Glaucoma Patient Knowledge Regarding Genetics As A Risk Factor For Glaucoma

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Purpose: Genetics has been identified as a key risk factor in the development of glaucoma, and screening of family members is paramount to early detection of disease. However, there are no clinical studies that have investigated whether patients actually advise their family members to be screened for glaucoma. We performed a prospective clinical study and utilized a survey to evaluate our glaucoma patient population’s understanding of family history as a risk factor for glaucoma. We hypothesize that the majority of our patients do not realize that glaucoma is hereditary and that they will not have previously advised their family members to be screened for glaucoma.

Methods: With IRB approval, we administered a survey to 50 of our patients who are routinely followed in the glaucoma clinic. We included patients who were over the age of 18 years and had been previously diagnosed with glaucoma or were suspected to have glaucoma. The primary outcome was whether or not these patients had advised their family members to be screened for glaucoma. We also assessed whether or not patients knew that glaucoma is hereditary, and likewise if they knew if any other blood-related relatives had been diagnosed with glaucoma previously.

Results: Of the patients we surveyed, 35% were > age of 70, 35% were Haitian and 76% had a high-school diploma. 38% knew if they had a family member with glaucoma and 54% did not know that glaucoma is hereditary. Moreover, only 38% advised their family members to be screened for glaucoma. Those who had advised family members to be screened were also more often aware if other blood-related relatives had been previously diagnosed with glaucoma.

Conclusions: The results support our hypotheses, demonstrating that the majority of our patients are not aware that glaucoma is hereditary and therefore most have not advised their family members to be screened for glaucoma. This brings to light a gap in patient knowledge that could be improved through patient education and expanded to promote early preventive strategies.

Commercial Relationships: Elizabeth Esparaz, None; Manishi Desai, None

Program Number: 3681 Poster Board Number: B0024 Presentation Time: 3:45 PM–5:30 PM

G6P missense variant (rs1671152) and risk of primary open-angle glaucoma in African Americans from a biorepository linked to de-identified electronic medical records

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Purpose: Primary open-angle glaucoma (POAG) is the second leading cause of permanent vision loss and blindness in the U.S. Genome-wide and candidate gene association studies have identified loci associated with POAG risk in European-descent and Japanese populations. African Americans are ~15 times as likely to develop permanent vision impairment from glaucoma vs. European Americans, yet few studies have been performed in this population. We use the Epidemiologic Architecture for Genes Linked to Environment (EAGLE) study accessed the Vanderbilt University

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Medical Center’s BioVU, a DNA repository linked to de-identified electronic medical records, to identify cases and controls of POAG among African Americans to perform a genetic association study.

**Methods:** Using a combination of International Classification of Diseases diagnostic codes, Current Procedural Terminology billing codes, and manual review of clinical records, we identified 114 African American POAG cases and 1341 controls. Cases/controls were genotyped on the Metabochip, an Illumina genotype array targeting ~200,000 SNPs chosen with an emphasis on metabolic diseases and traits. After quality control, ~116k SNPs were included in analyses. We performed single SNP tests of association for common variants (MAF > 0.05) using logistic regression in PLINK assuming an additive genetic model adjusted for age, sex, and first three principal components.

**Results:** None of the tests of association passed a strict Bonferroni correction (p<4.3x10^-5). The five most significant associations are shown in the table.

**Conclusions:** Our study did not detect a strong association for POAG risk in African Americans on the Metabochip. Small sample sizes and lack of genome wide coverage are major limitations in this study. Of interest for future studies is rs1671152 (OR=1.87; p =4.53x10^-5), a known missense variant in the glycoprotein VI (GP6) gene. GP6, a collagen receptor, is involved in platelet aggregation but is expressed in the eye and brain. Potential implications may include scleral collagen organization and integrity of the blood-retinal barrier in glaucoma susceptibility.

### Table: Most significant associations in African American POAG association study

<table>
<thead>
<tr>
<th>CHR</th>
<th>SNP</th>
<th>Allele</th>
<th>OR</th>
<th>CI</th>
<th>p-value</th>
<th>CAF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>rs4678836</td>
<td>A</td>
<td>1.95</td>
<td>(1.41-2.70)</td>
<td>4.31x10^-7</td>
<td>35.1</td>
</tr>
<tr>
<td>19</td>
<td>rs1671152</td>
<td>A</td>
<td>1.87</td>
<td>(1.38-2.53)</td>
<td>4.53x10^-5</td>
<td>48.8</td>
</tr>
<tr>
<td>19</td>
<td>rs9928269</td>
<td>A</td>
<td>2.01</td>
<td>(1.43-2.81)</td>
<td>4.59x10^-7</td>
<td>33.1</td>
</tr>
<tr>
<td>6</td>
<td>rs479660</td>
<td>G</td>
<td>1.88</td>
<td>(1.38-2.55)</td>
<td>4.42x10^-7</td>
<td>56.4</td>
</tr>
<tr>
<td>6</td>
<td>rs1155927</td>
<td>G</td>
<td>1.93</td>
<td>(1.40-2.66)</td>
<td>5.28x10^-7</td>
<td>30.5</td>
</tr>
</tbody>
</table>

*CA%: Allele frequency (CAF%), confidence interval (CI), odds ratio (OR)*

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Program Number: 3685 Poster Board Number: B0027

Presentation Time: 3:45 PM–5:30 PM

Genetic susceptibility to open angle glaucoma: the Blue Mountains Eye Study

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Purpose: Six single nucleotide polymorphisms (SNPs); rs4656461 (TMCO1), rs4619890 (AFAP1), rs11969985 (GMDS), rs4977756 (CDKN2B-AS1), rs2472493 (ABCA1) and rs10483727 (SIX1/SIX6) have recently been reported to be associated with the development of primary open angle glaucoma (OAG).

Methods: OAG diagnosis by expert panel was based on masked glaucomatous visual field loss and matching optic disc appearance, information of intraocular pressure. Genetic analysis was performed using Illumina HumanHap670 quad arrays. Logistic regression models were used to assess associations between the genetic loci and POAG, adjusting for age and gender. Risk scores were constructed quantifying the effect of each additional risk allele among SNPs significant together in multivariable modeling.

Results: A total of 2481 participants in the BMES cohort had data on SNPs and glaucoma status. Of these, 85 had POAG (cases) and 2396 did not (controls).

When analyzed individually, four SNPs, rs4656461 (risk allele G), rs4977756 (risk allele A), rs10483727 (risk allele A) and rs2472493 (risk allele G) all conferred increased risk of OAG (p=0.047, 0.004, 0.04 and 0.006 respectively) (Table 1). Corresponding risk allele frequencies were 0.12, 0.60, 0.39 and 0.43. In multivariable modeling, 3 SNPs (rs4656461, rs4977756 and rs2472493) remained significantly associated with OAG (OR 1.61-1.67, p<0.05). These effects appeared largely independent of each other. Proportions of participants developing OAG were 1.7%, 2.7%, 4.3% or 6.0% among those carrying 0-1, 2, 3 or 4-6 risk alleles from these three SNPs.

Conclusions: These newly discovered SNPs were associated with OAG in a European-derived older population, each conferring about a 50% increased risk. Increasing number of risk alleles was associated with increasing glaucoma risk in a dose-dependent manner. Genetic risk scoring may have clinical utility by providing a glaucoma-enriched population for screening.

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Table 1: Adjusted associations between six SNPs and cumulative OAG status in BMES 1.2 or 3 in logistic regression models (using additive model, whereby each additional risk allele is treated as conferring the same increment of risk)

<table>
<thead>
<tr>
<th>SNP</th>
<th>Risk Allele</th>
<th>Age-gender adjusted OR* (95% CI)</th>
<th>P value</th>
<th>Multivariable adjusted OR** (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>rs4656461_G</td>
<td>G</td>
<td>1.55 (1.01, 2.39)</td>
<td>0.047</td>
<td>1.67 (1.07-2.57)</td>
<td>0.02</td>
</tr>
<tr>
<td>rs4977756_A***</td>
<td>A</td>
<td>1.63 (1.17, 2.27)</td>
<td>0.004</td>
<td>1.65 (1.17, 2.31)</td>
<td>0.004</td>
</tr>
<tr>
<td>rs10483727_A</td>
<td>A</td>
<td>1.39 (1.01, 1.91)</td>
<td>0.04</td>
<td>1.35 (0.88, 1.86)</td>
<td>0.067</td>
</tr>
<tr>
<td>rs2472493_G</td>
<td>G</td>
<td>1.55 (1.13, 2.12)</td>
<td>0.006</td>
<td>1.61 (1.21, 2.21)</td>
<td>0.004</td>
</tr>
<tr>
<td>rs4619890_G</td>
<td>G</td>
<td>1.27 (0.92, 1.74)</td>
<td>0.14</td>
<td>1.23 (0.89, 1.69)</td>
<td>0.2</td>
</tr>
<tr>
<td>rs11969985_A</td>
<td>A</td>
<td>1.35 (0.76, 1.73)</td>
<td>0.5</td>
<td>1.16 (0.76, 1.76)</td>
<td>0.4</td>
</tr>
</tbody>
</table>

*For age-gender adjusted models were run for each SNP separately
**The multivariable model is a single model which adjusts for age, gender and all six SNPs simultaneously
***rs4977756 the minor allele (G) appears to be protective, so we have modelled here the effect of each additional A allele, where the A allele confers risk

Program Number: 3685 Poster Board Number: B0028

Presentation Time: 3:45 PM–5:30 PM

Loss of Prss56 Function Contributes to Angle Closure Glaucoma-Relevant Phenotypes

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Purpose: We have previously characterized an ENU-induced mutant mouse model that recapitulates features of angle closure glaucoma (ACG), which is estimated to affect 16 million people worldwide. The causal mutation was identified in the gene coding for serine protease Prss56. Prss56 mutant mice exhibit reduced ocular axial length and a relatively large lens, features that predispose the iris to be pushed forward causing blockage of the drainage structure (angle closure) and elevated intraocular pressure (IOP). Prss56 variants contribute to nanophthalmos and are associated with ACG in humans. None of the mutations reported to date completely disrupts the catalytic domain of Prss56. Thus, it is not clear if mutations in Prss56 act through their inability to cleave an endogenous substrate(s) or because they function in a promiscuous manner. Here, we utilized mice with a targeted Prss56 null mutation to determine if loss of Prss56 function leads to ACG-relevant phenotypes.

Methods: The Prss56 knockout mouse was generated by replacing Prss56 exon 1 with the gene encoding Cre recombinase (Prss56-Cre). Mice lacking Prss56 are viable and fertile. Prss56 knockout and control littersmates were assessed for angle closure glaucoma-relevant phenotypes. Slit-lamp biomicroscopy of eyes was performed at ages ranging from 1 to 8 months. IOP was measured at various ages within this range. Ocular dimensions were measured using a Vernier Caliper. Prss56-Cre mice were bred to a Rosa26-LtTomato reporter line to determine endogenous Prss56 expression in ocular tissues.

