A total of 24 Papers (n=3) and Posters (n=20) with Wills Eye Faculty and Trainees as primary presenters. A total of 17 Papers (n=9) and Posters (n=8) presented by collaborators at other institutions.

Summary of Papers and Posters with Wills Eye Faculty and Trainees as primary presenters

3 Paper Sessions: Primary Presenters Wills Eye Faculty and Trainees

Sessions:
Retina (n=2)
Low Vision (n=1)

Presenters:
Eric Shiuey - Medical student intern
Matthew Starr MD – Retina Clinical Fellow
Allen Chiang MD - Wills Eye Attending/Faculty

1 Members-in-Training Career Forum Presented by Wills Eye Faculty

Work Life Balance – Presenter: Julia Haller MD

1 Minisymposium Organized by Wills Eye Faculty

Epidemiology of diabetic retinopathy and age-related macular degeneration: Past, present and future — A tribute to Barbara and Ronald Klein (CL) – Co-Organizer: Leslie Hyman PhD

20 Poster Sessions: Primary Presenters Wills Eye Faculty and Trainees

Sessions:
Retina (n=6)
Glaucoma (n=4)
Anatomy and Pathology/Oncology (n=4)
Clinical/Epidemiologic Research (n=4)
Eye Movements/Strabismus/Amblyopia/Neuro-Ophthalmology (n=2)

Presenters:
Faculty (n=1)
Fellows (n=9)
Residents (n=5)
Medical Students (n=5)
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Members-in-Training Career Forum: Primary Presenter: Wills Eye Faculty

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<td>L A. Dalvin, Z Bas, S Tadepalli, R Rao, C L. Shields</td>
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<td>Contrast sensitivity as a home detection tool for diabetic patients</td>
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WILLS EYE 2020 ARVO ABSTRACTS

Paper Sessions

Primary Presenter: Wills Eye Faculty and Trainees
Abstract Number: 1935

Relationships Between Vision-Related Performance, Vision-Related Quality of Life, Clinical Findings, and Symptom Stage in Patients with Glaucoma

Track: Paper Session
Scientific Section: Low Vision - Evaluation of visual impairment using visual function questionnaires

Author Block: Eric J. Shiuey1, Benjamin E. Leiby2, Sheryl S. Wizov3, Carina Sanvicente4, Michael Waisbourd5, George Spaeth3

1Sidney Kimmel Medical College, Philadelphia, Pennsylvania, United States; 2Division of Biostatistics, Department of Pharmacology and Experimental Therapeutics, Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, Pennsylvania, United States; 3Glaucoma Research Center, Wills Eye Hospital, Philadelphia, Pennsylvania, United States; 4Emory Eye Center, Emory University, Atlanta, Georgia, United States; 5Department of Ophthalmology, Tel Aviv Sourasky Medical Center, affiliated to the Sackler Faculty of Medicine, Tel Aviv University, Israel

Purpose
To examine associations between clinical visual measurements, vision-related performance (VRP), and vision-related quality of life (VRQoL) in patients with glaucoma.

Methods
This 4-year, prospective cohort study recruited patients with moderate-stage glaucoma seen at the Wills Eye Hospital Glaucoma Service between May 2012 and May 2014. Patients received a complete ocular exam, automated visual field (VF) test, and spectral domain optical coherence tomographic scan. Contrast sensitivity was measured using the Pelli-Robson (PR) and Spaeth-Richman Contrast Sensitivity (SPARCS) tests. VRP was assessed with the Compressed Assessment of Ability Related to Vision (CAARV). VRQoL was assessed using the National Eye Institute Visual Function Questionnaire 25 (VFQ-25) and a modified Glaucoma Symptom Scale (MGSS). Patients were staged using the MGSS (symptomatic <85) and presenting clinical “warning signs” (intraocular pressure [IOP] >30 mmHg, IOP difference between eyes >5 mmHg, mean deviation [MD] < -5 dB, SPARCS score <70, retinal nerve fiber layer thickness [RNFLT] <70 μm). Mixed effects models were used to estimate rate of change of each variable over time for each subject and ordinal mixed effects logistic regression was used to assess associations between variables and stage.

Results
A total of 161 patients were enrolled. Annual change in CAARV variables were strongly correlated with change in bilateral visual acuity (VA) (r=0.71), SPARCS score in the better eye (r=0.61), and PR CS (r=0.47) (all p<0.0001). Change in RNFLT and VF MD did not correlate strongly with any VRP or VRQoL measures. Worse symptom stage was associated with worse VA in the better eye (odds ratio [OR]=1.26, 95% confidence interval [CI] 1.03-1.53, p=0.023), larger SPARCS score difference between eyes (OR=1.35, 95% CI 1.05-1.72, p=0.017), lower total CAARV score (OR=1.17, 95% CI=1.05-1.30, p=0.006), and lower VFQ-25 score (OR=3.23, 95% CI 2.46-4.24, p<0.001). Greater difference between eyes in RNFLT, MD, and logMAR did not significantly influence symptom stage.

Conclusions
In patients with glaucoma, performance-based tests correlate strongly with clinical variables, especially contrast sensitivity. VFQ-25, SPARCS, CAARV score, and logMAR were significant predictors of worse symptom stage. Contrast sensitivity, VRQoL, and VRP may be useful in evaluating patients with glaucoma.

Disclosure Block: Eric J. Shiuey, None; Benjamin E. Leiby, None; Sheryl S. Wizov, None; Carina Sanvicente, None; Michael Waisbourd, None; George Spaeth, 8,042,946 Code P (Patent)
Utility of internal limiting membrane peeling during rhegmatogenous retinal detachment surgery

Track: Paper Session
Scientific Section: Retina - Macular edema and retinal surface disorders

Author Block: Matthew Starr1, Luv Patel1, Michael J. Ammar1, Ed Ryan2, Jason Hsu1, Omesh Gupta1, Yoshihiro Yonekawa1

1Mid Atlantic Retina, Wills Eye Hospital, Philadelphia, Pennsylvania, United States; 2Vitreoretinal Surgery, Minneapolis, Minnesota, United States.

Purpose
Post-operative epiretinal membrane formation (ERM) and proliferative vitreoretinopathy (PVR) following rhegmatogenous retinal detachment (RRD) surgery severely limit visual acuity and can lead to additional surgical procedures. Peeling of the internal limiting membrane (ILM) at the time of RRD repair may play a role in preventing these complications.

Methods
This was a multi-institutional, retrospective review of all retinal detachment surgeries involving PPV from January 1, 2015 through December 31, 2015. Pre-operative and post-operative metrics were recorded. The primary outcomes considered were single surgery anatomic success, post-operative visual acuity, and the development of post-operative ERM formation between eyes with and without peeling of the ILM.

Results
There were 1287 eyes that met inclusion criteria, with 87 eyes (6.8%) undergoing concomitant ILM peeling at the time of RRD surgery. At the time of surgery, 36 eyes (55.4%) in the ILM peeling cohort were recommended to undergo ILM peeling at the time of surgery versus 65 eyes (8.6%) in the non-ILM peeling cohort (p < 0.0001). The mean pre-operative logMAR VA for all eyes was 1.14 ± 1.1 (Snellen VA 20/276) and the mean post-operative logMAR VA was 0.45 ± 0.57 (Snellen 20/56, p value <0.0001). The single surgery success rate for all eyes was 83.2%. Eyes without ILM peeling had a significant better final visual acuity (logMAR 0.44 ± 0.57, Snellen 20/55) versus those eyes with ILM peeling (logMAR 0.64 ± 0.66, Snellen 20/87, p 0.0096). On multivariate analysis accounting for pre-operative VA, pre-operative PVR, pre-operative macular hole status, and pre-operative macular attachment status there was no difference in post-operative visual acuity between eyes with and without ILM peeling (p = 0.2373). The single surgery success rate in the ILM peeling cohort was 86.2% versus 83% in the non-ILM peeling cohort (p = 0.5571). There were 25 eyes (29.1%) in the ILM peeling cohort with ERM formation post-operatively versus 450 eyes (35.7%) in the non-ILM peeling cohort (p = 0.1330).

Conclusions
ILM peeling at the time of RRD surgery may not eliminate post-operative ERM formation nor increase the single surgery success rate.

