Gold Micro Shunt implantion. Out of these, 3 patients have had previous antiglaucoma surgery, 1 patient previous SLT.
Intervention: Three Ex-Press implantations under a scleral flap and 3 Gold Micro Shunt implantions were performed on 6 patients by the same surgeon.
Main outcome measures: IOP, BCVA, medication per patient.
Results: In the Ex-Press group, IOP was reduced from a mean of 32.8 mmHg preoperatively to a mean of 20.1 mmHg at 6 months follow-up. In the GMS group IOP was reduced from a mean of 30.1 mmHg preoperatively to a mean of 16.7 mmHg at 6 months follow-up. Ex-Press implant and GMS implant reduced IOP after 6 month respectively of 37.2% and 44.4%. BCVA preoperatively was in the Ex-Press group 0.44, in the GMS group 0.72. At 6 months follow-up it was 0.42 in the Ex-Press group and 0.76 in the GMS group. Medication per patient in the Ex-press group was 3.3 preoperatively and 1.0 at 6 months follow-up. In the GMS group it was 3.3 preoperatively and 2.3 at 6 months follow-up.
Conclusion: Ex -Press and GMS implantion seem to be effective procedures.
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GS17 CZECH GLAUCOMA SOCIETY: GLOBAL INDICES, GLAUCOMA HEMIFIELD TEST AND GLAUCOMA CHANGES

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Purpose: To monitor global indices (GI) and glaucoma hemifield test (GHT) in glaucoma patients.
Design: Correlation GI and GHT with visual field (VF) and optic nerve head (ONH).
Participants and controls: Sixty-five eyes (57 eyes with POAG and 8 controls) were evaluated.
Methods: The VF was examined by Full Threshold test (30-2) using Humphrey Field Analyzer (HFA) perimeter and evaluated by Aulhorn's scale of 0 to 6, by GI: Mean deviation (MD), Pattern standard deviation (PSD), Correlated pattern standard deviation (CPSD), Short fluctuation (SF) and by GHT. GI and GHT were correlated with optic nerve head using the Disc Damage Likelihood Scale (DDLS) from 1 to 10.
Main outcome measure: To evaluate relationship between functional and structural changes during evolution of glaucoma changes.
Results: In all correlations MD coefficient worsens very slowly, especially in the early glaucoma, changes are from VF 3 and from DDLS 4. Due to other glaucoma progression MD index accelerates. The apparent evolution of PSD index is from VF 2 and DDLS 4, value of PSD are lower when irregularities in the VF are mild (shallow scotomata), and increase as there is additional depression in the VF. Maximal level of PSD is due VF 4-5 and DDLS 7, later is PSD index decreased. CPSD curve is authentic image of PSD with lower values due to correlations. SF parameter slowly increases with crescentic changes in the VF and on the ONH by DDLS classification. GHT was 'within normal limits' at 8/9 eyes with POAG and VF 0.5, 8/8 eyes at VF 1, 1/8 at VF 2 and 1/10 at VF 3. DDLS 1 had 4/4 eyes with POAG, 0.5 at DDLS 2 and all 6/6 with at DDLS 3, 3/7 at DDLS 4 and 3/10 at DDLS 5. 'Borderline' GHT had only 2/57 eyes with POAG. One eye had VF 0.5 and DDLS 4, the other one VF 2 and DDLS 2. All eyes from VF 2 (except one-VF 3) and from classification DDLS 4 (except 3/10 DDLS 5 and 1/10 DDLS 6) were 'outside normal limits'. Three eyes had 'general depression of sensitivity' for advanced changes of the ONH and in the VF.
Conclusions: This study shows; GI and GHT correlate with evolution of glaucoma changes and they have own specific trend. PSD is worsening due to VF changes 2 to 4, MD from VF changes 3 and accelerates with VF deterioration. GHT is very sensitive, but in initial POAG can be negative. Therefore GI a GHT have to be compared with greyscale (Pattern Deviation Probability Plots) of the VF and objective examination of the ONH.
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GS18 CZECH GLAUCOMA SOCIETY: LENS PARTICLE GLAUCOMA AS A CONSEQUENCE OF SPONTANEOUS RUPTURE OF ANTERIOR CAPSULE IN HYPERMATURE CATARACT: TWO CASE REPORTS