Results: Prss56 knockout mice have significantly reduced ocular axial length with a normal occurring iris similar to that observed in ENU-induced Prss56 mutant mice (with an intact catalytic domain). However, the lens diameter of Prss56 knockouts was the same as that of the controls. Thus, the mutant lens occupies a larger ocular volume, a risk factor for ACG. Many Prss56 knockout mice also...
Increased expression of aquaporin1, aquaporin 2, VEGFA, ACW, anterior chamber volume (ACV), lens vault (LV), iris area, parameters anterior chamber depth (ACD), anterior chamber width

Commercial Relationships: Seyyedhassan Paylakhi, None; Cassandra Labelle-Dumais, None; Nicholas Tolman, None; Michael Sellaro, None; Piotr Topilko, None; Simon W. John, None; Saidsad Nair, None
Support: NIH EY022891

Program Number: 3686 Poster Board Number: B0029
Presentation Time: 3:45 PM–5:30 PM
Differential iridial gene expression as a novel tool for glaucoma diagnosis
Tina T. Wong1, 2, Arun Naryanaswamy1, Henrietta Ho1, Hla M. Htoon1, Monisha nongpuii2, Li-Fong Seet2, 3, 1Singapore National Eye Centre, Singapore, Singapore; 2Singapore Eye Research Institute, Singapore, Singapore; 3Duke NUS Graduate Medical School, Singapore, Singapore.
Purpose: To determine gene expression profile in glaucoma iris and quantitatively differentiate primary angle closure from primary open angle glaucoma.
Methods: Iris tissues were obtained during trabeculectomy surgery by iridectomy from glaucoma patients diagnosed with PACG or POAG. 26 cadaver non-glaucoma iris provided baseline values for comparison. Gene expression in iris was measured by real-time polymerase chain reaction. Anterior segment optical coherence tomography (ASOCT) imaging was also performed for a subset of patients. Gene expression of type I collagen, aquaporin, VEGFA, VEGFB, VEGFC and VEGF receptors 1 and 2 in PACG and POAG iris was compared to non-glaucomatous iris. The biometric parameters anterior chamber depth (ACD), anterior chamber width (ACW), anterior chamber volume (ACV), lens vault (LV), iris area, iris volume and pupil diameter were also measured in PACG and POAG.
Results: Increased expression of aquaporin1, aquaporin 2, VEGFA, VEGFB, VEGFC and VEGFR1 was found in glaucoma iris compared to normal iris. The expression of four genes COL1A1, VEGFB, VEGFR1, VEGFR2 was significantly greater in PACG compared to POAG (P<0.01). The biometric parameters ACD and ACV were significantly smaller (P<0.0005 and <0.01 respectively) and LV significantly larger (P<0.0005) in PACG compared to POAG. The expression of the four genes only, three biometric parameters only and a combination of the gene expression and LV were used in discriminant analyses to distinguish between PACG and POAG, correctly classifying 73.4%, 86.8% and 91.2% of the original cases respectively.
Conclusions: Gene expression profile in glaucoma iris is distinct from non-glaucomatous iris, with further distinction found between glaucoma subtypes. A discriminant function based on iris gene expression (COL1A1, VEGFB, VEGFR1, VEGFR2) together with one biometric parameter (LV) is superior to either gene expression data alone or biometric parameters alone for the differentiation of PACG from POAG. Distinct iris gene expression profile is a potentially new tool for the diagnosis of glaucoma, that can discriminate PACG from POAG in addition to known anatomical markers.
Commercial Relationships: Tina T. Wong, None; Arun Naryanaswamy, None; Henrietta Ho, None; Hla M. Htoon, None; Monisha nongpuii, None; Li-Fong Seet, None
Support: Republic of Singapore, NMRC/TCR/002-SERI/2008

Program Number: 3687 Poster Board Number: B0030
Presentation Time: 3:45 PM–5:30 PM
Higher blood pressure predicts functional glaucoma progression in males with open angle glaucoma
Joseph Carr1, Alon Harris2, Brent A. Siesky3, George Eckert2, Leslie Tobe1, Darrell WuDunn1, Willy Gama2, Rehan Hussain1, Alice Chandra Verticchio Vercellin1
1Ophthalmology, Indiana University School of Medicine, Indianapolis, IN; 2Biostatistics, Indiana University School of Medicine, Indianapolis, IN; 3Eye Clinic, University of Pavia, Pavia, Italy.
Purpose: To examine blood pressure, ocular perfusion pressure and functional disease progression in patients with open-angle glaucoma (OAG) over a 5-year period.
Methods: 111 OAG patients (Mean age 65 yr; 43 male, 68 female) were assessed for intraocular pressure (IOP), systolic blood pressure (SBP), mean arterial pressure (MAP), systolic perfusion pressure (SPP), diastolic perfusion pressure (DPP), ocular perfusion pressure (OPP), mean perfusion pressure (MPP) and functional glaucoma progression with Humphrey Visual field every 6 months over 5 years. 74 patients (Mean age 70 yr; 30 male, 44 female) were assessed at 5-year follow-up. Functional progression was defined as two consecutive visits with mean deviation decrease ≥2 and/or Advanced Glaucoma Intervention Study score increase ≥2 compared to baseline. Mixed-model ANCOVA was used to test for significant change from baseline to 5-year follow-up. Time to progression was analyzed using Cox proportional hazards models. Interactions were tested to determine if effects of the factors on progression time differed by sex.
Results: In male and female OAG patients over 5 years, IOP, blood pressures and perfusion pressures all decreased (p<0.05). In males and females, respectively, IOP was 17 mmHg (95% CI 15-18) and 17 mmHg (15-18) at baseline and 16 mmHg (14-18) and 15 mmHg (13-16) at 5 years. SBP was 136 mmHg (130-142) and 135 mmHg (129-141) at baseline and 130 mmHg (123-137) and 129 mmHg (122-135) at 5 years. DBP was 82 mmHg (78-86) and 84 mmHg (80-87) at baseline and 79 mmHg (74-83) and 84 mmHg (80-87) at 5 years. MAP was 100 mmHg (96-104) and 101 mmHg (97-105) at baseline and 96 mmHg (91-100) and 94 mmHg (90-98) at 5 years. Higher SBP, DBP, MAP, SPP, DPP, OPP and MPP were all associated with shorter time to functional progression in males (p≤0.01) but not in females, leading to a significant sex difference (p≤0.02).
Conclusions: Higher blood pressure was predictive of glaucomatous functional progression in males but not in females. These data suggest that vascular factors may play a different role in the functional progression of the disease according to sex.
Commercial Relationships: Joseph Carr, None; Alon Harris, AdOM (I), Alcon (R), BioLight (C), Isama Therapeutics (C), Isama Therapeutics (R), Nano Retina (C), Ono (C), Science Based Health (C); Brent A. Siesky, None; George Eckert, None; Leslie Tobe, None; Darrell WuDunn, InnFocus (F), Aerie Pharmaceuticals (F), Matti Therapeutic, Inc. (F); Willy Gama, None, Rehan Hussain, None; Alice Chandra Verticchio Vercellin, None
Support: This study was supported in part by an unrestricted grant from Research to Prevent Blindness, NY NY.

Program Number: 3688 Poster Board Number: B0031
Presentation Time: 3:45 PM–5:30 PM
Risk factors for visual field progression in normal tension glaucoma with intraocular-pressure equal or less than 15mmHg
Kyoko Ishida1, Satoko Kokuzawa2, Tetsuya Yamamoto2
1Ophthalmology, Toho University Ohashi Medical Center, Tokyo, Japan; 2Ophthalmology, Gifu University, Gifu, Japan.
Purpose: To assess visual field progression in patients with normal tension glaucoma (NTG) with IOP <15 mmHg at baseline.
Methods: 111 NTG patients (Mean age 71 yr; 47 male, 64 female) were followed for 5 years. IOP was 13 mmHg (12-14) at baseline and 12 mmHg (11-13) at 5 years. Visual field progression was assessed as percentage of visual field loss (PVF) and functional visual field loss (FVF). TotalVF, VFdisc, Mean Deviation (MD), Mean Sensitivity (MS) and Pattern SD (PSD). The factors associated with VF progression were examined using multivariate regression analysis. Results: Baseline visual field was lower in males (P<0.01) and in patients with a lower mean arterial pressure (P<0.01). Higher baseline SBP, DBP, MAP, OPP, MPP and DPP and lower baseline SBP, DBP, OPP, MPP and DPP were all associated with greater functional progression (p<0.01). Correlation was stronger for males (p<0.01) than females (p<0.05). Conclusions: Higher baseline SBP, DBP, MAP, Opportunity pressure, Modified pressure and diastolic perfusion pressure and lower baseline SBP, DBP, OPP, MPP and DPP are risk factors for NTG visual field progression in patients with IOP<15 mmHg. Further research is needed to detect the etiology and evaluate the effect of this variable on visual field progression.
Commercial Relationships: Kyoko Ishida, None; Satoko Kokuzawa, None; Tetsuya Yamamoto, None
Support: This study was supported by an unrestricted grant from Research to Prevent Blindness, NY NY.

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Purpose: To investigate the risk factors in normal tension glaucoma (NTG) with intraocular-pressure (IOP) ≤ 15mmHg.

Methods: Seventy eyes of NTG with 24-h diurnal intraocular-pressure (IOP) ≤ 15 mmHg were retrospectively included in this study. We employed two definitions for visual field (VF) progression: (1) Collaborative Normal Tension Glaucoma Study (CNTGS) VF criterion (2) an annual decrease in Mean deviation (MD) slope less than -0.33dB/year (MD slope criterion). To identify factors associated with VF progression, we adopted multivariate logistic regression analysis, employing VF progression as the outcome variable and several demographic and clinical parameters as explanatory variables. The latter included: age, refraction, baseline MD, baseline IOP before treatment, IOP parameters during follow-up period including average and standard deviation of IOPs, and disc hemorrhage (DH) development during follow-up.

Results: Mean age was 57.1 yrs. Mean follow-up periods was 11.3 yrs. Mean IOP during follow-up was 12.2 mmHg. DH was observed in 34 of 70 eyes. In the multivariate model, average IOP (RR 0.546, P=0.049) was detected as a risk factor for VF progression by CNTGS criterion. According to MD slope criterion, DH (RR 3.059, P=0.0362) was associated with VF progression. In comparison of the clinical characteristics between the progression and non-progression groups by CNTGS and MD slope criteria, development of DH was significantly more in VF progression group by both criteria, and average IOP was significantly higher in VF progression group by CNTGS criterion.

Conclusions: Higher average IOP and development of DH during the follow-up period were risk factors for progression in NTG with IOP ≤ 15mmHg.

Commercial Relationships: Kyoko Ishida, None; Satoko Kokuzawa, None; Tetsuya Yamamoto, None

Program Number: 3689 Poster Board Number: B0032

Presentation Time: 3:45 PM–5:30 PM

Female risk factors for primary open-angle glaucoma and normal tension glaucoma

Chikako Sannohe1, Yoko Ikeda1, Kazuhiko Mori1, Hiromi Yamada1, Satsuma Tsuzaki1, Morio Ueno1, Masakazu Nakano1, Kengo Yoshii1, Shigeru Kinoshita1, None; Kazuaki Kishi2, None; Satsuki Oike-Ikeda Eye Clinic, Oike-Ikeda Eye Clinic, Kyoto, Japan; 2Oike-Ikeda Eye Clinic, Oike-Ikeda Eye Clinic, Kyoto, Japan; 3Kyoto Prefectural University of Medicine, Department of Ophthalmology Kyoto Prefectural University of Medicine, Kyoto, Japan; 4Kyoto Prefectural University of Medicine, Department of Genomic Medical Sciences Kyoto Prefectural University of Medicine, Kyoto, Japan.