Disclosure Block: Matthew Starr, None; Luv Patel, None; Michael J. Ammar, None; Ed Ryan, None; Jason Hsu, None; Omesh Gupta, None; Yoshihiro Yonekawa, None.
Abstract Number: 4307

Assessment of Progression of Geographic Atrophy in the FILLY Study

Track: Paper Session
Scientific Section: Retina - Emerging AMD therapeutics

Author Block: Allen Chiang¹, David Lally²

¹Retina Service, Wills Eye Hospital, Lower Gwynedd, Pennsylvania, United States; ²New England Retina Consultants, Massachusetts, United States.

Purpose
To further assess progression of geographic atrophy (GA) by categories of change in GA in eyes receiving treatment with APL-2 or sham.

Methods
The FILLY trial was a Phase 2 multicenter, randomized, single-masked, sham-controlled clinical trial of APL-2 in patients with GA. Intravitreal injection of APL-2 was administered in the study eye monthly (M) or every other month (EOM) for 12 months. The primary efficacy endpoint was the change in square root GA lesion size from baseline to Month 12 compared to sham. Post hoc analysis was conducted to assess progression of GA (change in square root of GA lesion size from baseline) by quartiles in the overall dataset as well as by treatment groups. Only patients with observed data at Month 12 were included.

Results
Of 246 patients enrolled, 192 had efficacy endpoint observations at Month 12 and were included in this analysis. The overall mean change in GA lesion size was 1.46 (p<0.05), 1.63 (p=0.067), 2.19 mm² in the M (n=67), EOM (n=58) and sham (S) (n=67), respectively. The quartile distribution (change from baseline GA lesion size) for the overall patient population was as follows: Q1: <0.13, Q2: 0.13-<0.27, Q3: 0.27-<0.41, Q4: >0.41 mm. Proportion of patients in each treatment group by quartile were: Q1 (M: 27%; EOM: 35%; S: 15%); Q2 (M: 30%; EOM: 28%; S: 18%); Q3 (M: 24%; EOM: 17%; S: 33%); Q4 (M: 19%; EOM: 21%; S: 34%). When assessed by each treatment group, quartile distributions demonstrated a shift in the sham group compared to the APL-2 treatment arms (Q1: <0.12 for M, <0.11 for EOM and <0.21 mm for S; Q4: >0.37 for M, >0.36 for EOM and >0.47 mm for S).

Conclusions
Consistent with the overall results, the proportion of patients with relatively smaller change in lesion size was higher in the APL-2 treatment arms compared to the sham control group suggestive of APL-2 control over GA progression. This finding was further supported by accelerated progression of GA lesion size in the sham group compared to the APL-2 groups.

Disclosure Block: Allen Chiang, Apellis Code F (Financial Support), Apellis Code C (Consultant), Genentech Code F (Financial Support), Regeneron Code F (Financial Support), Recens Medical Code C (Consultant), Orbit Biomedical Code C (Consultant), David Lally, Apellis Code F (Financial Support), Apellis Code C (Consultant)
WILLS EYE 2020 ARVO ABSTRACTS

Members-in-Training Career Forum

Primary Presenter: Wills Eye Faculty
Members-in-Training Career Forum

Work Life Balance

Author Block: Julia Haller

Wills Eye Hospital, Philadelphia, Pennsylvania, United States.

Presentation Description:
I will discuss the challenges with work-life balance in clinical practice and research and will give suggestions to help manage the balance.

Disclosure Block: Julia Haller, None.
WILLS EYE 2020 ARVO ABSTRACTS

Minisymposia

Organized by Wills Eye Faculty
Minisymposia

Epidemiology of diabetic retinopathy and age-related macular degeneration: Past, present and future — A tribute to Barbara and Ronald Klein (CL)

Organizers: Ecosse Lamoureux and Leslie Hyman
Speakers: Barbara Klein, Lloyd Paul Aiello, Tien Wong, Caroline Klaver and Emily Chew

Over the past few decades, extraordinary progress has been made in understanding the epidemiology of diabetic retinopathy (DR) and age-related macular degeneration (AMD), with much of the groundwork laid by Professors Ronald and Barbara Klein. It is hard to think of another couple who have had a similar prolific and prodigious impact in Ophthalmology and vision research. Their combined work has yielded a rich array of extraordinarily important insights into the epidemiology of these two ocular pathologies. They established groundbreaking cohort studies, such as the Wisconsin Epidemiology Study of Diabetic Retinopathy (WESDR) and Beaver Dam Eye Study (BDES) and have been at the forefront of new advances in Ophthalmology and vision research, including imaging, genetics and disentangling gene-environment interactions. The world is facing an unprecedented age shift, and this “silver tsunami” has grave consequences for current and future approaches for clinical ophthalmic epidemiology for DR and AMD, notwithstanding the potential, but uncertain, roles of new retinal treatments, gene therapy, big data, and artificial intelligence. This mini-symposium brings together a platform of highly esteemed retinal epidemiologists and clinician-scientists who have trained or collaborated with the Kleins and will share how the couple’s body of work has shaped our understanding about these two ocular pathologies. They will discuss past achievements, current challenges, and future research in risk, diagnosis, treatment, and management of DR and AMD, while celebrating this unique opportunity to acknowledge our collective gratitude to Ronald and Barbara Klein for their extraordinary contribution to clinical ocular epidemiology and ophthalmic research.
WILLS EYE 2020 ARVO ABSTRACTS

Poster Sessions

Primary Presenter: Wills Eye Faculty and Trainees
Long-Term Outcomes of Subconjunctival Gel Stent with and without Concomitant Cataract Surgery

Abstract Number: 947 - B0029

Track: Poster
Scientific Section: Glaucoma - Surgery and wound healing I

Author Block: Saami Zakaria, Christopher Ahmed, Nikki Angela Mehran, Sapna Sinha, Reza Razeghinejad, Jonathan S. Myers, Marlene R. Moster, Daniel Lee, Natasha Kolomeyer

1Wills Eye Hospital, Philadelphia, Pennsylvania, United States.

Purpose
We performed a retrospective, observational clinical study to evaluate the one-year outcomes of the subconjunctival gel microstent (XEN45, Allergan) in glaucoma patients with and without combined cataract surgery.

Methods
Retrospective analysis of patients that received a XEN45 implant for medically uncontrolled glaucoma at a tertiary care center between January 2017-December 2018 was conducted. Demographics, intraocular pressure (IOP), anti-glaucoma medications (AGM), needling, and subsequent glaucoma surgeries were noted. Success was defined as IOP reduction > 20% from baseline and IOP < 18 mm Hg with (qualified success) or without (complete success) glaucoma medication. Subjects receiving additional surgery besides needling/revisions at any point prior to examination intervals were censored, counted as failures, and noted as having subsequent surgeries. Patients with/without combined cataract surgery at the time of stent implantation were also compared.

Results
162 eyes met inclusion criteria (mean age 74, 59% female, 73% white). Mean preop IOP was 24.3 mm Hg (95% CI, 23.0, 25.6). Mean change in IOP was -9.0 (-7.4, -10.7), and -8.4 (-6.8, -9.9), at 6, and 12 months (m, p< .0001 for all). Mean AGM was 3.0 (2.9, 3.2) at baseline and 1.2 (1.0, 1.5) at 12m follow up (p<.0001). 44 (27%) eyes required needling. 33 (20%) eyes required subsequent glaucoma surgery within 12m (15% repeat XEN implants, 39% trabeculectomies, 46% tube shunts). 53% and 31% of eyes met criteria for qualified and complete success at 12m. Patients that had combined cataract surgery (N=31) had less IOP reduction (15%) than pseudophakic (N=68) and phakic patients (N=63) (39% and 38%, respectively, p=.001).

Conclusions
This study highlights significant IOP and medication reductions with gel stent implantation. 20% of patients required a subsequent glaucoma surgery, beyond needling or revision, within a 12-month period. Concomitant cataract surgery was associated with less IOP reduction. These findings warrant further study.

Disclosure Block: Saami Zakaria, None; Christopher Ahmed, None; Nikki Angela Mehran, None; Sapna Sinha, None; Reza Razeghinejad, None; Jonathan S. Myers, Aerie Code C (Consultant), Allergan Code C (Consultant), Glaukos Code C (Consultant), MicroOptx Code C (Consultant), Allergan Code F (Financial Support), Glaukos Code F (Financial Support), Aerie Code R (Recipient), Allergan Code R (Recipient), Marlene R. Moster, None; Daniel Lee, Allergan Code C (Consultant), Allergan Code F (Financial Support), Natasha Kolomeyer, Spouse - Allergan Code C (Consultant)
Abstract Number: 1302 - B0347

Ocular Tolerability of Intravitreal Defibrotide Sodium Injections in Brown Norway Rats

Track: Poster
Scientific Section: Retina - Imaging of retinal vascular disease

Author Block: Rebecca Russ Soares¹, Jason Hsu¹

¹Wills Eye Hospital, Philadelphia, Pennsylvania, United States.