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Objective: To demonstrate two case reports of lens particle glaucoma with unique aetiology.
Method: In these cases there was no ocular or orbital trauma or history of surgery. The two patients were women with acute lens particle glaucoma as a consequence of spontaneous rupture of anterior capsule in hypermature cataract. Principal symptoms prompting the women to seek medical assistance were monocular eye pain and blurred vision. Objective findings showed pronounced elevation of intraocular pressure (IOP) to 50 mmHg and very low visual acuity, hand motion and no light perception. In the first case, a 61-year-old woman was recommended to Department of Ophthalmology at the University Hospital in Olomouc with acute IOP elevation. In addition to IOP elevation, pseudohypopyon (caused by lens particles), tyndalisation in anterior chamber, hypermature cataract and radial rupture of anterior capsule were present. In the second case, a 92-year-old woman was brought by her family members with 'white' eye. Slit-lamp examination showed an intact transparent cornea but behind it there was an anterior chamber filled with a yellowish substance. Nothing further was visible. The clinical picture looked like an endophthalmitis. However from the CT scans it was not possible to differentiate anterior chamber and lens. In the scans there was only strong hyperdensity of lens nucleus in the right side. Both patients had uncontrolled IOP elevation so acute that surgery was indicated. Phacoemulsification of residual lens fragments and intraocular lens implantation were performed. Both patients remained pain-free following surgery, IOP normalized and visual acuity improved to 1.0 (20/20) and 4-meters finger count respectively.
Conclusion: Lens particle glaucoma can occur in intact eyes.
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GS19 CZECH GLAUCOMA SOCIETY: PRIMARY ANGLE CLOSURE IN THE CZECH REPUBLIC –IS LASER IRIDOTOMY A SUFFICIENT METHOD OF TREATMENT?

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Purpose: To assess risk of primary angle closure (PAC) in patients with shallow anterior chamber and result of van Herick test with grades 1 or 2.
Methods: The data were obtained from patients of the Glaucoma center within the Department of Ophthalmology at the General Teaching Hospital, Prague. As a result of van Herick tests with grades of 1 and 2, there was a suspicion of angle closure. All patients underwent a detailed ophthalmic examination including: visual acuity; intraocular pressure measurement by Goldmann tonometry; visual field testing; estimation of the anterior chamber width by gonioscopy; ultrasound biometry and imaging of the anterior chamber angle structures by anterior segment OCT. It is generally agreed that eye with occludable angle should undergo laser iridotomy. After the iridotomy was done, all examination procedures were repeated.
Results: There was a significant widening of the anterior chamber angle after laser iridotomy. Van Herick grade increased by 88.46%. In the group of patients without antiglaucomatous therapy, IOP was compensated after laser iridotomy in all of the cases. Fifty percent of patients who had local antiglaucomatous therapy followed by laser iridotomy no longer needed antiglaucomatous therapy.
Conclusions: Primary angle closure is not so rare in the Czech Republic. Van Herick test is a simple, noncontact and sensitive examination method for screening of patients with suspection of angle closure. To confirm the diagnosis of primary angle closure a complete ophthalmic examination and especially gonioscopy has to be done. If laser iridotomy is performed in the early stage of the disease, there is a low risk of progression and visual field loss resulting from primary angle-closure glaucoma (PACG). Strategies for early detection of PAC could reduce the risk of blindness. Laser iridotomy is a sufficient method of treatment in majority of cases of primary angle closure. Medical therapy should not be used as a substitution for laser iridotomy. The study was supported by the IGA grant MZ ČR 8337-3.

GS20 CZECH GLAUCOMA SOCIETY: TRABECULECTOMY WITH RESTRICTIVE MATTRESS SUTURE- SAFER METHOD FOR THE OUTPATIENT GLAUCOMA FILTERING SURGERY

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Objective: Author show video of the relatively very safe trabeculectomy procedure using 10-0 nylon restrictive mattress suture over the scleral flap. Method is very quick and advantage of this tamponing suture is that it can be released easily and completely any time after the primary procedure.
Conclusion: Trabeculectomy seems to be still standard among glaucoma procedures and every step to make this procedure safer is important for the patients.
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GS21 CZECH GLAUCOMA SOCIETY: CATARACT SURGERY AS TREATMENT OF ANGLE CLOSURE

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We investigated results of cataract surgery in patients with angle closure whose intraocular pressure (IOP) had not been controlled with conventional treatment and in patients with potential risk of acute angle closure. We compared the effect of the cataract surgery in patients with chronic angle closure glaucoma and patients with a history of acute angle closure.
Methods: The data were obtained from patients of the Glaucoma center within the Department of Ophthalmology at the General Teaching Hospital, 1st Medical Faculty in Prague. Patients underwent a detailed examination including visual acuity, biometry, visual field testing, pachymetry, Goldmann applanation tonometry, van Herick's test, gonioscopy, ophthalmoscopy and anterior segment OCT before and after cataract surgery. Configuration of anterior chamber angle width was analyzed with anterior segment OCT and ultrasound biometry. Group of patients included 26 eyes of 16 women. Laser iridotomy was performed in all of the eyes before cataract surgery to avoid the risk of pupillary block. There were 18 eyes with primary angle closure (PAC) and 8 eyes after acute angle closure. Cataract surgery was performed by routine technique – temporal clear cornea incision, phacoemulsification, implantation of an acrylic lens or PMMA into the capsular bag. Synechiolysis and stretching of iris and use of viscoelastic material was necessary. Complications after surgery were analyzed.
Results: Anterior chamber (AC) was 1.37 times deeper compared with the width of AC before surgery, the angle was 1.57 times wider after surgery. Mean anterior chamber angle width was 19.6° before surgery and 42° after surgery. Mean anterior chamber depth was 1.83 mm before and 3.67 after surgery. Mean intraocular pressure (IOP) before operation was 18.2 torr compared with the value of 15,6 torr IOP after surgery, 6 eyes were without any antiglautomatous therapy, 10 eyes were treated with monotherapy, 10 eyes were treated with multiple therapy. Mean visual acuity (VA) was 0.308 before surgery, 0.64 after surgery.
Conclusion: There was a significant lowering of IOP as well as a widening of the anterior chamber angle, significant improvement of visual acuity and stable visual field after cataract surgery in patients with history of acute angle closure as well as in patients with chronic angle closure. Modern cataract surgery is an effective treatment for selected patients with angle closure whose IOP is not controlled with conventional treatment.