Purpose: There have been several reports regarding the female glaucoma risk factors for systemic factors. However, the relationship between female hormones and primary open-angle glaucoma (POAG) or normal tension glaucoma (NTG) has yet to be fully elucidated. The purpose of this present study was to investigate the systemic risk factors, including female hormone, and other systemic and ophthalmic factors, among female Japanese POAG and NTG patients and normal controls (NC).

Methods: This study involved 422 females who were interviewed about their menarche age and menopause age; 69 POAG patients (mean age: 68.9 age: years), 216 NTG patients (mean age: 68±10.0 years), and 137 normal control subjects (mean age: 65.1 age: years). The glaucoma patients were enrolled at Sannohe Eye Clinic, Aomori, Japan and at Oike-Ikeda Eye Clinic, Kyoto, Japan from March 2005 to November 2014, and were diagnosed by glaucoma specialists as normal after undergoing optic disc imaging. Female hormone factors included menarche and menopause age, periods between menarche and menopause. Systemic factors included Body Mass Index (BMI), the existence of systemic diseases [i.e., diabetes mellitus (DM), heart disease (HD), hypertension (HT), and hyperlipidemia (HL)]. Ophthalmic factors included family history of glaucoma (FH), axial length, refractive errors with phakic eye. All factors were evaluated in relation to glaucoma type using logistic regression analysis. If data was available from both eyes, right-eye data was used.

Results: Logistic regression analysis showed no significant factors between POAG and NC. However, significant factors existed between NTG and NC: BMI (odds ratio: 0.9, p=0.028), FH (odds ratio: 3.2, p=0.003), and menarche age (odds ratio: 0.7, p=0.001). Significant factors existed between POAG including with NTG and NC: BMI (odds ratio: 0.9, p=0.027), FH (odds ratio: 3.0, p=0.006), and menarche age (odds ratio: 0.7, p=0.001).

Conclusions: The female glaucoma risk factors for NTG and POAG were different from our dataset. Low BMI, FH of glaucoma, early menarche age were risk factors only in women with NTG.

Commercial Relationships: Chikako Sannohe, None; Yoko Ikeda, None; Kazuhiko Mori, None; Hiromi Yamada, None; Satsuma Tsuzaki, None; Morio Ueno, None; Masakazu Nakano, None; Kengo Yoshii, None; Shigeru Kinoshita, None

Program Number: 3690 Poster Board Number: B0033

Presentation Time: 3:45 PM–5:30 PM

Migraine and the increased risk of developing open angle glaucoma: a population-based cohort study

Chien-Chia Su. Ophthalmology, National Taiwan University Hospital,Hsin-Chu branch, Hsin-Chu, Taiwan.

Purpose: Migraine is a neurovascular disorder of unknown etiology. In previous literature, migraine is associated with visual field progression in glaucoma subjects. Disturbances of autonomic activity during migraine attack may lead to alteration of ocular circulation and cause ganglion cell death. However, the association between migraine and open angle glaucoma is not determined. The purpose of our study is to investigate the association between migraine and the subsequent risk of open angle glaucoma (OAG) development after migraine diagnosis.

Methods: Patients with migraine aged ≥20 years were identified from the Taiwan National Health Insurance Research Database between 2000 and 2010. Each migraine patient was randomly matched to four subjects without migraine or other headache disorders based on age, sex, and index date. Patients with antecedent glaucoma at baseline year were excluded. Both cohorts were followed up until the end of 2010. The incidence rates of open angle glaucoma (OAG) were compared and risk factors were identified. The comorbid medical conditions for each subject were evaluated by using the established age-adjusted Charlson comorbidity index (ACCI). By using ACCI score, we further assess the hazard ratio for OAG in migraineurs with different level comorbidity. The Kaplan–Meier method was used to compute 10-year cumulative incidence rate of OAG.

Results: A total of 18011 patients in the migraine cohort and 69132 patients in the matched control cohort were enrolled. The incidence rates per 1000 person-years of OAG among patients with migraine and the non-migraine controls were 1.29 and 1.02, respectively. Patients with migraine had significantly higher cumulative incidence rate than the matched cohort. (P=.021, log-rank test) The crude and adjusted HRs for patients with migraine versus comparison group with an ACCI score 0 were 1.73 (95% CI, 1.24-2.42) and 1.68 (95% CI, 1.20-2.36). For those patients with migraine versus comparison groups with an ACCI score 1-2 and with an ACCI score ≥3, the adjusted HRs were not significantly different. (P=.788 and P=.879, respectively)
Conclusions: This population-based study demonstrates that migraine is associated with an increased risk of OAG, particularly in patients with no comorbidity and aged under 50 years.

Commercial Relationships: Chien-Chia Su, None

Program Number: 3691 Poster Board Number: B0034
Presentation Time: 3:45 PM–5:30 PM

Glaucoma severity at first presentation
V Swetha E. Jeganathan1,2, Ahmed El-Medhany1, Andrew J. Tatham1. 1Princess Alexandra Eye Pavilion and Department of Ophthalmology, University of Edinburgh, Edinburgh, UK., Edinburgh, United Kingdom; 2Dumfries and Galloway Royal Infirmary, Dumfries, United Kingdom.

Purpose: As glaucomatous visual loss is irreversible, advanced disease at presentation is an important risk factor for subsequent blindness. In the UK free eye examinations are available at community optometrists for those at risk, however some patients still present with severe glaucoma. The aim of this study was to identify the proportion of patients presenting with advanced glaucoma and to determine the risk factors for late presentation.

Methods: This was a cross-sectional study of 100 consecutive patients with suspected glaucoma referred from optometrists to Princess Alexandra Eye Pavilion Edinburgh. 84 of 100 patients were found to have glaucoma in at least one eye and were included subsequent analyses. All subjects had a comprehensive ophthalmic examination including slit lamp examination, intraocular pressure (IOP), central corneal thickness (CCT), fundus examination and standard automated perimetry (SAP). Information was also collected regarding family history of glaucoma. Patients were deemed to be late presenters if SAP mean deviation (MD) in the worse eye was worse than or equal to -6 dB and very late presenters if MD was worse than or equal to -10 dB. Logistic regression analysis was used to identify factors associated with late and very late presentation.

Results: Patients had a mean ± standard deviation age of 73.2 ± 10.2 years. 36 of 84 patients (42.9%) were female and 28 (33.3%) had a first or second-degree family history of glaucoma. 48.8% had a MD in the worse eye of worse than -6 dB at first examination (late presenters) and 27.4% had a MD in the worse eye of worse than -10dB (very late presenters). Older age (P = 0.004) was a significant risk factor for late presentation, however gender (P=0.660), IOP (P = 0.712) CCT (P = 0.968), and family history (P = 0.108) were not associated with late presentation.

Conclusions: Although most patients with newly diagnosed glaucoma had early or moderate disease at diagnosis, almost half of patients presented with a MD of worse than -6 dB in at least one eye. Older patients were more likely to have advanced disease at presentation. Efforts to increase awareness of glaucoma in the elderly population may allow earlier diagnosis and reduce vision related morbidity.

Commercial Relationships: V Swetha E. Jeganathan, None; Ahmed El-Medhany, None; Andrew J. Tatham, None

Program Number: 3692 Poster Board Number: B0035
Presentation Time: 3:45 PM–5:30 PM

Biometric measures in Kazakh and European healthy subjects predisposing to angle closure glaucoma
Assel Talaspayeva. Kazakh Research Institute of Eye Diseases, Almaty, Kazakhstan.

Purpose: To identify anatomical parameters in a Kazakh population predisposing to the development of angle closure glaucoma.

Methods: Data from healthy Kazakhs (N= 98) and European origin subjects (N= 82) aged 20-75 yr were collected. Visual acuity, refraction, gonioscopy, ultrasound biometry of the anterior chamber, lens, vitreous, and axial length of the globe (BS-2000, Nidek, Japan), slit lamp examination, Anterior Segment ASOCT (Visante, Germany) were obtained. Anterior chamber parameters were measured.

Results: On gonioscopy the frequency of narrow angle in Kazakhs was 57.6% vs 19% among European ethnicity. On gonioscopic exam ciliary body band was not visible in 57.6% of Kazakhs, but was visible in 74% of Europeans. On ASOCT in Kazakhs anterior chamber depth averaged 2.15 ± 0.05 mm vs European 3.0 ± 0.04 mm. By ASOCT frequency of narrow angles was higher in Kazakhs than Europeans (74% vs 15% respectively). Axial length in Kazakhs averaged 22.6 ± 0.1 mm vs European 23.4 ± 0.12 mm; and in Kazakhs anterior chamber depth was lower (mean 2.25 ± 0.05 mm) and the thickness of the lens was higher (mean 4.3 ± 0.07 mm) than European (p <0.05 vs European). In Kazakhs a crowded low profile anterior chamber angle lead to a significant decrease in anterior chamber depth (p <0.01) and narrowing angle (p=0.001).

Conclusions: These findings identified statistically significant differences between Kazakh and European biometric measures. In particular, Kazakh eyes had a relatively shorter axial length, shallower angles and anterior chamber depth and a thicker lens. All these factors can contribute to a predisposition among Kazakhs to the occurrence of various forms of acute or progressive angle-closure glaucoma.

Commercial Relationships: Assel Talaspayeva, None

Program Number: 3693 Poster Board Number: B0036
Presentation Time: 3:45 PM–5:30 PM

An evaluation of target intraocular pressure use in the Collaborative Initial Glaucoma Treatment Study
David C. Mauch1,2, Leslie M. Nizio1, Brenda W. Gillespie1, Paul R. Lichter1. Ophthalmology & Visual Sciences, University of Michigan, Ann Arbor, MI; 2Epidemiology, University of Michigan, Ann Arbor, MI. 3Biostatistics, University of Michigan, Ann Arbor, MI.

Purpose: To describe the extent to which an established target intraocular pressure (IOP) was met during treatment, and to test the relationship between meeting target and visual field outcomes in the Collaborative Initial Glaucoma Treatment Study (CIGTS) participants.

Methods: 607 subjects with newly diagnosed open-angle glaucoma were enrolled in the CIGTS. A study eye was selected prior to treatment initiation for participants with two treatment-eligible eyes, and a target IOP was set based on a formula that accounted for pre-treatment IOP and visual field (VF) severity as measured by the mean deviation (MD). Measures of meeting the target IOP were tested for associations with VF loss over time. Using a previously published model for predicting VF loss, the predictive value of adding measures of target IOP adherence were assessed by means of repeated measures linear regression.