Purpose
Currently, no treatment for lysing the thrombus in central retinal vein occlusion (CRVO) has been proven to be effective. The pleotropic effects of defibrotide sodium on clot lysis and inflammation make it a candidate for treatment of ischemic CRVO. The purpose of this study was to evaluate the tolerability of defibrotide delivered by intravitreal injection (IVI) at various concentrations in Brown Norway (BN) rats.

Methods
Five BNs assigned to one of four groups (balanced salt solution [BSS] or defibrotide 20 mg/ml, 50 mg/ml, or 80 mg/ml) received a single 5ml IVI of test article to the right eye. BNs then underwent ocular exams, optical coherence tomography (OCT), fundus imaging (clinical signs scored from 0 [none]-4 [severe]), and electroretinography (ERG) at baseline, Day 2 and Day 7. Animals were euthanized at Day 7, and eyes fixed and H&E stained. Data were analyzed with ANOVA or t-test with Dunnett’s post-test.

Results
Ocular exams showed no significant difference in clinical scores between groups or right vs. left eye at Day 7 for hyperemia (p=0.0627) or chemosis p=0.42. Fundus exam showed similar mild venous tortuosity in all right eyes on Day 2 which resolved by Day 7. OCT showed mild vitritis in the BSS, 20 mg/ml, and 50 mg/ml but not the 80mg/ml group. At Day 7 the 80mg/mL concentration group had a mean clinical score of 0 for vitritis, significantly lower than the mean clinical score of 0.3± 0.1 for the BSS group (p= 0.03). ERG showed systematic reduction in dark- and light-adapted amplitudes in both eyes for all groups. Both eyes in the 20mg/ml defibrotide group had a significant pairwise reduction in b-wave amplitudes at maximum light intensity from Day 0 to 7 (p=0.03, p=0.002). Untreated left eyes in this group had a significantly greater mean reduction (-350.0±72.7mV) compared to right eyes (-248.8±93.5mV, p=0.02). Histologic sections taken at Day 7 showed no structural or cellular changes.

Conclusions
No significant durable adverse effects of IVI defibrotide at any concentration on clinical exam, OCT, or histology was found. Venous tortuosity was transient in nature in all eyes receiving IVI, including BSS control, possibly related to the volume of injection and increase in intraocular pressure. Systematic reduction in ERG wave amplitudes was possibly random or a result of stress [JH1] [RS2] from IVI. Additional testing is needed, as nonsignificant comparisons may be underpowered.

Disclosure Block: Rebecca Russ Soares, Jazz Pharmaceuticals Code F (Financial Support), Jason Hsu, None
Clinical Outcomes of Neovascular Glaucoma Treated with Intravitreal Anti-Vascular Endothelial Growth Factor Injection

Track: Poster
Scientific Section: Retina - Imaging of retinal vascular disease

Author Block: Erik Mark Massenzio1,2, David Xu1, Turner David Wibbelsman1, Anthony Obeid1, Jason Hsu1

1Retina Service, Wills Eye Hospital, Philadelphia, Pennsylvania, United States; 2Sidney Kimmel Medical College, Philadelphia, Pennsylvania, United States.

Purpose
To determine the patient characteristics that predict worse clinical outcomes in the setting of neovascular glaucoma (NVG) secondary to proliferative diabetic retinopathy (PDR), central retinal vein occlusion (CRVO), central retinal artery occlusion (CRAO), or ocular ischemic syndrome (OIS) treated with intravitreal anti-VEGF injections.

Methods
The study is a retrospective case series of patients with NVG treated with intravitreal bevacizumab or ranibizumab. Markers predicting progression of NVG were assessed. The main outcome variables were worsening of visual acuity (VA) at 3 months from time of diagnosis and uncontrolled intraocular pressure (IOP) requiring glaucoma surgery. Patients were excluded due to prior panretinal photocoagulation, vitrectomy, or glaucoma surgery. All statistical analyses were conducted using SPSS, Version 26 (SPSS, Inc., Chicago, IL, USA). Multivariate model generated using forward stepwise variable selection method of logistic regression.

Results
At the time of diagnosis, none of the 31 eyes of 31 patients had received glaucoma surgery in the affected eye, and median VA was count fingers (CF). Of the 31 cases, causes of NVG were 12 from CRVO (39%), 8 from CRAO (26%), 8 from PDR (26%), 2 from both CRVO and PDR (6%), and 1 from ocular ischemic syndrome (3%). Multivariate analysis revealed that HM vision or worse at time of diagnosis (p=0.043) and female sex (p=0.027) were independent factors for receiving glaucoma surgery in the affected eye (OR: 10.64 and 12.82, respectively.) Age <65, greater than 4 prescription glaucoma drops per day, and IOP > 30 were not significant predictors. No factors were significant predictors for worsening VA at 3 months.

Conclusions
Worse baseline VA and female gender were correlated with an increased risk of requiring glaucoma surgery in the setting of NVG treated with intravitreal anti-VEGF agents. However, worse VA at 3 months was not correlated with age, number of glaucoma drops per day, increased IOP, gender, or VA at time of diagnosis.

Disclosure Block: Erik Mark Massenzio, None; David Xu, None; Turner David Wibbelsman, None; Anthony Obeid, None; Jason Hsu, Roche/Genentech Code F (Financial Support), Santen Code F (Financial Support), Ophthotech Code F (Financial Support), Orbit Biomedical Inc Code C (Consultant)
Factors associated with risk of retinal surgery cancellation

Track: Poster
Scientific Section: Clinical/Epidemiological Research - Healthcare delivery and economic research I

Author Block: Luv Patel¹, Michael J. Ammar¹, Matthew Starr¹, Louis Cai¹, Allen C. Ho¹

¹Retina Service, Wills Eye Hospital, Philadelphia, Pennsylvania, United States.

Purpose
Retinal surgery cancellation is an adverse event that represents a delay in care to the patient, while also imposing a significant cost of resources on the provider and healthcare system. This study is a retrospective, analysis of the factors impacting retinal surgery cancellation.

Methods
A retrospective analysis of 3306 consecutive cases over 10 months of scheduled surgeries of a multi-provider, multi-location retina practice. A surgery was identified as cancelled if it had been scheduled with the surgical center and not performed. Zip code of home address was associated with median household income through the American Community Survey 2017 database. A cohort of consecutively selected 200 cancelled surgeries was identified along with a cohort of consecutively selected 400 kept surgeries for multivariate analysis. Gender and race were self-reported from review of medical records. Urgency of surgery and diabetes status were identified from chart review.

Results
The overall rate of surgery cancellation was 5.99%. Among patients residing in low-income zip codes (<$50000 median income), the rate increased to 10.15%, whilst among patients residing in high-income zip codes (> $100000 median income), the rate was decreased to 3.98%. The relative risk of cancellation was 2.55 greater in the low-income group compared to the high-income group (P < 0.0001). Multivariate analysis of the cohort demonstrated a significantly greater adjusted odds ratio of cancellation amongst patients with diabetes (2.89, P<0.0001), identifying as nonwhite (2.33, P<0.0001), residing in zip codes with incomes lower than US median (1.20, P = 0.004), and requiring surgery deemed non-acute (3.13, P = 0.039). Gender and age did not significantly alter the risk of surgery cancellation.

Conclusions
Socioeconomic status and race are demographic factors that significantly impact the likelihood of surgery cancellation, while diabetes was a significant medical factor. Identification of these factors provides insight into disparities in access to care, enumerating barriers to care faced by our patients.

Disclosure Block: Luv Patel, None; Michael J. Ammar, None; Matthew Starr, None; Louis Cai, None; Allen C. Ho, None.
Weather Patterns Associated with ‘No-Shows’ and Cancellations in Glaucoma Clinic

**Track:** Poster  
**Scientific Section:** Clinical/Epidemiologic Research - Healthcare delivery and economic research I

**Author Block:** Nikki Angela Mehran, Israel Ojalvo, Qiang Zhang, Jonathan S. Myers, Reza Razeghinejad, Natasha Kolomeyer, Daniel Lee

1Glaucoma, Wills Eye Hospital, Philadelphia, Pennsylvania, United States.