GS22 CZECH GLAUCOMA SYMPOSIUM: CHANGES IN MACULAR THICKNESS AFTER CATARACT SURGERY IN GLAUCOMA PATIENTS RECEIVING PROSTAGLANDIN ANALOGUES

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Purpose: To determine if the continuous application of prostaglandin analogues during the perioperative period in glaucoma patients undergoing cataract surgery causes significant changes in macular thickness or cystoid macular edema and if therefore this treatment should be discontinued before surgery.
Design: Prospective longitudinal study.
Participants and control: Patients scheduled for cataract surgery were separated into three groups: patients with glaucoma treated with prostaglandin analogues (group A, n = 15), glaucoma patients with another glaucoma therapy (group B, n = 15) and cataract patients without glaucoma and any permanent ocular therapy (group C, n = 15).
Methods: Macular thickness and macular volume were examined in all groups by means of optical coherence tomography prior to surgery, 1 week, 1 month and 3 months after surgery. Changes in macular thickness were statistically compared among all three groups.
Main outcome measure: Patients in all groups underwent an uneventful phacoemulsification with implantation of a foldable intraocular lens. An increase in retinal thickness and macular volume after cataract surgery were proved in all groups of patients and reached the maximum in months 1 an 2 in all examined areas. An increase in retinal thickness was proved to be most prominent in the inner macular area.
Results: No significant difference in macular thickness among all three groups was found during the follow-up period and cystoid macular edema did not occur in any patient from group A.
Conclusions: First results of our prospective longitudinal study suggest that the occurence of cystoid macular edema after an uneventful cataract extraction in patients receiveing prostaglandin therapy is not higher than in patients without this treatment. Results of our project could bring important conclusions for clinical practice with regard to the perioperative management of glaucoma patients.
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GS23 CZECH GLAUCOMA SYMPOSIUM: SELECTIVE LASER TRABECULOPLASTY – EFFICACY OF 270° TREATMENT IN PRIMARY OPEN-ANGLE GLAUCOMA

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Purpose: To determine the efficacy of 270° selective laser trabeculoplasty (SLT) in primary open-angle glaucoma (POAG).
Method: The SLT spots are burn in the extent of 270° of trabecular meshwork (1 mJ, 80 spots, 400 um).
Results: In 569 eyes with POAG followed up retrospectively at 12 months after SLT, it was in 357 eyes possible due to decrease of intraocular pressure (IOP), to decrease the medication, or to decrease the frequency of its application. In the other 197 eyes, the IOP was stabilized with no change of therapy, in 15 eyes trabeculectomy was necessary. In the second group of POAG patients (133 eyes) followed-up prospectively in the period 1, 3, 6 and 12 months after SLT, the decrease of IOP from 21.1 mmHg (SD 4.5) to 17.8 mmHg (SD 3.2) after 1 month ($P < 0,0001$), to 18.6 mmHg (SD 3.6) after 3 months, to 17.8 (SD 3.1) after 6 months, to 17.7 (SD 2.8) after 12 months was established.
Conclusion: 270° SLT was found to be an efficacious method in the treatment of POAG.
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GS24 DEEP NONPENETRATING SCLERECTOMY – COMPLICATIONS