Results: Initial target IOPs ranged from 13 to 25 mmHg. During follow-up, the measured IOP was within ±2 mmHg of the target IOP in 42% of visits, >2 mmHg under target IOP in 44% of visits, and >2 mmHg over target IOP in 14% of visits. IOP ±5 mmHg over target IOP was found in 4% of visits. The visit-specific difference between the measured IOP and the target IOP, whether evaluated as a continuous or categorical variable, was not a significant predictor of MD over time when added to the previously published model. The cumulative percentage of visits in which the measured IOP was greater than target IOP was also not a significant predictor of MD. However, indices of variability in the difference between measured and target IOP over time (standard deviation, maximum, and range) were significant predictors of MD. Larger variation was associated with worse VF. Even so, these variables were no better at predicting VF than measured IOP and its variation.

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Conclusions: The extent to which measured and target IOP differed was not predictive of VF progression. Variability in this difference over time was predictive of VF progression, but not more predictive than variability around each patient’s mean. While setting and meeting a specific target IOP was not associated with further VF loss, quite probably the fact that patients were given a target forced CIGTS ophthalmologists to treat as aggressively as necessary to meet it, thereby reducing overall VF loss in the Study.

Commercial Relationships: David C. Musch, None; Leslie M. Nizioł, None; Brenda W. Gillespie, None; Paul R. Lichter, None
Support: NIH Grant EY-020912
Clinical Trial: NCT00000149

ARVO 2015 Annual Meeting Abstracts

The Ocular Hypertension Treatment Study (OHTS): Improving prediction of which participants who developed glaucoma will/will not have visual field (VF) progression in 5 years
Feng Gao¹, Philip Miller¹, Julia B. Huecker¹, Michael A. Kass², Mae O. Gordon².¹ Division of Biostatistics, Washington University School of Medicine, St. Louis, MO; ²Department of Ophthalmology & Visual Sciences, Washington University School of Medicine, St Louis, MO.

Purpose: To improve accuracy of predicting which participants who developed glaucoma will/will not have VF progression by the use of joint model to incorporate longitudinal predictors

Methods: We analyzed VF data from 164 eyes of 164 participants with glaucoma who had ≥7 post-diagnosis VFs (median f/up of 5 years) and ≥3 pre-diagnosis VFs. VF progression was defined using post-diagnosis VFs and based on the 2-omitting point-wise linear regression (PLR) algorithm that flags a VF test point if the slope is statistically significant (p≤0.01) and clinically significant (≤-1.0 dB/year). An eye was classified “progression” if at least two adjacent points from the same hemifield met the above criteria.

We then compared the accuracy of 3 models using pre-diagnosis mean deviation (MD) to predict which eyes had been classified as “progressed”: Model 1 - a logistic regression including only MD at diagnosis, Model 2 - a logistic regression adding the slope of pre-diagnosis MD estimated by a simple linear regression, and Model 3 - a joint model incorporating the whole series of pre-diagnosis MD. The joint model was fitted using Markov chain Monte Carlo (MCMC) method with WinBUGS software. All models were also compared using simulation studies where the parameters were chosen after the OHTS pre-diagnosis MD data.

Results: 32 eyes (20%) were classified as “progression”. Figure 1 shows the ROC curve and area under the curve (AUC) for each model. The joint model that uses all pre-diagnosis MD has the highest accuracy. Table 1 compares the estimated regression coefficients in each model to the “true value”. The greater the difference, the greater the bias in the effect estimated by each model. Estimates in Models 1&2 are badly biased towards null due to the presence of high variability in MD.

Conclusions: Although it is common practice to use the most recent measurements as covariates in prediction models, we show that the joint model which incorporates the whole series of longitudinal measurements (if available) uses information more efficiently and improves the predictive accuracy.

Figure 1. ROC curve and AUC for predicting progression using pre-diagnosis MD

Table 1. Simulation study¹: Mean ± SD for the estimated regression coefficients of longitudinal MD on progression

Commercial Relationships: Feng Gao, None; Philip Miller, None; Julia B. Huecker, None; Michael A. Kass, None; Mae O. Gordon, None
Support: NIH Grant EY09341, NIH Grant EY023452, and Research to Prevent Blindness (RPB)
Clinical Trial: NCT00000125
Program Number: 3695 Poster Board Number: B0038
Presentation Time: 3:45 PM–5:30 PM
Frequency of glaucoma and its associations in a large cohort, UK Biobank
Fang Ko1, 2, Nicholas G. Strouthidis2, 3, Praveen J. Patel2, 3, Jennifer L. Yip4, Zaynah Muthy5, Peng T. Khaw2, 3, Paul J. Foster2, 3. 1Glaucoma, Moorfields Eye Hospital, London, United Kingdom; 2Institute of Ophthalmology, University College of London, London, United Kingdom; 3NIHR Biomedical Research Centre in Ophthalmology, Moorfields Eye Hospital, London, United Kingdom; 4Department of Public Health and Primary Care, Institute of Public Health, University of Cambridge School of Clinical Medicine, Cambridge, United Kingdom.

Purpose: To determine frequency of reported glaucoma and its associations in a cohort of 112,690 people.

Methods: UK Biobank is a multi-site community-based study of UK residents aged 40–69 years who are registered with the National Health Service. Participants received ophthalmology examination, health questionnaire, and were asked whether they had been diagnosed with glaucoma.

Results: 1919 people (1.70%) reported a glaucoma diagnosis. Mean age is 61.4 years among those with glaucoma versus 56.7 years among those without (p<0.001). Frequency among people age 40-49 is 0.48%, among those age 50-59 is 1.18% (p<0.001), and among those age 60-70 is 2.7% (p<0.001). Frequency is lower among women (1.37%) versus men (2.10%, p=0.001). When ethnicity is considered, 1.62% whites, 3.28% blacks (p=0.001 compared to whites), 2.14% Asians (p=0.009), 1.55% Chinese (p=0.91), and 1.95% mixed/other (p=0.26) have glaucoma diagnosis. Mean Townsend deprivation index is higher among those with glaucoma (-0.72) versus those without (-0.95, p=0.001). Frequency of glaucoma is highest among those with low household income and decreases as income increases (2.39% for those with <£18000, 1.79% for £18000–30999, 1.43% for £31000–51999, 1.16% for £52000–100000, and 0.92% for >£100000); however, after adjusting for age, there is no significant association between income and glaucoma except for those in the lowest category. Mean cornea-corrected IOP in the right eye is 18.9 mmHg in those with glaucoma versus 16.0 mmHg in those without (p<0.001). Mean visual acuity in right eye is LogMar 0.09 among those with glaucoma versus 0.03 among those without (p<0.001).

Multivariable regression shows significant association with older age (age 40-49 reference; age 50-59, OR 2.49; age 60-69, OR 5.41, p<0.001); male gender (OR 1.50, p<0.001); black or Asian ethnicity as compared to whites (blacks, OR 2.81, p=0.001; Asians, OR 1.46, p=0.006); income <£18000 (OR 1.27, p=0.001 compared to £31000 – 51999), higher IOP (OR 1.07 per mmHg, p<0.001); and worse visual acuity (OR 1.08 per 0.1 LogMar, p=0.001).

Conclusions: In the UK Biobank cohort, 1.7% of people report glaucoma diagnosis. Glaucoma is significantly associated with older age, higher IOP, and lower visual acuity, and is higher in men, non-white people, and those with lower income.

Commercial Relationships: Fang Ko, None; Nicholas G. Strouthidis, Alcon (R), Allergan (R), Heidelberg Engineering (R), Novartis (R); Praveen J. Patel, None; Jennifer L. Yip, None; Zaynah Muthy, None; Peng T. Khaw, None; Paul J. Foster, None
Support: NIHR Biomedical Research Centre in Ophthalmology at Moorfields Eye Hospital, International Glaucoma Association, Richard Desmond Charitable Trust via Fight for Sight, Special Trustees of Moorfields Eye Hospital

Program Number: 3696 Poster Board Number: B0039
Presentation Time: 3:45 PM–5:30 PM
The associations between vertical cup to disc ratio and retinal vascular diameters; The Nagahama Cohort

Purpose: To date, glaucoma has been reported to have associations with several cardiovascular disorders clinically and genetically. In this study, we investigated relevant risk factors with vertical cup-to-disc ratio (VCDR), an important indicator of glaucoma, using Japanese cohort.

Table 1A. Characteristics of those with and without glaucoma. Mean ± standard error.

Table 1B. Frequency of glaucoma by risk factor. Percentage ± standard error.

Multivariable regression of risk factors for glaucoma.

Commercial Relationships: Fang Ko, None; Nicholas G. Strouthidis, Alcon (R), Allergan (R), Heidelberg Engineering (R), Novartis (R); Praveen J. Patel, None; Jennifer L. Yip, None; Zaynah Muthy, None; Peng T. Khaw, None; Paul J. Foster, None
Support: NIHR Biomedical Research Centre in Ophthalmology at Moorfields Eye Hospital, International Glaucoma Association, Richard Desmond Charitable Trust via Fight for Sight, Special Trustees of Moorfields Eye Hospital

Program Number: 3696 Poster Board Number: B0039
Presentation Time: 3:45 PM–5:30 PM
The associations between vertical cup to disc ratio and retinal vascular diameters; The Nagahama Cohort

Purpose: To date, glaucoma has been reported to have associations with several cardiovascular disorders clinically and genetically. In this study, we investigated relevant risk factors with vertical cup-to-disc ratio (VCDR), an important indicator of glaucoma, using Japanese cohort.
Methods: We included 3,655 Japanese healthy volunteers from the Nagahama Study. To examine the risk factors associated with VCDR, all relevant factors including atherosclerosis, blood pressure, retinal vascular diameter and ocular parameters were used in a stepwise multiple regression analysis with VCDR.

Results: Mean VCDR was 0.449±0.122. Among 11 explanatory variables selected in the predictive model, disc area, diameters of the central retinal artery and the vein, age, body weight, systolic and diastolic blood pressure, axial length, spherical equivalent refraction, and corneal curvature made significant contributions to the model (P<0.05). Regression coefficients were as follows: β = -0.086; P=0.00071, β = -0.094; P=0.00011, β = -0.16; P=0.0047, β = -0.11; and P=0.0011, β = -0.082, respectively; β, standardized partial regression coefficient).

Conclusions: We showed associations between VCDR and retinal vascular diameters after adjustment for blood pressure and ocular parameters. Our data suggests that atherosclerosis and smaller retinal vascular diameters may precede larger optic disc cupping, which could result in the development of glaucoma.

Commercial Relationships: Munemitsu Yoshikawa, None; Kenji Yamashiro, None; Masahiro Miyake, None; Tadamichi Akagi, None; Hanako O. Ikeda, None; Hideo Nakashima, None; Satoshi Morooka, None; Kyoko Kumagai, None; Yugo Kimura, None; Nagahisa Yoshimura, None

Program Number: 3697 Poster Board Number: B0040
Presentation Time: 3:45 PM–5:30 PM
Factors associated with loss of visual function in far advanced primary open angle glaucoma with lower baseline intraocular pressure

Purpose: To investigate risk factor associated with progressive loss of visual function in far advanced primary open angle glaucoma with lower baseline intraocular pressure(POAGLP).