**Purpose**  
Patient non-adherence to follow-up appointments has been associated with more severe glaucomatous defects. Identifying weather-related factors that are associated with ‘no-shows’ and cancellations could result in considerable administrative insight and assist in designing interventions to avoid negative patient consequences.

**Methods**  
A retrospective review of appointment records from June 1, 2017 - May 31, 2019 was performed at an urban tertiary eye hospital. 36810 visits from 7383 patients were included in this study. Data collection included clinic type (resident vs. attending), patient age, gender, insurance, distance, and appointment type. Visits were divided into 3 groups based on appointment status: kept (64.6%), cancelled (23.5%), and no-show (11.8%); statistical correction was performed for repeat visits by the same patient. Daily Weather Records and Storm Events database were analyzed from the National Centers for Environmental Information website and included: average(avg), minimum(min), maximum(max) temperature (T in °F), avg precipitation (in), avg snowfall (in), avg wind speed (mph), and presence/type of storm event.

**Results**  
Age and gender were statistically different between patients who kept their appointments versus those who cancelled or were ‘no-shows’ (p < 0.0001, Kruskal-Wallis and Fischer Exact test). Using multivariable logistic regression the following factors were (positively or negatively) associated with likelihood of patient ‘no-show’: avg snowfall [OR 1.27 (95% CI: 1.17, 1.37)]; presence of a storm event [OR 1.41 (1.31, 1.51)]; avgT [OR 0.93 (0.90, 0.96)]; minT [OR 1.02 (1.01, 1.03)]; maxT [OR 1.04 (1.03, 1.06)]; and avg windspeed [OR 0.98 (0.97, 0.99)]. Using multivariable logistic regression the following factors were associated with likelihood of patient cancellation: avg snowfall [OR 1.37 (1.29, 1.45)]; avgT [OR 1.02 (1.01, 1.03)]; maxT [OR 0.99 (0.98, 0.99)]; and presence of a storm event [OR 1.12 (1.03, 1.21)].

**Conclusions**  
Patient age, gender and daily weather (temperature, snowfall, wind speed, and storm events) were significantly associated with rates of patient cancellations and ‘no-shows’ in glaucoma clinic. Understanding these variables will help plan for weather-related schedule adjustments and suggests weather is an under-analyzed factor in patient follow-up rates that warrants further investigation.

**Disclosure Block:** Nikki Angela Mehran, None; Israel Ojalvo, None; Qiang Zhang, None; Jonathan S. Myers, None; Reza Razeghinejad, None; Natasha Kolomeyer, None; Daniel Lee, None;
Abstract Number: 2637 - B0045

Characteristics of fellow eye conversion to neovascular age-related macular degeneration in patients with unilateral neovascular disease

Track: Poster
Scientific Section: Retina - AMD clinical research I

Author Block: David Xu, Matthew R. Starr, Luv Patel, Michael J. Ammar, Nick Boucher, Namrata Saroj, Allen C. Ho

1Wills Eye Hospital/Mid Atlantic Retina, Philadelphia, Pennsylvania, United States; 2Vestrum Health, Ottawa, Ontario, Canada; 3All Eyes Consulting LLC, New York, New York, United States.

Purpose
The fellow eye of patients with unilateral neovascular age-related macular degeneration (nAMD) treated with intravitreal anti-vascular endothelial growth factor (VEGF) injections may undergo conversion to nAMD. Assessing the incidence of conversion in a real-world setting can yield clinically relevant insights.

Methods
We retrospectively analyzed longitudinal, aggregated electronic health records from multiple retinal centers across the United States (Vestrum Health Retina Database). Patients were included with unilateral nAMD treated with anti-VEGF therapy between January 1, 2013 and August 31, 2019. All patients had at least 3 years of follow up after initiating treatment in the first eye. The frequency of fellow eye conversion within a 3-year window after onset of nAMD in the first eye was calculated. Visual acuity (VA) and central retinal thickness (CRT) at time of development of nAMD was recorded for both eyes when data was available.

Results
A total of 42,674 patients with unilateral nAMD who had received their first anti-VEGF treatment between January 1, 2013 and August 31, 2016 were included. Fellow eyes of 18,899 (44%) patients converted to nAMD during the study period. Among these, 6,098 (14%), 4,378 (10%) and 3,572 (8%) patients converted in years 1, 2 and 3 respectively after diagnosis in the first eye. The median time to conversion in the second eye was 655 days. Mean VA at time of diagnosis of nAMD in the first eye (n=10,491) was 51.8 ETDRS letters (~20/100) and 57.2 ETDRS letters (~20/80) in the fellow eye (p<0.0001). At 12 months, mean VA was 52.6 ETDRS letters (~20/100) in the first eye and 57.5 ETDRS letters (~20/80) in the second eye (p<0.0001). The breakdown of VA is provided in Table 1. CRT at time of diagnosis (n=2,806) in the first eye was 326 microns versus 312 microns in the fellow eye (p<0.0001).

Conclusions
Patients with unilateral nAMD have significant rates of conversion of the fellow eye. The fellow eye should be monitored at regular intervals to detect signs of neovascularization. Fellow eyes presented with significantly better vision at diagnosis than the initial eye and maintained better VA at 12 months.

Disclosure Block: David Xu, None; Matthew R. Starr, None; Luv Patel, None; Michael J. Ammar, None; Nick Boucher, Vestrum Health Code E (Employment), Namrata Saroj, Regeneron Pharmaceuticals Code E (Employment), Allen C. Ho, Allergan Code C (Consultant), Alcon Code C (Consultant), Genentech Code C (Consultant), Allergan Code F (Financial Support), Alcon Code F (Financial Support), Genentech Code F (Financial Support), Iconic Code F (Financial Support)
Comparison of Primary Intra-arterial Chemotherapy for Retinoblastoma Based on Exophytic versus Endophytic Growth Pattern

Track: Poster
Scientific Section: Anatomy and Pathology/Oncology - Retinoblastoma

Author Block: Wan Thamolwan Surakiatchanukul¹,², Stavropoula I. Tjoumakaris³, Pascal M. Jabbour³, Carol L. Shields²

¹Department of Ophthalmology, Jamaica Hospital Medical Center - New York Medical College, Jamaica, New York, United States; ²Ocular Oncology, Wills Eye Hospital, Thomas Jefferson University, Philadelphia, Pennsylvania, United States; ³Department of Neurological Surgery, Thomas Jefferson University Hospital, Philadelphia, Pennsylvania, United States.

Purpose
To compare outcomes of primary intra-arterial chemotherapy (IAC) for exophytic vs. endophytic retinoblastoma

Methods
Retrospective chart review of 82 eyes of 82 consecutive patients with retinoblastoma treated with IAC

Results
Of the 82 eyes, the tumor was primarily exophytic (n=51, 62%) or endophytic (n=31, 38%). A comparison (exophytic vs. endophytic retinoblastoma) revealed exophytic with younger mean patient age at first IAC (18 vs. 31 months, p=0.02) but with similar mean initial largest tumor diameter (19 vs. 18 mm, p=0.47) and similar mean initial tumor thickness (10 vs. 10 mm, p=0.33). There was no difference with regards to the International Classification of Retinoblastoma ([Group A] 0% vs. 0%, [B] 6% vs. 0%, [C] 10% vs. 0%, [D] 47% vs. 68%, and [E] 37% vs. 32%; p=0.09) and mean number of IAC sessions (3 vs. 3 sessions, p=0.96). Outcomes at mean follow-up (32 vs. 26 months, p=0.22) revealed successful globe salvage (73% vs. 68%, p=0.64), only 1 case of metastasis in the exophytic group (2% vs. 0%, p=0.43), and no death in either group. There was no difference in mean tumor diameter reduction (40% vs. 40%, p=0.98), mean tumor thickness reduction (48% vs. 39%, p=0.67), solid tumor recurrence (10% vs. 13%, p=0.66), and associated retinal detachment (10% vs. 26%, p=0.05). The exophytic group demonstrated less vitreous seed recurrence (12% vs. 39%, p<0.01), yet greater subretinal seed recurrence (45% vs. 23%, p=0.04).