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Objective: The purpose of this retrospective study was to evaluate an incidence of complications after deep nonpenetrating sclerectomy with different type of implant.
Methods: A total of consecutive 91 eyes (61 patients) that underwent deep sclerectomy were divided into 3 groups according to the type of nonpenetrating surgery. The first group underwent deep sclerectomy without implant (40 eyes, 26 patients), the second group underwent deep sclerectomy with absorbable collagen implant (Staar Surgical AG, Nidau, Switzerland) (24 eyes, 16 patients) and the third group underwent deep sclerectomy with non-absorbable implant T-Flux® (27 eyes, 19 patients). The complications were divided into 3 types – peroperative, early postoperative and late postoperative.
Results: The incidence of complications in above mentioned 3 groups was as follows: Peroperative complications: Perforation of trabeculo-Descemet's membrane (2.6; 4.2; 3.7% respectively). Early postoperative complications: filtrating operating wound (no occurrence in our groups), choroideal detachment (17; 19; 16% resp.), hypotony (10; 8; 5% resp.), hyphaema (7; 3; 0% resp.), infectious complications (no incidence of blebitis or endophthlamitis in our groups), flat anterior chamber (7; 5.7; 5,5% resp.), dislocation of implant (1 case of dislocation of the absorbable collagen implant, 1 case of dislocation of T-Flux®). Late postoperative complications: fibrosis of filtering bleb (30; 36; 24% resp.), encapsulated filtering bleb (no incidence in our groups), peripheral anterior synechiae (0; 4.2; 3.7% resp.), Cataract progression (total incidence 5.5%), there was no incidence of chronic hypotony, scleral ectasia and late endophthlamitis in our groups.
Conclusions: Based on our results, we suggest that deep sclerectomy allows effective lowering of intraocular pressure, without the necessity of opening the anterior chamber. It brings lower incidence of complications compared to classical penetrating trabeculectomy. The use of an implant increases the success of surgery due to intrascleral fibrosis reduction. We documented a better effect of the non-absorbable implant T-Flux® compared to the absorbable collagen implant. The highest incidence of intrascleral fibrosis was in the group of patients that underwent deep sclerectomy without implant.
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GRAND ROUNDS

D.L. Epstein (Chair), R. Thomas (Chair), P.B. Gross, S. Tejwani, G. Murthy, R. Venkatesh, S. Kaushik
Panel: V. Lerner, C. Migdal, I. Goldberg, W. Alward

Clinical glaucoma cases with relevance to important mechanisms of glaucoma and need for advanced therapy will be presented and discussed.

GR01 A 77-YEAR-OLD MAN WITH BLURRY VISION AND PAIN

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History: The patient is a 77-year-old white male with a complaint of blurry vision and mild pain affecting OS for two months. He was being treated at an outside practice with tropicamide BID, prednisolone acetate 5x/day and timolol maleate BID. POHx: Bilateral cataract surgery (facoemulsification) in 2004. PMHx, Meds, SHx and FHx: Non-contributory.
Examination: Vision: 20/20 OD, 20/30 OS.
Slit lamp examination: The OS showed a shallow anterior chamber and posterior synechiae, along with 1+ cell reaction. Both eyes are pseudophakic (posterior chamber IOLs).
Tonometry (Goldmann): 10 mmHG OD, 38 mmHG OS.
Fundus examination: The left disc shows evidence of advanced glaucomatous cupping with a mainly remanescent nasal rim. The macula, vessels, peripheral retina and vitreous OS are within normal limits. Fundus OD within normal limits.
Gonioscopy (Possner lens): Peripheral anterior synechia (PAS) almost 360 degrees OS. Angle open and mildly pigmented trabeculum OS.
Visual fields: Testing using the Humphrey automated perimeter showed advanced
glaucomatous field loss OS. The visual field was normal OD.
Clinical course: The patient was submitted to a successful trabeculectomy with MMC, with IOP ranging from 10 to 12 mmHg in the first months post-op. During a visit at month 6 postop, OS presented with IOP 54 mmHg and a very shallow anterior chamber. Gonioscopy showed a gelatinous material obstructing the trabeculectomy ostium. IOP was lowered to 40 mmHg after vigorous superior eye massage. Assuming an aqueous humour misdirection component, the anterior chamber deepened slightly with atropine drops BID and Yag:laser posterior capsulotomy. The IOP was controlled at 14 mmHg with timolol maleate + brimonidine tartrate BID. Four months later there was a relapse of the same clinical findings (elevated IOP and shallow anterior chamber) despite topical medications.
Ancillary exams: Ultrasound biomicroscopy (UBM): The OS UBM showed cataract cortical material remanescent 360° and an inverted IOL. The cortical material was obstructing the trabeculectomy ostium. There were also anteriorized ciliary processes. OD examination was unremarkable. Differential diagnosis: 1) Plateau iris syndrome; 2) Inverted IOL leading to glaucoma (PAS) and uveitis (rubbing of the posterior iris surface, posterior synechiae); 3) Cataract cortical remanescents intermittently obstructing the trabeculectomy ostium; 4) Aqueous humour misdirection post trabeculectomy.
Treatment: The patient was submitted to a second trabeculectomy with MMC associated with anterior hialoidectomy via iridectomy with a posterior vitrectomy system. Currently, the OS IOP is 13 mmHg and the anterior chamber is deep.