Methods: Eighty nine eyes of 89POAGLP patients with baseline visual field (VF) mean deviation (MD) less than -10 decibel (dB) (average follow up period; 5.3 years) were included. Participants were categorized into two groups according to the baseline VF MD,ie, group 1 (-16 dB ≤), and group 2 (-16 dB >), respectively. Total participants were divided into older group (≥64 years) and younger group (<64 years) according to the median split of baseline age. Hazard ratios (HRs) for the association between potential risk factors and progression were obtained using Cox proportional hazards models in total participants as well as in each subgroup. VF progression rate was obtained by linear regression analysis of serial VF MD values and compared among three subgroups based on mean follow up IOP.

Results: Fifty three eyes were classified as group 1 (VF MD; -13.5 ± 1.8 dB) while 36 eyes as group 2 (-21.0 ± 4.1 dB). Thirty four eyes (64.2%) in group 1and 29 eyes (80.6%) in group 2 showed progression during follow-up period. In group 1, younger age and lower baseline best-corrected visual acuity were found to be associated with progression, whereas no significant risk factor was found in group 2. In younger group, myopia and disc hemorrhage were found to be the risk factors while no risk factor was found in older group. In group with mean follow up IOP under 13.5mmHg, MD progression rate was -0.340±0.431 dB/year, while in group with IOP between 13.5mmHg and 15.2mmHg, -0.213±0.500 dB/year, in group with IOP over 15.2mmHg, -0.345±0.618 dB/year (p=0.543).

Conclusions: Risk factors associated with progressive loss of visual function were different according to the stages of VF or baseline age among far advanced POAGLP patients.

Commercial Relationships: Sophia Kim, None; Kyung Rim Sung, None

Program Number: 3698 Poster Board Number: B0041
Presentation Time: 3:45 PM–5:30 PM
Epidemiology of Neovascular Glaucoma (NVG) from 2002 to 2012 at King Khaled Eye Specialist Hospital, Saudi Arabia

Purpose: Neovascular glaucoma (NVG) is an ischemic ocular complication with a potential of causing severe visual impairment and blindness. We present the incidence and determinants of NVG between 2002 and 2012 at a tertiary eye hospital in Saudi Arabia.

Methods: In this ophthalmic charts review, NVG cases diagnosed by vitreo-retina and glaucoma units at the King Khaled Eye Specialist Hospital in Riyadh were included. The annual incidence rate was calculated. The determinants included gender, age, systemic comorbidities, lens status, type of NVI and visual acuity on presentation. Additionally, the impact of anti-angiogenic therapy on incidence on NVG was studied. We used univariate analysis for statistical analysis.

Results: We studied 597 eyes with NVG. The overall annual incidence of NVG was 6.6/10,000. It markedly declined from 13/10,000 in 2008 to 0.1/10,000 in 2012 (figure: 1). Of note was the introduction of intravitreal injection of Bevacizumab in 2008 in Saudi Arabia. Males had significantly higher risk of NVG than females (OR = 2.2). Diabetes and hypertension were associated with NVG in 88% and 42.7% of cases, respectively. In 377(72%) of diabetic patients, the glycemic control was poor (HbA1C >7 %). Visual acuity on presentation was 20/20 to 20/40 in 14 (2%), 20/50 to 20/200 in 79 (13%) and <20/200 to 20/400 in 456 (76%) and <20/400 in 45 (7%) eyes. Intraocular pressure was higher than 30mmHg in 438 (73%) eyes. A total 340 (57%) eyes were phakic. The cup-to-disc (CD) ratio was greater than 0.8 in 86 (14%) eyes. During early period (2002 to 2007) and later period (2008 to 2012), the glaucoma presentation; CD ratio (χ 2 = 4, p =0.09) and type of angle (p = 0.8) was not different. The contralateral eye showed NVG at presentation (OR = 0.8, p = 0.3) or follow up (OR = 1.0, p = 0.9) in both periods was not different.

Conclusions: NVG was more common in males and associated with poor glycemic control. There was risk of the contralateral eye developing glaucoma. Most patients had poor visual acuity at presentation. The incidence of NVG decreased following the introduction of anti-angiogenic therapy in 2008.

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Figure: Incidence (per 10,000 cases) of Neovascular Glaucoma at King Khaled Eye Specialist Hospital, Saudi Arabia
X axis denotes year of presentation of neovascular glaucoma case.
Y axis denotes incidence per 10,000 eye patients per year.

Commercial Relationships: Rajiv Khandekar, None; Abdullah Al-Bahlal, None; Tariq Alzahim, None; Deepak P. Edward, None; Igor Kozak, None

Program Number: 3699 Poster Board Number: B0042
Presentation Time: 3:45 PM–5:30 PM

Outcomes of glaucoma referrals across Europe
Panayiota Founti1, 2, Fotis Topouzis2, Gabor Hollo3, Barbara Cvenkel4, Michele M. Jester5, Bettina Haidich6, Peter Kohy7, Ananth C Viswanathan7. 1Glaucoma Service, Moorfields Eye Hospital, London, United Kingdom; 2Department of Ophthalmology, School of Medicine, Aristotle University of Thessaloniki, Thessaloniki, Greece; 3Department of Ophthalmology, Semmelweis University, Budapest, Hungary; 4Department of Ophthalmology, University Medical Centre Ljubljana, Ljubljana, Slovenia; 5University Eye Clinic, DIoGMi, University of Genova, Genova, Italy; 6Department of Hygiene and Epidemiology, School of Medicine, Aristotle University of Thessaloniki, Thessaloniki, Greece; 7NIHR Biomedical Research Centre, Moorfields Eye Hospital NHS Foundation Trust, University College London (UCL) Institute of Ophthalmology, London, United Kingdom.

Purpose: To assess differences in the outcomes of glaucoma referrals across European countries.

Methods: Two hundred and fifty patients newly referred to a Glaucoma Specialist Practice were prospectively and consecutively enrolled by five centres (50 patients/centre) in the United Kingdom (UK), Hungary, Slovenia, Italy and Greece. The referral source and reason for referral were recorded. To reflect real-life clinical practice, subjects were examined according to the protocol followed in each centre and diagnosis was left to the discretion of the glaucoma expert. A management outcome was defined as positive when intervention or further monitoring was offered. Differences in quantitative variables across centres were assessed with ANOVA. The association between qualitative variables was assessed with chi-square test or Fisher’s exact test whenever the expected count was <5. Differences in the outcomes of referrals were assessed with ANOVA and Chi-square test.

Results: Sex (overall 44.0% males, 56% females) and age (overall mean±standard deviation 57.6±16.3 years) of referred subjects did not differ between centres (ANOVA p=0.056 and chi-square test p=0.052, respectively). In the UK 20% of patients were African and 12% were Asian, whereas in other countries almost all patients were Caucasian (Fisher’s exact test p<0.001). Glaucoma diagnosis was less frequent in the UK (10%), Hungary (10%) and Greece (14%), whereas it was more frequent in Slovenia (48%) and Italy (42%) (Fisher’s exact test p<0.001) (table 1). Similarly, Italy (78%) and Slovenia (72%) had higher percentages of positive outcomes, whereas these were lower for Greece (40%), Hungary (46%) and the UK (54%) (Chi-square test p<0.001). Most referrals were initiated by optometrists in the UK (56%), and by ophthalmologists in Hungary (64%), Slovenia (94%), Italy (54%) and Greece (64%) (Fisher’s exact test p<0.001). Interestingly, a third of all referred subjects in Hungary, Italy and Greece were self-referrals. In all centres, intraocular pressure >21mmHg was the commonest reason for referral (overall 47.6%) (Fisher’s exact test p<0.001). A smaller percentage of subjects were referred because of suspicious optic disc (23.2%) or suspicious visual fields (14%) (table 2).

Conclusions: Despite a structured system for glaucoma referrals in the UK, glaucoma diagnosis and positive outcomes were less frequent compared to other European countries. In all centres, less than 50% of referred subjects were diagnosed with glaucoma.
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<th>Reconciling EMR: Glaucoma Medication Regimens</th>
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<tr>
<td>Authors:</td>
<td>Thomas Bacon, Kenneth Fan, Manishi Desai</td>
</tr>
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<td>Hospital:</td>
<td>Ophthalmology, Boston Medical Center, Boston, MA</td>
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**Purpose:**
The electronic medical record (EMR) and its implementation through the Affordable Health Care Act and Meaningful Use criteria has added an additional layer of complexity to patient care. This study is to evaluate the consistency between the EMR medication reconciliation (med rec) and the physician note in documenting the glaucoma medication regimen. Also to analyze which regimen the patient adheres to when there is a discrepancy between the med rec and the physician note. Finally demographic and patient care variables are analyzed in relation to compliance.

**Methods:**
A continuous retrospective chart review of three glaucoma physicians in a tertiary care center between 10/1/2014 and 11/15/2014. Inclusion criteria included glaucoma clinic patients, age > 18, and documentation of a glaucoma medication regimen in the EMR med rec or most recent physician encounter note. Additional data fields included age, sex, total number of medications, and glaucoma regimen as stated by: EMR med rec, physician note, and patient stated compliance. Comparison between the most recent physician encounter and EMR med rec showed consistency in 159 (79.5%) patients. When patients were not compliant they were most likely to follow neither physician plan nor med rec (16%), followed by the physician note (14.5%) and lastly the med rec (2.5%). No difference in compliance between males and females (p=0.426) was noted. When grouped by decade, the highest noncompliance (9%) was age 70-79 (p=0.075). When stratified by total number of medications being taken, 1-5 group had the best compliance (71.87%) patients, and 16-20 medications group had the worst compliance (61.9%) (p=0.0059).

**Results:**
200 individuals were reviewed, 83 male and 117 female (average age 62.8, std dev 11.41). Overall 134 (67%) patients had consistent documentation between the EMR med rec, physician note, and patient stated compliance. Comparison between the most recent physician encounter and EMR med rec showed consistency in 159 (79.5%) patients. When patients were not compliant they were most likely to follow neither physician plan nor med rec (16%), followed by the physician note (14.5%) and lastly the med rec (2.5%). No difference in compliance between males and females (p=0.426) was noted. When grouped by decade, the highest noncompliance (9%) was age 70-79 (p=0.075). When stratified by total number of medications being taken, 1-5 group had the best compliance (71.87%) patients, and 16-20 medications group had the worst compliance (61.9%) (p=0.0059).

**Conclusions:**
This study revealed high consistency between the EMR and physician encounter when evaluating glaucoma medication regimens but left room for improvement in documentation. It also highlights that when patients were non compliant they did not correlate well with medication reconciliation or physician plan. As previously established in the literature, this study also verified that increasing number of medications correlates with decreased medication compliance. Age may factor into compliance although results were slightly outside significance, while the sex of the patient does not.

**Commercial Relationships:**
Thomas Bacon, None; Kenneth Fan, None; Manishi Desai, None

**Program Number:** B0043

**Presentation Time:** 3:45 PM–5:30 PM

**African Descent and Glaucoma Evaluation Study (ADAGES): Racial differences in the risk of developing visual field damage vary by level of IOP**

Linda M. Zangwill, Naira Khachatryan, Christopher Bovd, Jeffrey M. Liebmann, Christopher A. Girkin, Robert N. Weinreb, Pamela A. Sample, Naama Hammel, Lucie Sharpsten, Felipe A. Medeiros, 'Ophthalmology, Univ of California-San Diego, La Jolla, CA; 2Ophthalmology, University of Alabama at Birmingham, Birmingham, AL; 3Harkness Eye Institute, Columbia University Medical Center, New York, NY.