Conclusions
A comparison of exophytic vs. endophytic retinoblastoma treated with IAC revealed similar tumor control with globe and life salvage, but greater recurrence of vitreous seeds (endophytic group) and subretinal seeds (exophytic group).

Disclosure Block: Wan Thamolwan Surakiatchanukul, None; Stavropoula I. Tjoumakaris, None; Pascal M. Jabbour, None; Carol L. Shields, None.
Characteristics of Clinical Studies Evaluating Off-Label Indications for Novel FDA-Approved Therapeutics in Ophthalmology

Track: Poster
Scientific Section: Clinical/Epidemiologic Research - Healthcare delivery and economic research II

Author Block: Anand Gopal1, Joshua Wallach2, Saloni Shah3, Carl Regillo1, Joseph Ross2

1Department of Ophthalmology, Wills Eye Hospital, Philadelphia, Pennsylvania, United States; 2Department of Internal Medicine, Yale University School of Medicine, New Haven, Connecticut, United States; 3Sidney Kimmel Medical College at Thomas Jefferson University, Philadelphia, Pennsylvania, United States.

Purpose
Little is understood about how novel therapeutics garner evidence for off-label (i.e., non-FDA approved) use in ophthalmology. While the US Food and Drug Administration (FDA) prohibits off-label promotion, industry may sponsor and distribute peer-reviewed studies supporting off-label indications, regardless of the studies’ rigor. We characterized and compared clinical studies of FDA-approved and off-label indications for novel therapeutics in ophthalmology and assessed differences between industry and non-industry funded studies of off-label use.

Methods
We performed a retrospective analysis of prospective clinical studies, registered on ClinicalTrials.gov or PubMed-indexed through December 2018, of novel therapeutics approved by FDA for an ophthalmologic indication between 2008 and 2012. We characterized the proportion of studies evaluating original FDA-approved indication, supplemental FDA-approved indications, and off-label indications, stratified by therapeutic and study characteristics. We used Chi-squared testing to assess differences with a corrected Type I error of 0.006.

Results
There were 7 novel therapeutics approved by FDA for an ophthalmologic indication between 2008 and 2012; we identified 469 unique prospective clinical studies of these therapies. Over half (256; 54.6%) assessed the original FDA-approved indication, while 24.3% (114) assessed off-label indications. 67.0% (314) were for a single therapeutic (aflibercept) (Figure). Median number of off-label indications studied was 4 (IQR, 0-12; range 0-27). Median number of studies evaluating an off-label indication was 1 (IQR, 1-2; range 1-19). Compared to FDA-approved indication studies, off-label indication studies were smaller (p<0.0001) and less frequently used an active comparator (44.4% vs 68.1%; p=0.002). Industry-funded off-label studies did not differ statistically from non-industry funded off-label studies but tended to be larger and more rigorously designed (Table).

Conclusions
For most therapies, few studies of any indication are conducted after FDA approval. Most off-label indications are infrequently studied. Understanding the rigor of these studies is important when considering adopting approved therapies for new uses.

Disclosure Block: Anand Gopal, None; Joshua Wallach, None; Saloni Shah, None; Carl Regillo, Allergan Code C (Consultant), Kodiak Code C (Consultant), Genentech/Roche Code C (Consultant), Novartis Code C (Consultant), Allergan Code F (Financial Support), Kodiak Code F (Financial Support), Genentech/Roche Code F (Financial Support), Novartis Code F (Financial Support), Regeneron Code F (Financial Support), Joseph Ross, Medtronic Code F (Financial Support), U.S. Food and Drug Administration Code F (Financial Support), Centers of Medicare and Medicaid Services Code F (Financial Support), Blue Cross Blue Shield Association Code F (Financial Support), Johnson and Johnson Code F (Financial Support), Agency for Healthcare Research and Quality Code F (Financial Support), Medical Device Innovation Consortium Code F (Financial Support), National Heart, Lung and Blood Institute of the National Institutes of Health Code F (Financial Support), Laura and John Arnold Foundation Code F (Financial Support)
Effectiveness of a Phone Call System On Mitigating Lost-To-Follow-Up In Patients Receiving Anti-VEGF therapy.

Track: Poster
Scientific Section: Clinical/Epidemiologic Research - Healthcare delivery and economic research II

Author Block: Michael J. Ammar¹, Anthony Obeid¹, Luv Patel¹, Matthew Starr¹, Jason Hsu¹

¹Wills Eye Hospital/ Mid Atlantic Retina, Philadelphia, Pennsylvania, United States.

Purpose
Few studies have evaluated the efficacy of interventions in reducing noncompliance with follow-up post treatment. A follow-up phone call (FUPC) system was implemented to track and contact patients after each injection visit if noncompliance was detected. Our study evaluates the effectiveness of this system on mitigating lost-to-follow-up (LTFU) after the first treatment visit.

Methods
Patients who had their first injection in 2016-2019 for either neovascular age related macular degeneration (nAMD), diabetic retinopathy (DR), or retinal vein occlusion (RVO) were included in the analysis. Noncompliant visits were defined as a first injection visit with no immediate subsequent follow-up visit within 12 weeks. The follow-up phone call (FUPC) system was implemented on 9.18.18 and consisted of a full-time patient retention specialist who evaluated compliance for each injection visit and reached out to patients via phone call for those who missed their recommended follow-up date. Categorical comparisons were made using a chi-square test. Statistical significance was defined as P<0.05.

Results
14049 first injections visits were eligible for analysis. Mean age (SD) was 71.3 (±14.1) years. Prior to the introduction of the FUPC, 951 out of 11351 (8.4%) of the first injection visits did not have compliant follow-up vs 198 out of 2698 (7.3%) (p=0.08). There was no significant increase in the number of noncompliant first injection visits pre and post FUPC in patients with nAMD (5.7% vs 6.4%, p = 0.36) and RVO (8.3% vs 5.9%, p=0.06). There was a significant reduction in noncompliant first injection visits pre vs post introduction of FUPC system in patients with DR (11.2% vs 9.0%, p=0.03).

Conclusions
The FUPC system may have a meaningful impact on compliance with follow-up after the first injection, particularly in diabetic retinopathy. However, further study will be required to determine its effectiveness on long-term follow-up.

Disclosure Block: Michael J. Ammar, None; Anthony Obeid, None; Luv Patel, None; Matthew Starr, None; Jason Hsu, None.
Outcomes of Subconjunctival Gel Microstent Implantation: Age and Gender Analysis

Track: Poster
Scientific Section: Glaucoma - Surgery and wound healing II

Author Block: Christopher W. Ahmed1,2, Saami Zakaria1,2, Nikki Angela Mehran2, Sapna Sinha2, Reza Razeghinejad2, Jonathan S. Myers2, Marlene R. Moster2, Daniel Lee2, Natasha Kolomeyer2

1Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, Pennsylvania, United States; 2Wills Eye Hospital, Philadelphia, Pennsylvania, United States;

Purpose
We performed a retrospective, observational clinical study to evaluate the effect of patient demographics (age, gender) on surgical outcomes of subconjunctival gelatin stent (XEN45) in glaucoma patients.

Methods
Retrospective analysis of patients who received a XEN45 implant for medically uncontrolled glaucoma at a tertiary care center between January 2017-December 2018 was conducted. Demographic data, intraocular pressure (IOP), anti-glaucoma medications (AGM), needling, and subsequent non-needling glaucoma surgeries were noted for each patient. Outcomes were examined at 6 and 12 months (m) postoperatively. Success was defined as having no subsequent glaucoma surgery, IOP < 18 and IOP reduction of >20% from pre-op, with (qualified success) or without (complete success) anti-glaucoma medications (AGM). Advanced patient age was defined as >84 years.

Results
162 eyes met inclusion criteria (mean age 74, 59% female, 17% >84 years). Qualified/complete success was 53%/31% at 12m using the stringent success criteria. 27% and 20% required needling or subsequent glaucoma surgery, respectively. Mean IOP was 24.3 ± 8.2 at baseline and 15.9 ± 4.3 at 12m. Mean number of AGM was 3.0 ± 1.1 at baseline, and 1.2 ± 1.4 at 12m. Lower rates of subsequent surgery (14% vs. 22%) and needling (14% vs. 30%) were observed for patients aged >84, but this was not statistically significant. Men had a greater rate of subsequent surgery (29% vs. 15%, p=0.029). We did not identify significant differences in IOP reduction or success by gender or age cohort.