GR02 GLAUCOMA WITH SCLEROKERATITIS: WHETHER TO TOUCH THE SLEEPIING LION

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History: A 23-year-old male, student staying in a hostel at Bangalore presented to us with history of decreased vision in left eye since one week. His vision in the left eye had been fluctuating since past few years.
Treatment history: The patient was diagnosed to have secondary glaucoma elsewhere and was on topical Beta-blockers since 1993. Systemic history was insignificant.
Examination: BCVA was 20/20 and HM in OD and OS respectively. Conjuctival congestion was present in left more than right eye. Cornea showed scars, peripheral superficial vascularization and haze in the periphery almost 360º in OS more than OD. Cornea had central epithelial edema in OS. Rest of the anterior segment was unremarkable. IOP was 12 and 40 mmHg in OD and OS respectively on applanation tonometry. Gonioscopy showed open angles with a lot of pigment and scattered inflammatory PAS in both eyes. Posterior segment showed normal retina and macula, Disc was healthy in OD and 0.9 cup with inferior notch in the OS.
***Ancillary tests*:** Humphrey visual fields were done that were normal in OD and very constricted (less than 10º) in OS. UBM was consistent with peripheral corneal and scleral inflammation
Diagnosis: OU Active sclerokeratitis in both eyes (OS > OD) with secondary glaucoma OS.
***Treatment*:** Maximal medical therapy was started to control the pressures. We worked along with internist for systemic problems. Meanwhile he also developed an inflammatory nodule in the left eye nasally. The patient was given i/v methyl prednisolone pulse therapy and then oral steroids and Methotrexate. IOP came down to 27 and vision improved to 20/125, however, it kept fluctuating between 27-38 mmHg on maximum medical therapy.
Dilemma: To perform trabeculectomy with the risk of scleral melt as the inflammation was still active or to watch the glaucoma progress.
Surgery: Considering his pressures and advanced damage, the patient was taken up for a filtering procedure, explaining all the risks involved. Simple trabeculectomy with minimal cautery and without any antifibrotic agents was performed.
Postoperative period: On the very first post-op day, reversal of cupping was seen with vision of 20/200; a diffuse large bleb and IOP being 02 mmHg in OS. Gradually pressures improved to 10 mmHg with out any antiglaucoma medication.
Last follow-up: Five months postoperatively, he had

20/30 vision with stable fields and non-inflammed eye on Methotrexate and no antiglaucoma medication, however, as the hypotony recovered the cup has reappeared to 0.8 on disc evaluation.

GR03 UGH SYNDROME WITH SULCUS-FIXATED IOL
G. Murthy

History: A gentleman aged 61 yrs, presented with c/o recurrent blurring and redness of OS, of 18 month duration.
Medication history: Topical steroids (Dexamethasone 0.1%) on and off since 8 months. Currently on betaxolol 0.5% bd, Dorzolamide eye dops bd, and Dexamethasone 0.1% eye drops four times/day.
Surgical history: Two years earlier OS post phacoemulsification with foldable IOL.
Systemic history: Diabetic since 12 years on treatment. He is also on Tab Aspirin 150 mg/day. O/e-BCVA- OU- 6/6, n6.
A/S:OD: Pseudophakic, otherwise with in normal limits, pupils briskly reactive to light.
OS: Conjunctival congestion+, cornea: clear, few kps+, ac: Flare ++, cells ++, no NVI, IOL in the sulcus. Inferior capsule stained with haem. Gonio- OD- normal open angle OS- open till SS, heavy pigmentation of TM, inferiorly PAS, blood in the angle +
IOP: OD- 14, OS- 26 mmHg (applanation). Fundus: OD: Normal, OS: normal.
Investigations: Visual Fields: 30-2, SITA standard, OD: normal, OS: generalised depression of retinal sensitivity. SLP-GDX VCC RNFL analysis: Normal OU. UBM: shows haptic of IOL eroding ciliary body.
Other investigations: Hb 13.8 gm%, Hematocrit 43%, red cell count 4.9 million/cmm, platelet count - 194000/cmm MCV 87 fl, MCH 28 pg, MCHC 32% TLC 6900/cumm ,ESR 10 mm at 1st hr, Peripheral blood smear- normal liver function tests – WNL FBS 147 mg%, PPBS 197 mg%. Total cholesterol 155mg/dl, HDL 43 mg/dl, LDL 91mg/dl. Uric acid 3.8 mg/dl, urine routine – normal.
Differential diagnosis: 1) Uveitis glaucoma hyphaema syndrome; 2) Fuchs heterochromic iridocyclitis; 3) Neovascular glaucoma.
Diagnosis: UGH syndrome. Anterior segment slit lamp, and goniophotographs, and reports of all other investigations and UBM will be presented.

GR04 BILATERAL ACUTE ANGLE-CLOSURE GLAUCOMA FOLLOWING TOPIRAMATE THERAPY FOR MIGRAINE PROPHYLAXIS
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History: A healthy young woman presented with sudden, bilateral, symmetrical, profound and painful loss of vision. On evaluation, she was found to have bilateral acute angle-closure glaucoma without pupillary block. She had a history of migraine and was recently started on topiramate for migraine prophylaxis. The glaucoma was attributable to an idiosyncratic reaction of ciliary body oedema due to topiramate. Classical photographic evidence is presented to highlight the possibility of extremely poor vision at presentation which is rarely reported with topiramate. A rapid and dramatic recovery on successful treatment is skillfully documented with successive photography.