**Purpose:** To investigate racial differences in the development of visual field (VF) damage and the rate of rim area loss in glaucoma suspects.

**Methods:** 636 eyes from 357 glaucoma suspects and ocular hypertensive patients with normal VF at baseline and ≥2 years of follow-up from the multicenter ADAGES were included. Racial differences in the development of VF damage and rate of rim area loss were examined using multivariable Cox Proportional Hazard models and mixed effects models.

**Results:**
31 (25.4%) of the 122 African descent (AD) participants and 47 (20.0%) of the 235 European descent (ED) participants developed VF damage (p=0.078) after a mean follow-up of 7.1 ± 2.4 years. In multivariable analysis, worse baseline VF mean deviation, higher mean arterial pressure during follow up, and a race-IOP interaction term were significantly associated with the development of VF damage suggesting that racial differences in the risk of VF damage varied by IOP. At higher IOP, AD was predictive of the development of VF damage; after adjusting for corneal thickness, disc area, baseline VF mean deviation, age, and other parameters. At the highest quartile of mean IOP during follow-up (> 21 mm Hg), the multivariable HRs (95%CI) for development of VF damage in AD compared to ED subjects was 5.22 (1.81-15.08) while at lower mean IOP (< 21 mm Hg) during follow-up, AD was not predictive of the development of VF damage HR: 0.81 (0.43-1.51) (See Figure). By including race in the model, the R² increased from 36% to 54%. Moreover, among those developing VF damage, the mean rate of rim area change was significantly faster in AD compared to ED subjects (multivariate global rim area, -2.42 mm²*10⁻²/year versus -0.79 mm²*10⁻²/year, P<0.001).

**Conclusions:** In this cohort of glaucoma suspects with similar access to treatment, at higher IOP during follow-up, individuals of AD were more likely to develop VF damage than individuals of ED, and they tend to progress at a faster rate. Further research is needed to evaluate the complex interaction of ophthalmic, genetic, systemic and other factors to improve our understanding of racial differences in the earlier onset of glaucoma and its faster progression at various levels of IOP.

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Clinical Trial: NCT00221923

Program Number: 3702 Poster Board Number: B0045 
Presentation Time: 3:45 PM–5:30 PM 
Incidence rate of glaucoma after pars plana vitrectomy 
Hunjin Choi, Jonghun Lee, Jin Hyoung Kim, Do hyung Lee. 
Ophthalmology, Inje university, Ilsan Paik hospital, Goyang, Korea (the Republic of) 

Purpose: To evaluated the incidence of postoperative glaucoma after pars plana vitrectomy (PPV) and difference of the incidence rate of glaucoma between phakic and pseudophakic vitrectomized eyes. 

Methods: Retrospective chart review of patients who underwent PPV between January 2007 and May 2014. The outcome measure was the presence or absence of postoperative glaucoma, defined as sustained elevation of intraocular pressure (IOP) or definitive loss of neuroretinal rim defect on fundus exam or optical coherence tomography or showing glaucomatous change on visual field test that warranted maintenance of ocular hypotensive therapy. 

Results: There were 408 patients average age 56.21±7.94 included this study. Patients were followed for an average of 58±32 months. In the vitrectomized eye, 85 of the 408 patient were newly diagnosed as postoperative glaucoma. There were significantly higher incidence rate of postoperative glaucoma in vitrectomized eye compared with unoperated fellow eye. (p<0.01, Fisher exact test). And there were significantly higher incidence rate of postoperative glaucoma in pseudophakic eye compared with phakic eye. (p<0.01, Fisher exact test) 

Conclusions: The incidence rate of glaucoma is higher in PPV patients, and it seems to particularly higher to those with pseudophakic eye. Therefore careful monitoring of the IOP is needed and appropriate manage in virectomized eye is essential, especially in pseudophakic patients.

Commercial Relationships: Hunjin Choi, None; Jonghun Lee, None; Jin Hyoung Kim, None; Do hyung Lee, None

Program Number: 3703 Poster Board Number: B0046 
Presentation Time: 3:45 PM–5:30 PM 
Glatucoma treatments, patient perspectives and preferences 
Lilia Golas1, Catherine Marando1, Leonard Seibold1, Mina B. Pantcheva2, Pradeep T. Ramulu1, Malik Y. Kaoook1, Jeffrey R. SoodHoo2. Ophthalmology, Rocky Mountain Lions Eye Institute, Aurora, CO; Wilmer Eye Institute, Baltimore, MD. 

Purpose: The efficacy of topical medications to treat glaucoma is dependent on adherence to prescribed regimens. New treatment modalities that seek to treat glaucoma yet require less adherence from patients are in development. As part of our program evaluation study, we surveyed patients to elucidate patients’ preferences for treatment of their glaucoma. 

Methods: A survey inquiring about patient preferences for glaucoma treatments was administered in our clinic. Eligibility criteria included current use of glaucoma drops for at least one week prior to survey administration, age between 18-100 years, and willingness to answer the questionnaire. Exclusion criteria included mental or physical disability precluding questionnaire administration, a language barrier in the absence of a translator, a lack of time to complete the survey, and a lack of patient desire to participate. In total, 126 patients completed the survey. 

Results: Of the surveyed patients, the majority expressed a desire to continue topical medications when presented with theoretical alternative therapies. The least preferred treatments were an invasive surgical procedure and an intraocular injection of medication. A replaceable punctal implant was the preferred sustained drug delivery method compared to a surgically implanted permanent refillable implant implanted in or on the eye. Patients were asked to rank treatment options from 1 to 4, with 1 being the most desirable (Figure 1). Of note, the patients that chose a punctal implant over topical medications were more likely to be using more than one topical glaucoma medication. Patients cited a fear of potential risks and complications as factors that would deter them from switching from their current topical medications to one of the presented alternatives. 

Conclusions: The majority of glaucoma patients surveyed expressed a desire to continue with their current treatment regimen using topical medications. As new treatment options become available, further study will be needed to identify potential barriers to patients’ willingness to switch from using topical therapies. 

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Conclusions: While initial and repeat patient-centered counseling significantly improved patient knowledge regarding glaucomatous disease and the importance of appropriate follow-up, the majority of newly diagnosed glaucoma patients did not return for care, suggesting that factors other than disease information likely impact adherence to appropriate follow-up schedules.

Commercial Relationships: Anna Do, None; Kuldev Singh, None; Manju Pilai, None; Vijayakumar Balakrishnan, None; Robert Chang, None; Bradford Lee, None

Program Number: 3705 Poster Board Number: B0048
Presentation Time: 3:45 PM–5:30 PM
The EQUALITY Program: Evaluating Change in Patient Attitudes and Knowledge about Glaucoma
Lindsay A. Rhodes1, Carrie E. Huisingh1, Gerald McGwin1, Stephen Mennemeyer1, John Crews2, Christopher A. Girkin1, Cynthia Owssley2.
1Ophthalmology, Univ of Alabama at Birmingham, Birmingham, AL; 2Division of Diabetes Translation, Centers for Disease Control and Prevention, Atlanta, GA.
Purpose: The Eye Care Quality and Accessibility Improvement in the Community (EQUALITY) telederm medicine program provided evidence-based eye health education tailored for patients at-risk for glaucoma seeking eye care at Walmart Vision Centers. The education program was based on the InCHARGE eye health education program designed for African Americans1,4 and materials from Prevent Blindness and NEI’s National Eye Health Education Program.4,5 This study investigated the impact of EQUALITY’s eye health education on at-risk patients’ knowledge and attitudes about glaucoma.

Methods: Patients with any of these criteria were eligible to participate: African American or Hispanic ≥40 years, white ≥50 years, diabetes, family history of glaucoma, and/or a pre-existing glaucoma diagnosis. A survey was administered prior to the participant’s eye exam, the eye health education was given, and a follow-up survey was conducted 2-4 weeks later by phone. Within-group changes of survey responses from baseline to follow-up were compared using McNemar’s test. Logistic regression assessed the association of patient characteristics (age, sex, race, prior glaucoma diagnosis, employment status, educational level) with improvement in knowledge and attitudes.

Results: 521 patients completed both the pre- and post-educational surveys. From baseline to follow-up, the percent that agreed “it was important to go to the eye doctor once every two years” increased from 88% to 93% (p=0.0017) and that “it was important to go even if they’re not having an eye problem” increased from 80% to 87% (p<0.001). Improvement in knowledge was observed for correctly answering the question “how often is it recommended to get your eyes examined?” from 23% to 56% (p<0.001), “how often are dilated pupils recommended?” increased from 55% to 70% (p<0.001), and the knowledge to “how often do you need to change your glasses?” increased from 23% to 54% (p<0.001). Analysis indicated that participants who were unemployed or had less than a high school education were less likely to improve their knowledge (OR 0.64, 95% CI 0.43-0.96; OR 0.55, 95% CI 0.29-1.0 respectively).

Conclusions: EQUALITY’s eye health education program improved attitudes and knowledge about eye care and glaucoma. Future eye health education should address the needs of the unemployed and less educated in order to improve disease understanding in this group.

Commercial Relationships: Lindsay A. Rhodes, None; Carrie E. Huisingh, None; Gerald McGwin, None; Stephen Mennemeyer, None; John Crews, None; Christopher A. Girkin, Carl Zeiss Meditec (F); Cynthia Owssley, None

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Purpose: Glaucoma is a slow, progressive disease that is among the leading causes of blindness worldwide. However, patient adherence to treatment is exceedingly low. We performed a retrospective study to determine the role of telephone reminders in increasing adherence.

Methods: This retrospective, case-controlled study included randomly selected subjects from a cataract and primary eye care clinic (CPEC) and a specialty glaucoma clinic. Subjects in the CPEC clinic received telephone reminders while those in the glaucoma clinic did not. Each sample was selected to have similar proportions of follow-up recommendations of 1 month, 3 months, and 6 months, and subjects were considered adherent if they returned within the specified timeframe. Chi-square tests were conducted to compare adherence rates between different clinics, age groups, genders, races, insurance statuses, glaucoma diagnoses, number of ocular medications, and follow-up recommendations. A logistic regression model was used to determine the odds ratios for each factor.

Results: A total of 144 subjects from the glaucoma clinic and 151 subjects from the CPEC clinic were included. There was no significant difference in follow-up rates between the glaucoma clinic (68.1%) and the CPEC clinic (65.6%) (P=0.65). We found that patients who were on more than two ocular medications were more likely to return for follow-up (OR=3.99 95%CI 1.92-8.30). Subjects ages 50 to 80 (71.4%) were more likely to follow-up than those in the younger (57.9%) and older (54.9%) peers.

Conclusions: The follow-up adherence of patients in a primary eye care clinic who receive telephone reminders is similar to patients in a glaucoma clinic who do not. Young and elderly subjects are less likely to follow-up.