Conclusions
Demographics assessed were not associated with surgical outcomes, with the exception of gender. Males had a higher rate of additional surgery. Needling/additional surgery rates were lower in the advanced age group, although not statistically significant. Further research is warranted to better understand the effect of demographics on XEN outcomes.

Disclosure Block: Christopher W. Ahmed, None; Saami Zakaria, None; Nikki Angela Mehran, None; Sapna Sinha, None; Reza Razeghinejad, None; Jonathan S. Myers, Allergan Code C (Consultant), Aerie Pharmaceuticals Code C (Consultant), Glaukos Code C (Consultant), MicroOptx Code C (Consultant), Allergan Code F (Financial Support), Glaukos Code F (Financial Support), Aerie Code R (Recipient), Allergan Code R (Recipient), Marlene R. Moster, None; Daniel Lee, Allergan Code C (Consultant), Allergan Code F (Financial Support), Natasha Kolomeyer, Allergan Code C (Consultant)
**Abstract Number:** 3710 - A0348

**Anatomic and visual outcomes of primary retinal detachment in younger adults: a report from the multicenter Primary Retinal Detachment Outcomes (PRO) Study**

**Track:** Poster  
**Scientific Section:** Retina - Vitreoretinal surgery - DR and novel approaches

**Author Block:** Louis Cai, Michael J. Ammar, Ed Ryan, Jay Wang, Claire Ryan, Connie M. Wu, Matthew Starr, Luv Patel, Antonio Capone, Dean Elliott, Geoffrey Emerson, Daniel Joseph, Omesh Gupta, Carl Regillo, Yoshihiro Yonekawa

1Wills Eye Hospital, Philadelphia, Pennsylvania, United States; 2Massachusetts Eye and Ear, Massachusetts, United States; 3VitreoRetinal Surgery, Minnesota, United States; 4Associated Retinal Consultants, Michigan, United States; 5The Retina Center, Minneapolis, Minnesota, United States; 6The Retina Institute, Minneapolis, Minnesota, United States;

**Purpose**
This study aimed to compare surgical outcomes of scleral buckle (SB), pars plana vitrectomy (PPV), and combined scleral buckle and vitrectomy (SB/PPV) for primary retinal detachments (RD) in younger adults (ages 20-45). The primary outcomes examined were single surgery success (SSS) and good visual acuity.

**Methods**
The Primary Retinal Detachment Outcome study is a multicenter, interventional, cohort study of all non-complex retinal detachment surgeries from January 1, 2015 through December 31, 2016. Frequency tables were used to compare demographic, pre-surgical, surgical, and post-surgical variables. The primary outcomes evaluated in this study were single surgery success (retinal attachment with at least 90 day follow up without subsequent surgery for RD) and achievement of good final visual acuity (VA > 20/50). ANOVA and multiple regression analysis were used to examine differences among the surgical modalities and their relationship to the primary outcomes. Statistical tests were performed in R (R Development Core Team, Vienna, Austria) and MedCalc (MedCalc Software, Ostend, Belgium).

**Results**
263 patients aged 20-45 were identified in the cohort who either had SB (n = 129), PPV (n = 54), or SB/PPV (n = 80). SB/PPV had the highest single surgery success rate (mean 83.8%), compared to SB (72.1%) and PPV (64.8%), but there was not a statistically significant difference among the groups (P = 0.135). In contrast, there was a significant difference (P = 0.001) in the percentage of patients who achieved final visual acuity > 20/50 with SB (76.0%), PPV (59.3%), and SB/PPV (52.5%). Multiple regression analysis showed that pre-surgical BCVA and final cataract grade provided the best model to predict final BCVA. Pre-surgical BCVA was worse in eyes with SB/PPV (mean LogMar Snellen 0.97) and PPV (0.80) compared to SB (0.41). Similarly, final cataract grade was different (P = <0.0001) among the surgical modalities with PPV (mean cataract grade 1.4) and SB/PPV (1.3) having higher grade cataracts compared to SB (0.3).

**Conclusions**
SB and SB/PPV had higher SSS compared to PPV in this young cohort, however this finding was not statistically significant. SB had the best final VA outcomes. Pre-operative visual acuity and final cataract grade were independently associated with visual outcomes.

**Disclosure Block:** Louis Cai, None; Michael J. Ammar, None; Ed Ryan, None; Jay Wang, None; Claire Ryan, None; Connie M. Wu, None; Matthew Starr, None; Luv Patel, None; Antonio Capone, None; Dean Elliott, None; Geoffrey Emerson, None; Daniel Joseph, None; Omesh Gupta, None; Carl Regillo, None; Yoshihiro Yonekawa, None;
Variability of Optical Coherence Tomography Measurements of Vertical Cup-to-Disc Ratio, Retinal Nerve Fiber Layer, and Ganglion Cell Layer in Glaucoma

Track: Poster
Scientific Section: Glaucoma - Clinical imaging I

Author Block: Sasha (Jing) Jia1,2, Jonathan S. Myers3, Daniel Lee4, Reza Razeghinejad5, Natasha Kolomeyer1, Aakriti Garg Shukla1

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Purpose
Measurement of optic nerve and ganglion cell layer (GCL) features by optical coherence tomography (OCT) can fluctuate, limiting our ability to detect true disease progression. This retrospective clinical study aims to test whether features such as thickness of the retinal nerve fiber layer (RNFL), vertical cup-to-disc ratio (VCDR), rim area, and more can lead to variability in their own measurements on OCT.

Methods
Data was collected from consecutive patients seen at a tertiary care academic glaucoma practice from 6/2011 – 11/2019 who had >3 spectral domain OCTs (Carl Zeiss Meditec; Dublin, CA) in right eyes. Scans with signal strength (SS) <3 were excluded. The main outcome was measurement variability on OCT of optic nerve and GCL features, which was defined as the width of the 95% confidence interval (WCI) of measurements. A linear regression model was used to test for a relationship between eye features and variability of their own measurements on OCT.

Results
506 OCTs of 100 patients (100 right eyes) were included. Demographics and mean OCT measurements are included in the Table. Increased RNFL, VCDR, and GCL measurements are associated with narrower WCI (P=0.02, P<0.01, P<0.01), suggesting that greater RNFL, VCDR, and GCL values are associated with less variability in their own measurements. Conversely, increased mean cup volume is associated with wider WCI (P<0.01). Disc size, rim area, and SS did not have a detectable relationship with variability of their measurements (P=0.60, P=0.41, P=0.48, respectively), nor did analysis of disc size by tertile [small (<1.6 mm²), medium (1.6-2.2 mm²), and large (>2.2 mm²)] (P=0.35, P=0.94, P=0.98, respectively).

Conclusions
RNFL and GCL are more variable at lower values. VCDR as measured by OCT is less variable at higher values, which has potential use in tracking disease progression in later stages of glaucoma. A multivariate analysis will further elucidate relationships between these variables.

Disclosure Block: Sasha (Jing) Jia, None; Jonathan S. Myers, Allergan Code C (Consultant), Glaukos Code C (Consultant), MicroOptx Code C (Consultant), Allergan Code F (Financial Support), Glaukos Code F (Financial Support), Allergan Code R (Recipient), Daniel Lee, None; Reza Razeghinejad, None; Natasha Kolomeyer, None; Aakriti Garg Shukla, None;
Ischemic Optic Neuropathy Secondary to Central Retinal Artery (CRA) Embolism

Track: Poster
Scientific Section: Eye - The optic nerve head morphological spectrum: Pallor and Swelling

Author Block: Archana Srinivasan¹, Mark L. Moster¹, Adam Debusk¹, Robert C. Sergott¹

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Purpose
To describe cases of embolic ischemic optic neuropathy (ION) detected by Orbital Color Doppler Imaging (OCDI).

Methods
The study design is retrospective patient chart review and analysis. A computerized search was performed to identify all patients with ION seen at the Neuro-ophthalmology Service, Wills Eye Hospital, Philadelphia between 2010 and present. It is our practice to perform OCDI in patients with ION with atypical features including absence of disc edema in the affected eye or ‘disc at risk” in the contralateral eye. We identified 38 patients who underwent OCDI and reviewed their clinical records.