Case summary: A 25-year-old healthy female presented to our emergency clinic with sudden, profound loss of vision occurring in a bilateral and symmetrical fashion, associated with pain and ocular discomfort for past two days. On examination, she was found to have severe corneal oedema with Descemet's membrane folds, severe scleral injection and some chemosis in both eyes. The anterior chambers were very shallow uniformly, in the centre as well as periphery, with irido-corneal touch. The pupils were mid-dilated and sluggishly reacting to light. The posterior segment could not be visualized due to the violent corneal oedema. The intraocular pressure was raised to 70 mmHg in both eyes. Her best corrected visual acuity (BCVA) was only counting fingers close to the face with an accurate projection of rays in both the eyes. There was no previous history of acute, red eye and no family history of glaucoma. Medical history was significant for migraine headaches since the past five years described as a unilateral temporal pressure and throbbing associated with nausea, light and noise sensitivity and occasional vomiting but without any aura. The headaches occurred about once a month until one year ago when the frequency increased to about once a week. Hence she was started on topiramate prophylaxis by her neurologist in a dose of 50 mg per day over the past one week. On obtaining this critical history, the violent and bilateral acute angle-closure glaucoma without pupillary block was attributed to the idiosyncratic reaction of ciliary body oedema due to topiramate. The patient was advised to stop topiramate immediately and started on intravenous mannitol (1.5 mg/kg), topical 0.5% timolol maleate twice daily and topical antibiotic steroid eye drops. Keeping in mind the vision threatening condition, she was also given oral prednisolone 1 mg/kg body weight to reduce the ciliary body oedema rapidly. On day three, the corneal oedema cleared sufficiently, the anterior chamber had deepened and the IOP had reduced to a respectable 23 mm Hg. Mannitol was withdrawn on day three and the patient was maintained on topical timolol and oral prednisolone alone. The IOP normalized on day 5 and by day 10 she had a vision of 20/20 with almost clear corneas and an IOP of 12 mmHg and an otherwise unremarkable anterior segment. She was tapered off the steroids and timolol was stopped. She is doing well at one month follow up without any sequel of the violent glaucoma that she experienced a month ago.

GR05 CLUES YET CLUELESS!
S. Kaushik

Objective: To demonstrate unusual clinical features in unilateral primary angle-closure
glaucoma.
Presenting complaints: A 40-year-old female presented with history of headache since 4 months. Diminution of vision in right eye since 4 months.
History of presenting illness: Insidious onset, gradually progressive, painless diminution of vision righteye since past four months accompanied by headache. No vomiting or any other systemic problem.
Treatment history: The patient was diagnosed glaucoma elsewhere and was started on G. Latanoprost 0.005%. (OD) HS about 1 month back. Ocular examination RE LE
BCVA 6/24 6/6 IOP (GAT) mmHg 14 (latanoprost) 12 (no treatment). Peripheral anterior chamber depth Van Herick's grade 0 Van Herick's grade 1.

Anterior segment: Clinically normal.
Gonioscopy: Angles closed in all 4 quadrants, with bumpy appearance of peripheral iris in temporal region. Angles closed in 3 quadrants. Non-pigmented meshwork visible in inferior angle.
Posterior segment right eye: Optic disc had a ear total cup. Serous retinal detachment supero-temporally involving macula. ILM folds radiating from the disc to the macula.
Posterior segment left eye: Clinically normal.
Visual Fields: RE: Advanced field loss. LE: normal.
Sratus OCT: Excavation in theoptic disc suggestive of a pit with serous retinal detachment. No communication seen with pit in any scan despite looking for the counduit.
Cirrus OCT: Findings similar to Stratus OCT. No conduit found. FFA Re showed persistent staining of the optic disc in the late phase localized to one area, very suggestive of an optic disc pit, but even on careful examination, it was not evident clinically.
UBM: Right eye showed pigment epithelial cyst corresponding to the bumpy iris appearance on gonioscopy. Left eye was normal.
Probable diagnosis: RE primary angle-closure glaucoma with acquired optic disc pit with pigment epithelial iris cyst. LE Primary angle closure
Management: Laser iridotomy both eyes. Right eye on medical treatment.

VIDEO SESSIONS

VS01 IS THE ANGLE OPEN OR CLOSED? - A VIDEO GUIDE TO MODERN GONIOSCOPY

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Aim: Conventional gonioscopy assesses whether the angle is 'open'. However, recent evidence shows that 'open'angles maybe 'closed'in dark lighting conditions, the latter characterised by iridotrabecular contact. The aim of this video is to provide a teaching guide to modern gonioscopy, used to determine if the angle is closed.
Design: Observational case series.
Participants: Patients who are normal or have open-angle or angle closure glaucoma.
Method: This video presentation outlines the problems with conventional gonioscopy and the current research into the changes of the angle in different lighting conditions leading to iridotrabecular contact and it's pathophysiological sequale. It finishes with methods and techniques used to assess whether the angle is closed or not.
Main outcome measure: Assessing iridotrabecular contact.
Results: The video guide explains the aims of gonioscopy, which goniolens to use, identifying anatomical landmarks, looking for signs of iridotrabecular contact (ie angle closure) and using dark room gonioscopy to confirm it (4). Each step is illustrated with videos or pictures with a running commentary.
Conclusion: Gonioscopy is poorly taught and not performed well in the clinical setting (5, 6). Conventional gonioscopy is used to assess whether the angle is "open". However, 'open' angles maybe "closed"in different lighting conditions (1-3) so angle closure glaucoma maybe missed if assessed with conventional gonioscopy. Examining the anterior chamber angle with gonioscopy is fundamental in the diagnosis and management of the glaucoma patient.
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VS02 EXCIMER LASER TRABECULOSTOMY (ELT)