Commercial Relationships: Brian Lee, None; Scott Fudemberg, None; Rachel Murphy, None; Lisa A. Hark, None; Michael Waisboud, None; Yang Dai, None; Benjamin Leiby, None

Support: Glaucoma Service Foundation

Program Number: 3706 Poster Board Number: B0049
Presentation Time: 3:45 PM–5:30 PM

Adherence to Follow-Up Appointments in a Resident Glaucoma Clinic vs. Primary Eye Care Clinic: A Retrospective Analysis
Brian Lee1, Scott Fudemberg*, Rachel Murphy1, Lisa A. Hark1, 2, Michael Waisboud1, Yang Dai1, Benjamin Leiby1. 1Glaucoma Research Center, Will’s Eye Hospital, Philadelphia, PA; 2Department of Ophthalmology, Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA; 3Division of Biostatistics, Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA.

Purpose: To assess longer-term patterns of glaucoma medication adherence and identify whether patterns of adherence established during the first year of medication use persist during three additional years of follow-up.

Methods: We conducted a retrospective longitudinal cohort analysis of beneficiaries enrolled in a U.S. managed care plan for ≥7 years between 2001-2012 who were ≥40 years old and newly diagnosed and treated for open-angle glaucoma. Group-based trajectory modeling (GBTM) classified patterns of adherence using the medication possession ratio (MPR) during the first year and over four years of follow-up. We compared beneficiaries to identify whether patterns of medication use in year 1 persisted over the 4 years. We identified socio-demographic and other factors associated with ideal patterns of adherence with regression analyses.

Results: Of the 1,234 subjects included, GBTM identified five distinct patterns of glaucoma medication adherence in both the one-year and four-year follow-up periods. The five groups were: 1) Never adherent after their index prescription fill (7.2%,15.5% of subjects in the one and four-year models, respectively); 2) Persistently very poor adherence (17.1%, 23.3%); 3) Declining adherence (9.1%, 9.1%); 4) Persistently moderate adherence (45.6%, 36.7%); and 5) Persistently good adherence (21.0%, 15.4%). At least 90% of beneficiaries in the 4 groups with the worst and best adherence patterns (Groups 1, 2, 3, 5) maintained their patterns from their first year throughout their 4 years of follow-up while those with mid-level adherence (Group 4) were most likely to change groups. Regression analyses identified that those with the best adherence over 4 years were more likely to be white, older, earn >$60,000/year, use mail order either exclusively or along with their local pharmacy and have more eye care visits (p<0.05 for all comparisons).

Conclusions: For most patients newly-started on glaucoma medications, adherence patterns observed in the first year of treatment reflect patterns of adherence over the subsequent 3 years. Investing resources in both identifying and helping patients with suboptimal adherence patterns over the first year may have a larger impact on longer-term adherence.

Commercial Relationships: Paula Anne Newman-Casey, None; Taylor Blachley, None; Paul P. Lee, Genentech (C); Novartis (C); Michele Heisler, None; Joshua D. Stein, None

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Program Number: 3708 Poster Board Number: B0051
Presentation Time: 3:45 PM–5:30 PM

Quality of life in glaucoma patients and normal subjects related to the severity of damage in each eye
Antonio Morilla-Grasa1, Olivia Pujol-Carreras1, 2, Alfonso Antonio-Lopez1, 2, Clara Mora1, Laia Pastor2, Silvia Gudiña2, Zaida Vega2, Virginia Garcia1, Robert Maul1. 1INSTITUT CATALA DE RETINA, Barcelona, Spain; 2PARC DE SALUT MAR, Barcelona, Spain.

Purpose: To assess the quality of life (QoL) in glaucoma patients and normal subjects, and to assess its relation with the severity of damage in each eye.

Methods: Three hundred and fifty nine subjects were included in the study and distributed in three categories. Group 1 had both eyes normal (normal intraocular pressure (PIO), optic disk and visual fields (VF)) or mild glaucoma defined as untreated PIO > 21 mmHg and abnormal VF with mean defect (MD) over -6dB. Group 2 comprised 81 patients with both eyes with mild or moderate glaucoma defined as untreated PIO > 21 mmHg and abnormal VF with MD between -6dB and -12dB. Group 3 included 70 patients with moderate to severe glaucoma (untreated PIO > 21 mmHg and abnormal VF with MD of less than -12dB) in both eyes. Group 4 included 61 patients with asymmetric glaucomatosus damage. Specifically, the patients in group 4 had one eye with severe glaucoma and the other eye normal or with mild glaucoma. All subjects completed 3 different questionnaires. Global quality of life was evaluated with EuroQol-5D (EQ-5D). Vision related quality of life was assessed with Visual Function Questionnaire (VFQ-25).

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Quality of life related to ocular surface disease was measured with Ocular Surface Disease Index (OSDI). The scores of the 4 groups were compared with analysis of variance. **Results:** VFQ-25 showed that group 1 and 4 had less difficulties than group 3 with distance activities (88.2±17.2; \( p=0.017 \) and 89.14±15.6; \( p=0.027 \), respectively), social function (93.6±15.3; \( p=0.009 \) and 94.87±13.4; \( p=0.011 \), respectively) and color vision (94.5±15.3; \( p=0.022 \) and 95.54±14.3p=0.027, respectively). Additionally, group 1 had less difficulties or higher punctuation than group 3 in near activities (85.5 ±20.2, \( p=0.006 \)), peripheral vision (91.75 ±19.8, \( p=0.012 \)) and general vision (71.4±15.3; \( p=0.011 \). In terms of global QoL, group 4 obtained a higher score (73.21±16.6) than all other groups (all, \( p<0.05 \)). QoL related to ocular surface disease did not show significant differences among the groups (all, \( p>0.05 \)). **Conclusions:** Patients with severe glaucoma in both eyes had worse QoL, or more difficulties performing different every day activities than patients with mild or asymmetric glaucomatous damage. No significant differences were found between asymmetric glaucomas and patients with normal or mild glaucomas in both eyes.  

**Commercial Relationships:** Antonio Morilla-Grasa, None; Olivia Pujol-Carreras, None; Alfonso Anton-Lopez, Alcon (F), Santen (C), Thea (C), Transcend (C); Clara Mora, None; Laia Pastor, None; Silvia Gudiña, None; Zaida Vega, None; Virginia Garcia, None; Robert Mauli, None

**Methods:** We prospectively studied 23 patients following glaucoma drainage device (GDD) surgery (15 Baerveldt and/or 9 Ahmed FP7) and 26 following trabeculectomy. At least 1 month after surgery, patients completed 3 questionnaires – the NEI 25-Item Visual Function Questionnaire (VFQ-25), the Adult Strabismus-20 questionnaire (AS-20), and the Diplopia Questionnaire (DQ). We defined diplopia as “Sometimes,” “Often,” or “Always” in distance straight ahead and/or reading positions on the DQ. We compared AS-20 and VFQ-25 subscale scores (each scaled 0 to 100, worst to best HRQOL) between diplopic and non-diplopic patients.

**Results:** Diplopia was reported in 8 of 49 patients (16%). Compared with non-diplopic glaucoma patients, diplopic glaucoma patients had lower AS-20 subscale scores (worse HRQOL) for self-perception (74.5±26.9 vs 87.1±20.1, \( p < 0.01 \)), interactions (77.9±28.3 vs 91.1±16.8, \( p < 0.05 \)), reading function (52.9±35.9 vs 70.3±24.5, \( p < 0.05 \)), and general function (55.8±35.8 vs 78.2±19.1, \( p < 0.001 \)). Some VFQ subscale scores were also lower for diplopic patients: general vision (65.0±31.6 vs 67.8±15.4), ocular pain (76.6±30.9 vs 82.3±18.7), near activities (55.2±30.2 vs 69.3±19.0), distance activities (68.2±31.8 vs 76.4±17.1), vision-specific (VS) social functioning (78.1±33.2 vs 89.3±17.1), VS mental health (58.6±22.2 vs 71.5±25.2), VS role difficulties (57.8±43.8 vs 74.1±25.1), VS dependency (64.6±44.7 vs 85.6±21.3), and peripheral vision (59.4±35.2 vs 71.3±22.1). Other VFQ subscales were not lower: general health (65.6±39.9 vs 64.0±23.1), driving (78.3±26.1 vs 67.4±25.8), and color vision (89.3±19.7 vs 88.8±17.9). Differences for 2 of 4 AS-20 subscales, but no VFQ-25 subscale, reached statistical significance (\( p<0.05 \)) using one-sided tests. **Conclusions:** Diplopia following GDD or trabeculectomy surgery negatively affects HRQOL. The strabismus-specific AS-20 is more sensitive than the VFQ-25 in detecting such issues.

**Commercial Relationships:** Philip Y. Sun, None; Jonathan M. Holmes, None; David A. Leske, None; Cheryl L. Khanna, None

**Purpose:** Glaucopa is the second leading cause of vision loss among the elderly in the U.S. Motor vehicle collision (MVC) rates in the U.S. increase sharply in drivers aged 70 and older. Despite its significance, there have been conflicting reports about whether glaucoma is associated with higher MVC rates. This study investigated whether older drivers with glaucoma have a higher MVC rate as compared to those without glaucoma.

**Methods:** The study was based on a population-based sample of 2000 licensed drivers aged 70 years and older who reside in north central Alabama. All MVC involvement for five years prior to enrollment was obtained from state records. Three aspects of visual function were measured: habitual binocular distance visual acuity, binocular contrast sensitivity and the binocular driving visual field constructed from combining the monococular visual fields of each eye (Huisingh et al., 2014). General cognitive status was assessed with the mini-mental status examination (MMSE). Glaucopa was confirmed by medical records.

**Results:** Drivers with glaucoma (n = 206) had a 1.65 (95% CI 1.20-2.28, \( p < 0.01 \)) times higher MVC rate compared to those without glaucoma even after adjusting for age, gender, and MMSE. Among drivers with glaucoma, visual field loss was more strongly associated with higher MVC rates (RR=2.48, 95% CI 1.28-4.82, \( p < 0.01 \)) compared to deficits in visual acuity (RR = 1.95, 95% CI 0.70-5.43, \( p = 0.20 \)) and contrast sensitivity (RR = 0.37, 95% CI 0.13-1.08, \( p = 0.07 \)). When the visual field was divided into six sub-regions (upper, lower, left, and right visual fields; horizontal and vertical meridians), left side visual field loss was most strongly associated with higher MVC rates (RR = 3.04, 95% CI 1.54-5.97, \( p < 0.01 \)) compared to the horizontal, upper, lower and right side visual field loss. There was, however, no association between deficits along the vertical meridian and higher MVC rates (RR = 1.20, 95% CI 0.61-2.38, \( p = 0.59 \)).

**Conclusions:** Findings suggest that older drivers with glaucoma are more likely to have a higher MVC rate than those without glaucoma. Impairment in the driving visual field appears to contribute most to this increased MVC rate as compared to impaired visual acuity and contrast sensitivity, highlighting the importance of clinicians discussing driving safety with glaucoma patients, particularly those with visual field defects.
Commercial Relationships: MiYoung Kwon, None; Carrie E. Huisling, None; Lindsay Rhodes, None; Gerald McGwin, Jr., None; Joanne M. Wood, None; Cynthia Owssley, None.
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Program Number: 3711 Poster Board Number: B0054
Presentation Time: 3:45 PM–5:30 PM
Relation between acute intraocular pressure elevation after intravitreal injection of an anti-VEGF drug and optic nerve head circulation
Makiko Wakuta1, 2, Miho Fukumura3, Tomoko Orita4, Ryoji Yanaiz, Kazuhiro Kimura5, Koh-hei Sonoda2. 1Ophthalmology, Ube industries central hospital, Ube, Japan; 2Ophthalmology, Yamaguchi university graduate school of medicine, Ube, Japan; 3Ophthalmology, Shiminoseki medical center, Shiminoseki, Japan.