Results
Twelve patients had positive finding of embolus on CDI. The average age was 69.3 years (median 70, range 44-92). All patients presented with sudden onset, unilateral vision loss except for one patient who had sudden realization of a preexisting visual loss. There was prior history of transient vision loss in the same eye (17%) and nonarteritic anterior ischemic optic neuropathy (NAION) in the contralateral eye (8%). Optic disc edema typical for NAION was noted at presentation (83%), but only one patient had disc at risk in the contralateral eye. Five patients were evaluated for giant cell arteritis prior to OCDI and had negative temporal artery biopsies. OCDI revealed retrobulbar embolus in the central retinal artery (CRA) (92%) and embolus anterior to the optic disc (8%). All patients were referred for stroke work up following diagnosis. Atrial fibrillation was detected in one patient, requiring long term anticoagulation.

Conclusions
Contrary to conventional wisdom, we have found CRA embolus in patients with IONs. OCDI is an important imaging modality that can help detect embolus in the retrobulbar course of the artery. The detection of embolus should be followed by evaluation of the embolic source to reduce the risk of subsequent hemispheric stroke.

Disclosure Block: Archana Srinivasan, None; Mark L. Moster, None; Adam Debusk, None; Robert C. Sergott, None.
Effect of Adjuvant Topical Dorzolamide-Timolol versus Placebo in Neovascular Age-Related Macular Degeneration: A Randomized Clinical Trial

Track: Poster
Scientific Section: Retina - AMD anti-VEGF

Author Block: Samir N. Patel¹, Jason Hsu¹, Jermy Wolfe², Chirag Shah³, Eric Chen⁴, Thomas Jenkins¹, Turner David Wibbelsman¹, Anthony Obeid¹, Mikel Mikhail², Sunir Garg¹, Allen C. Ho¹, Allen Chiang¹, Marc Spirin¹, James F. Vander¹

¹Wills Eye Hospital, Philadelphia, Pennsylvania, United States; ²Associated Retinal Consultants at William Beaumont Hospital, Royal Oak, Michigan, United States; ³Ophthalmic Consultants of Boston, Boston, Massachusetts, United States; ⁴Retina Consultants of Houston, Houston, Texas, United States.

Purpose
To compare the effect of topical dorzolamide-timolol versus placebo in eyes with neovascular age-related macular degeneration (nAMD) that are suboptimal responders to intravitreal anti-VEGF injections.

Methods
This prospective, multicenter randomized clinical trial enrolled patients with nAMD and persistent macular edema despite frequent fixed-interval intravitreal anti-VEGF therapy. Sixty-two patients with nAMD who had persistent exudation despite intravitreal anti-VEGF injections at 4-, 5-, or 6-week intervals were screened for eligibility. Patients were randomized to use dorzolamide-timolol or artificial tears twice daily for the study duration. After enrollment, they received the same anti-VEGF drug at the same interval as the 2 visits before enrollment for three additional study visits. The primary outcome measure was change in mean central subfield thickness (CST) on optical coherence tomography (OCT) from baseline to final visit. Secondary measures included change in mean maximum subretinal fluid (SRF) height, mean maximum pigment epithelial detachment (PED) height, and mean VA from baseline to final visit.

Results
Fifty patients completed the study with 27 in the dorzolamide-timolol group. Mean age was 78.4 years (range, 65–94) with 20.5 mean injections (range, 4–58) prior to enrollment. At enrollment, there were no differences between the dorzolamide-timolol and control groups in baseline demographic or OCT parameters (Table 1). Comparing the dorzolamide-timolol to the placebo group from baseline to final visit, mean (standard error) change in CST was -36.6 (11) μm vs. +1.7 (11) μm (P=0.023); maximum PED height was -31.5 (11) μm vs. +1.1 (4) μm (P=0.001); maximum SRF height was -49.4 (11) μm vs. -22.2 (12) μm (P=0.039); and logMAR VA was 0.031 (0.03) vs. 0.018 (0.03) (P=0.658) (Figure 1).

Conclusions
Topical dorzolamide-timolol in eyes with nAMD that have persistent exudation despite frequent anti-VEGF injections resulted in anatomic improvements on OCT compared to placebo. No significant change in visual acuity was detected.

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Factors Associated with Cancellations and ‘No-Shows’ in Glaucoma Patients

Track: Poster
Scientific Section: Glaucoma - Clinical studies

Author Block: Israel Ojalvo1,2, Nikki Angela Mehran1, Qiang Zhang1, Jonathan S. Myers1, Reza Razeghinejad1, Daniel Lee1, Natasha Kolomeyer1

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Purpose
Glaucoma is often an insidious disease, prone to decreased patient adherence to appointments as well as treatments. Nonadherence to appointments has been associated with severe glaucomatous defects. This retrospective study aims to identify factors associated with appointment cancellations and ‘no shows’ in a glaucoma clinic.

Methods
A retrospective review of appointment records from a glaucoma clinic in an urban tertiary eye care hospital from June 1, 2017 – May 31, 2019 was performed, resulting in 36,810 visits from 7383 individual patients. The visits were divided into three groups based on appointment status: kept (64.6%), cancelled (23.5%), and no-show (11.8%). Data collection included clinic type (resident vs. private), patient age, gender, insurance, and appointment type. Patient distance from the clinic was calculated as miles from patient’s zip code to the clinic using a Bing Maps Application Programming Interface which utilized the fastest route.

Results
Univariate analysis found a statistically significant difference in various factors including age, gender, and travel distance amongst patients based on appointment status (kept, cancelled or no-show; Kruskall-Wallis, Fishers exact test, Wilcoxon rank sum). Patients closer to the clinic (< 15 miles) had a higher rate of ‘no show’ but a lower rate of cancellations compared to those who travelled farther (p< 0.0001, logistic regression). Using multivariable logistic regression the following factors were (positively or negatively) associated with patient ‘no-show’: resident clinic [OR 1.79 (95% CI: 1.67, 1.98)], appointment type [OR 0.79 (95% CI: 0.67, 0.91)], male gender [OR 1.12 (95% CI: 1.05,1.19)], and age [OR 0.99 (95% CI: 0.98, 0.99)]. A multivariable logistic regression was also used to calculate factors associated (positively or negatively) with patient cancellations: female gender [OR 1.16 (95% CI: 1.10, 1.23)]; appointment type [OR 0.62 (95% CI: 0.41, 0.94)]; and travel distance [OR 0.89 (95% CI: 0.84, 0.94)].

Conclusions
Travel distance, gender, age, appointment type, and clinic type (resident vs. private) were found to be significant factors influencing rates of patient cancellations and/or no-shows in glaucoma clinic. It is important to understand these risk factors to be able to anticipate and design interventions to improve appointment adherence.

Disclosure Block: Israel Ojalvo, None; Nikki Angela Mehran, None; Qiang Zhang, None; Jonathan S. Myers, None; Reza Razeghinejad, None; Daniel Lee, None; Natasha Kolomeyer, None;
Conjunctival Melanoma: Features and Outcomes based on the Fitzpatrick Skin Type in 540 patients at a Single Ocular Oncology Center

Track: Poster
Scientific Section: Anatomy and Pathology/Oncology - Ocular surface, eye lid and orbital tumors

Author Block: Antonio Yaghy¹, Sarangdev Vaidya¹, Richard Pacheco¹, Lauren A. Dalvin², Sara E. Lally¹, Jerry A. Shields¹, Carol L. Shields¹

¹Wills Eye Hospital, Philadelphia, Pennsylvania, United States; ²Ophthalmology, Ocular Oncology, Mayo Clinic, Rochester, Minnesota, United States.

Purpose
Fitzpatrick skin type (FST) is an important determinant of risk for cutaneous melanoma. We conducted this study to determine the association of FST with conjunctival melanoma.

Methods
We performed a retrospective case series of conjunctival melanoma from April 18, 1974 to September 9, 2019 at a single ocular oncology center. Patients were classified according to FST classification (Types I-VI) based on external facial photograph at initial presentation. Patients were excluded if there was lack of external facial photograph as FST could not be judged.

Results
The FST was Type I (n=126, 23%), II (n=337, 62%), III (n=56, 10%), IV (n=8, 2%), V (n=12, 2%), and VI (n=1, <1%). A comparison (FST I vs. II vs. III, IV, V, and VI) revealed Types I and II associated with older mean patient age (63.9 vs. 60.7 vs. 51.1 years, \(p<0.001\)), greater percentage of female patients (68% vs. 44% vs. 42%, \(p<0.001\)), lower frequency of complexion associated melanosis (1% vs. 2% vs. 13%, \(p<0.001\)), smaller tumor thickness (2.1 vs. 2.8 vs. 3.6 mm, \(p=0.01\)), and less eyelid involvement (13% vs. 13% vs. 28%, \(p=0.02\)). Kaplan-Meier estimates for 5-year risk showed no difference by FST for visual acuity loss \(\geq 3\) lines, local tumor recurrence, exenteration, metastasis, or death.