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Objective: To illustrate the Excimer Laser Trabeculostomy (ELT) procedure and post operative results.
Design: Surgical video analysis of one patient, E.D.
Participants: One patient, E.D. undergoing ELT at Augen Laser Klinik in Detmold, Germany
Intervention: Excimer Laser Trabeculostomy of the right eye, under peribulbar anesthesia
Main outcome measure: IOP, anti-glaucoma medications, intraoperative adverse events.
Results: E.D. had a pre-operative IOP of 28 mm Hg on maximally tolerated medications. She underwent the ELT procedure and experienced no adverse events. At the first day post-operative visit her IOP was 21 mm Hg. One year post-operative, her IOP was 12 mm Hg with no glaucoma medications representing a 57% reduction.
Conclusions: ELT is a promising novel technique for the treatment of open angle glaucoma, safely and effectively lowering intraocular pressure and reducing medication requirements with a very low complication rate.

VS03 SUBSTANTIAL REDUCTION OF INTRAOCULAR PRESSURE BY A MODIFIED 360-DEGREE TRABECULOTOMY IN ADULT PRIMARY AND SECONDARY OPEN-ANGLE GLAUCOMA

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Purpose: To effectively reduce the intraocular pressure (IOP) in adult patients with both primary and secondary open angle glaucoma (POAG and SOAG) by incising Schlemm's canal 360-degree correctly and easily.
Design: A retrospective case-matched design.
Participants: A modified 360-degree suture trabeculotomy was performed for 25 eyes with POAG and 22 eyes with SOAG and a trabeculotomy with metal trabeculotomes was performed for 18 eyes with POAG and 19 eyes with SOAG.
Methods: We modified a 360-degree trabeculotomy by using a 5-0 nylon suture, making a corneal side port incision at the opposite side of the scleral flap for retrieving the suture, and making a scleral flap for the clear identification of Schlemm's canal. This technique was performed for 25 eyes with POAG and 22 eyes with SOAG, and then compared to the trabeculotomy with metal trabeculotomes in a retrospective case-matched design.
Main outcome measures: Intraocular pressure(IOP).
Results: By this modified technique, Schlemm's canal could be incised correctly without resistance and the mean post-operative IOP became below 14 mmHg with the mean number of different anti-glaucoma medications less than 0.6, that were significantly lower than that after the trabeculotomy with metal trabeculotomes.

Conclusion: These results suggest that the modified 360-degree trabeculotomy is effective for POAG and SOAG.

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VS04 MANAGEMENT OF AN ADVANCED CASE OF CONGENITAL GLAUCOMA WITH TRABECULOTOMY WITH TRABECULECTOMY WITH MITOMYCIN C

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Objective: Management of an advanced case of congenital glaucoma with trabeculotomy with trabeculectomy with Mitomycin C. Developmental glaucoma is a surgical disease. There are various surgical options described and the success rate depends on several factors like age of presentation, time of surgery and the severity of glaucoma. Most of the children in India , because of poor socio-economic status , present late with advanced stage of the disease. Most of these patients are unsuitable for goniotomy and results of primary trabeculotomy are poor with these moderate to advanced cases of congenital glaucoma. Combined trabeculotomy with trabeculectomy with or without mitomycin C can be the procedure of choice for these difficult cases, with a documented success rate in literature between 81-94.4% in various studies. This video demonstrates the microsurgical technique of combined trabeculotomy and trabeculectomy with mitomycin C in an advanced case of congenital glaucoma with cloudy cornea. The video also explains how to identify the anatomical landmarks in these cases with distorted limbal anatomy.

Conclusion: Combined approach allows good visual rehabilitation in eyes which otherwise have a very poor prognosis

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VS05 COMPREHENSIVE APPROACH TO GLAUCOMA IMPLANTS IN KERATOPROSTHESIS

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Purpose: The Boston type I Keratoprosthesis has been successfully transplanted for eyes with a poor prognosis for a conventional penetrating keratoplasty. The Boston Keratoprosthesis Study Group reported significant post-operative vision improvement with a high rate of graft retention. However, co-existing glaucoma has been found in the majority of these cases and it has significantly limited visual potential in cases with otherwise successful transplantations. Given a crowded anterior chamber, scarring and/or inability to visualize the anterior segment after the keratoprosthesis implantation, vitrectomy and pars plana tube placement is generally necessary. As a result, a surgical technique for the combined procedure is essential to avoid complications and to achieve optimal visual rehabilitation. We present effective surgical techniques for pars plana glaucoma tube placement in Keratoprosthesis with special considerations for optimal visual rehabilitation.