Purpose: Acute intraocular pressure (IOP) elevation is a complication of intravitreal injection of agents targeted to vascular endothelial growth factor (VEGF). We evaluated the relation between this phenomenon and optic nerve head circulation with the use of laser speckle flowgraphy.

Methods: Twenty-two eyes of 20 subjects (17 eyes of 15 men and 5 eyes of 5 women; mean age ± SD, 74.2 ± 15.7 years) who had received an intravitreal injection of 0.05 ml of aflibercept at Yamaguchi University Hospital for the treatment of wet age-related macular degeneration were enrolled. Blood pressure and pulse were measured before the injection for calculation of ocular perfusion pressure (OPP). IOP and blood flow at the optic nerve head both before and 10 minutes after injection were also determined. Blood flow at the optic nerve head was examined by laser speckle flowgraphy (LSFG-NA VI; Softcare Co. Ltd., Fukutsu, Japan), and blood flow values for the entire optic nerve area (MA: Mean of All area), the main optic nerve vessels (MV: Mean of Vascular area), and optic nerve tissue (MT: Mean of Tissue area) were determined with LSFG Analyze software. The subjects were divided into two groups on the basis of whether the postinjection increase in IOP was ≥10 mmHg (unchanged group) or <10 mmHg (elevated group).

Results: Thirteen and nine eyes were assigned to the unchanged and elevated groups, respectively. Age and pre-injection IOP did not differ significantly between the two groups. Postinjection IOP elevation in the elevated group (12.9 ± 2.66 mmHg) was significantly (P < 0.01) higher than that in the unchanged group (5.31 ± 2.43 mmHg). Pre-injection OPP in the elevated group (53.6 ± 6.63 mmHg) was significantly (P < 0.01) smaller than that in the unchanged group (63.1 ± 5.93 mmHg). The differences in MA, MV, and MT between the two groups were not statistically significant (P > 0.01). Conclusions: Whereas acute IOP elevation after intravitreal injection of an anti-VEGF drug did not affect blood flow of main optic nerve vessels, it reduced blood flow for optic nerve tissue.

Commercial Relationships: Makiko Wakuta, None; Miho Fukumura, None; Tomoko Orita, None; Ryoji Yanai, None; Kazuhiro Kimura, None; Koh-hei Sonoda, None.

Program Number: 3712 Poster Board Number: B0055
Presentation Time: 3:45 PM–5:30 PM
The effect of inhaled corticosteroids on intraocular pressure in patients with ocular hypertension or controlled glaucoma
Edward B. Moss, Stephanie A. Low, Darana Yuen, Yvonne M. Buys, Graham E. Trope. Ophthalmology and Vision Sciences, University of Toronto, Toronto, ON, Canada.

Purpose: This study was designed to evaluate the effect of inhaled fluticasone propionate on intraocular pressure (IOP) in patients with ocular hypertension (OHT) or controlled open-angle glaucoma (OAG). To our knowledge this potential adverse effect of steroid treatment has never been investigated using oral inhalers in a prospective, randomized, controlled trial.

Methods: This study was approved by the University Health Network Research Ethics Board. Twenty-two patients aged 18 to 85 years with OHT or stable OAG (including pseudoxefoliation, pigment dispersion, and steroid-induced glaucoma) were randomized in a double-masked fashion to a twice-daily inhaler: either 250 μg fluticasone propionate or saline placebo. Exclusion criteria included eyes with any prior incisional surgery, advanced glaucoma, or progressive/unstable disease in the previous 6 months. In the case of both eyes being eligible, the eye with poorer perimetric mean deviation was included as the study eye. There were 4 study visits: baseline, and weeks 2, 4, and 6 after starting the inhaler. Primary outcome was IOP; secondary outcomes included visual acuity, anterior segment changes, patient reported side-effects, and compliance.

Results: To date, 22 patients have been randomized and 7 have completed the study. Two subjects withdrew after randomization, one due to personal reasons and one who developed a rheumatogenous retinal detachment at 1 week and was subsequently removed from the study. 62% of all study visits have been completed. There was no significant change in IOP from baseline to 6 weeks (14.3 ± 3.6 mmHg vs 14.5 ± 4.0 mmHg, p = 0.34). There was no IOP elevation ≥20% from baseline at any study visit. LogMAR visual acuity was unchanged from baseline to 6 weeks (0.23 ± 0.12 vs 0.16 ± 0.14, p = 0.08). There were no patient-reported side-effects and all completed subjects (7/7) recorded ≥80% adherence.

Conclusions: Preliminary results revealed no evidence of IOP elevation after 6 weeks of twice-daily fluticasone propionate in 6 patients with OHT and/or OAG.

Commercial Relationships: Edward B. Moss, None; Stephanie A. Low, None; Darana Yuen, None; Yvonne M. Buys, Alcon (F); Allergan (F); Graham E. Trope, None

Clinical Trial: pending
sleep lab exam with CPAP treatment (CPAP treated group; n=31). The sleep lab exam (sleep period: from 11:00 pm until 6:00 am) included rebound IOP measurements, a complete ophthalmologic exam and nocturnal hemodynamic recordings. The IOP was measured serially using rebound tonometer (IOP: ICARE® PRO) performed while in sitting and supine positions before, during and after the sleep period. We compared the difference in IOP of non-CPAP and CPAP groups.

**Results:** The mean IOP of the non-CPAP and CPAP groups measured in sitting position before the sleep period was 14.1±2.41 mmHg and 13.6±2.07 mmHg, respectively (p=0.48). Assuming a supine position for 1 minute, significantly increased the IOP by 2.18±2.46 mmHg and 1.91±2.16 mmHg for both the non-CPAP and CPAP groups (Paired t-test; p=0.027, p=0.034, respectively), but this IOP rise showed no difference between the two groups. The IOP significantly increased further after 7 hours of sleep in the supine position, and the mean IOP of the non-CPAP and CPAP groups was 19.41±4.11 mmHg and 19.69±5.61 mmHg, respectively (independent t-test p=0.76). The rise in IOP for both groups was not correlated with any hemodynamic parameters.

**Conclusions:** OSAS patients have a significant rise in IOP during the sleep period when comparing measurements before and after the sleep period; however, CPAP therapy did not affect the measurements of IOP. In our study, the rise in nocturnal IOP in OSAS patients is not related to changes in hemodynamic parameters.

**Commercial Relationships:** Yuval Cohen, None; Eyal Ben-Mair, None; Eyal Rosenzweig, None; Dalia Shechter-Amir, None; Arieh S. Solomon, None

**Program Number:** 3714 Poster Board Number: B0057  
**Presentation Time:** 3:45 PM–5:30 PM

**Resident Identification of Disc Hemorrhages in Glaucoma**

**Patients:** Nisha Chadha, Jessica Maslin, Ji Liu, Christopher C. Teng.

**Department of Ophthalmology, Yale University, New Haven, CT.**

**Purpose:** To evaluate resident proficiency in identifying disc hemorrhages before and after a lecture on disc hemorrhages and clinical detection.

**Methods:** A pre-test consisting of a slideshow with 50 optic disc photographs, of which 14 had disc hemorrhages, was administered. 15 ophthalmology residents at one institution participated and were asked to identify whether or not a disc hemorrhage was present. Participants were shown each image for 10 seconds. The pre-test was followed by a lecture on disc hemorrhage pathophysiology, clinical implications, and strategies for improving clinical detection. The test was repeated after the lecture. Overall scores and accuracy with disc hemorrhage identification, before and after the lecture, were analyzed using paired t-test.

**Results:** 15 ophthalmology residents participated in the curriculum and 14 residents completed the post-test. The average overall performance did not change from pre-test to post-test, with average scores of 85% and 85% respectively (p=0.60). However, the average number of missed disc hemorrhage images improved from 23% to 14% (p=0.89). Sensitivity in disc hemorrhage detection improved from 79% to 85% while specificity remained relatively stable at 87% and 85%. When stratified by year of training, second and third year residents had the same pre and post-test average scores of 87%, while first year residents scored 78% on the pre-test, with improvement to 82% on the post-test. Similarly, second and third year residents missed fewer disc hemorrhages at 14% and 20% respectively, compared to first year residents who missed 34%. However, all residents improved in disc hemorrhage detection on the post-test to a rate of less than 13%, 9%, and 20% missed disc hemorrhages in the third, second, and first year resident groups respectively.

**Conclusions:** Disc hemorrhage identification is an essential component of glaucoma evaluations. Resident education on this topic is important for comprehensive patient care and can improve resident proficiency in detection at all levels of training.

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**Dental Health in Glaucoma**

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**Purpose:** To evaluate a possible association between dental health and primary open angle glaucoma (POAG), as recent results suggest that the oral microbiome contributes to glaucoma pathophysiology (Astafurov et al., 2014).

**Methods:** POAG cases (n=120) and controls without glaucoma (n=87) were recruited at SUNY Downstate between 2011 and 2013. Inclusion criteria for the POAG group were open angles, characteristic visual field (VF) defects, and typical optic nerve head (ONH) appearance (cup-to-disc ratio (CDR)>0.8) in at least one eye as determined by a glaucoma specialist. Controls had no current or past intraocular pressure elevation, no significant ONH asymmetry, and CDR<0.5 in both eyes. Data collection included a full ophthalmic examination (including dilated stereoscopic ONH evaluation) and information regarding medical history, dental health, and alcohol and tobacco consumption. POAG severity of each case was assessed by the VF mean deviation of the worse eye.

**Results:** Cases and controls were similar in frequency of systemic disease (diabetes, hypertension, hypercholesterolemia) as well as alcohol and tobacco consumption (p>0.05, Fisher’s exact test), but cases were older than controls by ~6 years (p<0.01, t-test) and had a higher proportion of males (47% vs 31%, p<0.04, Fisher’s exact test). POAG cases had fewer teeth than controls (18 vs 22, p<0.01, t-test) and a higher frequency of edentulism (p<0.03, Fisher’s exact test). The relationship between group status and number of teeth persisted in multivariate regression analysis (p<0.03), adjusting for sex and age. The number of teeth did not correlate with disease severity. Gingivitis, periodontal disease, or both were similarly prevalent among cases and controls. Within the POAG group, signs of gingivitis and periodontal disease were more prevalent in patients with “mild-moderate” glaucoma than patients with severe disease (35% vs 12%, p<0.01 for gingivitis and 58% vs 36%, p=0.02 for periodontal disease, Fisher’s exact test).

**Conclusions:** Decreased number of teeth (a marker for periodontal disease and dental health) may be associated with POAG. The lack of association between disease severity and number of teeth as well as the negative correlation between periodontal disease and glaucoma severity argues against POAG causing poorer dental health. Dental health may affect glaucoma by leading to chronic inflammation in the oral cavity. Further investigation of the association between dental health and glaucoma is warranted.

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