Design: A case series.

Participants: A 78-year-old female with exposed pars plana clip from chronic contact lens rubbing and a 55-year-old female with severe corneal scars after multiple failed conventional keratoplasty and uncontrolled glaucoma.

Main outcome measures: Contact lens fitting.

Results: The need for long term contact lens wear after keratoprosthesis necessitates the placement of the glaucoma tubes further from the limbus than would be otherwise in a standard combined vitrectomy and pars plana tube procedure. Surgical videos for a revision for pars plana clip exposure and a combined pars plana glaucoma implants placement, vitrectomy and Keratoprosthesis were demonstrated. We described steps for preparation of corneal and corneoscleral patch grafts. The proposed surgical techniques resulted in optimal contact lens fitting and improved vision in both cases.

Conclusions: A comprehensive approach to glaucoma implants in keratoprosthesis ensures optimal contact lens fitting leading to successful visual rehabilitation.

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VS06 REVISITING NEEDLING FOR FAILED BLEBS

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Needling is a simple procedure that can save a re-trabeculectomy. However, details of the procedure and ways to prevent complications have not been well described. Moreover, selecting the right adjunct is a challenge. This video aims to address all the above issues and help one to perform needling safely with good results.

VS07 AB INTERNAL TUBE TRIMMING IN AHMED VALVE IMPLANT

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Objective: To demonstrate a technique for trimming a tube without lifting the conjunctiva in eyes with well-functioning Ahmed valves.
Design: Case-report.
Participants: Primary Open-angle glaucoma patient with an Ahmed valve implanted 2 years previously after a failed trabeculectomy. who had tube-corneal touch, localized corneal decompensation and well controlled IOP.
Intervention: Tube trimming was performed through a 2 mm corneal wound constructed over the tube's position, while holding the tube with a 25G needle passing through a paracentesis located opposite to the tube. The tube segment was then brought close to the initial wound for removal with Kelman-McPherson forceps.
Results: No further tube-corneal contact remained after the procedure and adequate IOP control was preserved.
Conclusions: An ab-internal technique for trimming the tube in cases with tubes either too long, or touching the cornea or iris that avoids further conjunctival interventions is considered as very useful for selected cases where minimal invasive procedures are preferrable.

VS08 NEW TECHNIQUE OF PHACO SURGERY IN A SMALL PUPIL

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Purpose: To present the performance of the new injectable temporary pupil expansion device for cataract surgery
Methods: The device is a temporary ring-shaped implant with four circular loops that holds the iris at equidistant points. The current version of the device consists of a holder with a ring and inserter. To assess the impact of the injection method of ring implantation on the iris we performed phaco on 5 cadaver eyes. In a series of 37 patients with small pupils unresponsive to conventional pupil dilation techniques we assessed the clinical performance of the new device.
Results: Scanning electronic microscopy of cadaver irises after ring implantation showed minimal disturbance of the iris pigmented epithelial layer. Clinically there were minimal surgical complications in eyes managed with the ring. We present variable techniques of using the new device in challenging clinical cases.
Conclusions: The new iris ring has the advantage of enlarging the pupil without overly stretching it and traumatizing it. The ring expands the pupil, protects the iris sphincter during surgery, and allows the pupil to return to its normal shape, size, and function after the operation.
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VS09 TRAINING TO TACKLE GLAUCOMA IN DEVELOPING WORLD - THE SHAOLIN TEMPLE APPROACH

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Glaucoma is a leading cause of irreversible blindness disproportionately affecting persons in the less developed world. Recent publications have underscored glaring deficiencies in clinical teaching, infrastructure, and academic programs in ophthalmology residency programs and inadequate training of ophthalmologists in Indai in subspecialty areas like glaucoma. Human resource development is a crucial area identified by the Vision 2020 initiative to help address increasing blindness. We describe a structured training program to qualified ophthalmologists to address the challenge of minimizing glaucoma blindness with special emphases on acquiring clinical and diagnostic skills appropriate to the less developed world.

VS10 COMBATING GLAUCOMA BLINDNESS- REACHING THE UNDETECTED

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Glaucoma--second cause for blindness,is estimated to affect 12 million & account for 12.8% of blindness. Surveys have estimated prevalence to be 2.5-4.0% and 90% remained undiagnosed. 10% are blind, with more afflicted by severe vision impairment. Aravind Eye Comprehensive survey revealed that utilization of eye care services is low (7%). Early detection prevent progression and cost escalates with severity. Owing to low prevalence and low predictive value of diagnostic tools, population screening has poor yield and is economically unviable. The Video outlines various strategies adopted to increase awareness and identifying individuals for screening in the community.

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See you at WGC-2011!