Conclusions
Most patients with conjunctival melanoma show FST I or II, and this demonstrated no association with 5-year rate of vision loss, tumor recurrence, exenteration, metastasis, or death.

Disclosure Block: Antonio Yaghy, None; Sarangdev Vaidya, None; Richard Pacheco, None; Lauren A. Dalvin, None; Sara E. Lally, None; Jerry A. Shields, None; Carol L. Shields, None;
Conjunctival Melanoma: Features and Outcomes Based on Tumor Origin in 629 Patients at a Single Ocular Oncology Center

Abstract Number: 4665 - A0007

Conjunctival Melanoma: Features and Outcomes Based on Tumor Origin in 629 Patients at a Single Ocular Oncology Center

Track: Poster
Scientific Section: Anatomy and Pathology/Oncology - Ocular surface, eye lid and orbital tumors

Author Block: Richard Pacheco¹, Sarangdev Vaidya¹, Antonio Yaghy¹, Lauren A. Dalvin²,¹, Sara E. Lally¹, Jerry A. Shields¹, Carol L. Shields¹

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Purpose
Conjunctival melanoma is a life-threatening malignancy that can arise from primary acquired melanosis (PAM), a pre-existing nevus, or de novo. We performed a retrospective chart review to investigate clinical features and outcomes of conjunctival melanoma classified by tumor origin.

Methods
Patients diagnosed with histopathologically-confirmed conjunctival melanoma at a single oncology center between April 1974 and September 2019 were included. Patient charts were reviewed for demographic features, clinical features, treatment modalities and outcomes. Kaplan-Meier analysis was performed to determine cumulative probability of all outcomes.

Results
There were 629 patients with conjunctival melanoma that arose either from PAM (n=476, 76%), from preexisting nevus (n=59, 9%), or de novo (n=94, 15%). Mean patient age at presentation was 60 years (median 63, range 3-95 years). A comparison (PAM vs. nevus vs. de novo) revealed patients with tumors arising from PAM to be older (62 vs. 52 vs. 55 years, \( p<0.001 \)), have worse visual acuity at presentation (20/30 vs 20/25 vs. 20/25, \( p=0.03 \)), more clock hour involvement (5 vs. 4 vs. 3, \( p<0.001 \)), worse visual acuity at date last seen (20/50 vs. 20/40 vs. 20/40, \( p=0.02 \)), and greater frequency of visual acuity loss of three or more lines (25% vs. 15% vs. 10%, \( p=0.02 \)). Patients with tumors arising from nevus had lower frequency of fornix (31% vs. 9 % vs. 24%, \( p=0.02 \)) and tarsal involvement (29% vs. 9% vs. 26%, \( p=0.046 \)), as well as more tumors classified as AJCC category T1 (60% vs 89% vs 62%, \( p=0.01 \)). Kaplan-Meier estimates for 5-year risk showed no difference by tumor origin for visual acuity loss ≥3 lines, local tumor recurrence, exenteration, metastasis, or death.

Conclusions
Conjunctival melanoma most often arose from PAM, and tumor origin did not affect clinical outcomes.

Disclosure Block: Richard Pacheco, None; Sarangdev Vaidya, None; Antonio Yaghy, None; Lauren A. Dalvin, None; Sara E. Lally, None; Jerry A. Shields, None; Carol L. Shields, None.
Conjunctival Melanoma: Risk Factors for Recurrence or New Tumor in 540 Patients at a Single Ocular Oncology Center

Track: Poster
Scientific Section: Anatomy and Pathology/Oncology - Ocular surface, eye lid and orbital tumors

Author Block: Sarangdev Vaidya¹, Richard Pacheco¹, Antonio Yaghy¹, Lauren A. Dalvin²,¹, Sara E. Lally¹, Jerry A. Shields¹, Carol L. Shields¹

¹Ocular Oncology, Wills Eye Hospital, Edison, New Jersey, United States; ²Ocular Oncology Service, Mayo Clinic, Rochester, Minnesota, United States.

Purpose
To identify factors predictive of tumor recurrence in patients with conjunctival melanoma.

Methods
We performed a retrospective review of patients diagnosed with conjunctival melanoma at a single center from April 1974 to September 2019. Recurrence was defined as presence of new tumor at the site of previous melanoma or any other site in the conjunctiva, adnexa, or orbit. Demographic and clinical features of patients with recurrence were compared to those without recurrence using the Mann-Whitney U test and chi-square test. Binomial logistic regression was used to identify factors predictive of tumor recurrence.

Results
There were 540 patients with conjunctival melanoma, of which 180 (33%) had recurrence. A comparison (no recurrence vs. recurrence) revealed those with recurrence presented with older mean patient age (64.0 vs. 59.2 years, \( p=0.01 \)), greater frequency of prior conjunctival surgery (71% vs. 79%, \( p=0.03 \)), worse mean logMAR visual acuity (0.15 vs. 0.22, \( p=0.01 \)), greater frequency of corneal involvement (57% vs. 45%, \( p=0.03 \)), and fornicial involvement (24% vs. 38%, \( p=0.004 \)), tarsal (23% vs 34%, \( p=0.02 \)), and eyelid (12% vs. 19%, \( p=0.04 \)) involvement. Of those with recurrence, mean time to recurrence after date of presentation was 34.3 months (median 19.0, range 0.1-215.4 years). On regression analysis, factors predictive of recurrence included older patient age (\( p=0.04 \)), history of prior conjunctival surgery (\( p=0.01 \)), and fornicial involvement (\( p=0.02 \)). The risk of recurrence increased by 1% (OR=1.01) per 1-year increase in patient age, 86% (OR=1.86) with history of prior conjunctival surgery, and 77% (OR=1.77) with fornicial involvement.

Conclusions
Factors predictive of conjunctival melanoma recurrence include increasing age, history of prior conjunctival surgery, and fornicial involvement.

Disclosure Block: Sarangdev Vaidya, None; Richard Pacheco, None; Antonio Yaghy, None; Lauren A. Dalvin, None; Sara E. Lally, None; Jerry A. Shields, None; Carol L. Shields, None;
Visual outcomes in Eyes Lost to Follow Up with Diabetic Macular Edema treated with Anti-Vascular Endothelial Growth Factor

Track: Poster
Scientific Section: Retina - Diabetic macular edema: clinical research

Author Block: Douglas Matsunaga¹, Connie M. Wu¹, Anthony Obeid¹, Turner David Wibbelsman¹, Jason Hsu¹

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Purpose
Large clinical trials have established anti-VEGF as the first-line therapy for diabetic macular edema (DME), however these outcomes were established in the setting of strict adherence to trial protocols while real world studies have found loss to follow up to be a common treatment challenge. We sought to evaluate the visual and anatomic outcomes of DME patients treated with anti-VEGF who were lost to follow up (LTFU) during their treatment course.

Methods
Retrospective consecutive case series including 57 eyes of 43 DME patients who were LTFU for at least six months. Baseline patient characteristics, anti-VEGF treatment history, history of focal laser, visual acuity, and OCT measurements were obtained prior to LTFU, at first return date, 3 months after return, 6 months after return, 12 months after return, and final visit on record. Statistical analysis comparing continuous variables were made using a generalized estimating equation to account for intercorrelation between 2 eyes from the same patient.

Results
The mean age was 63.4 years with 28.1% having a history of focal laser. The average LTFU time was 373 days, and the average follow up time after return from LTFU was 354 days. There was a significant worsening in the mean logMAR VA (SD) at the return visit [0.55 (0.42), Snellen ~20/71] (p<0.001), the 12-month after return visit [0.44 (0.28), Snellen ~20/55] (p=0.007), and the final visit [0.49 (0.35), Snellen ~20/62] (p=0.009) when compared to the visit before LTFU [0.41 (0.27), Snellen ~20/51]. There was a significant increase in the mean CFT (SD) at the return visit [323 mm (171)] (p=0.02) when compared to the visit before LTFU [279 mm (118)]. There was no significant increase in the mean CFT at the final visit [294 mm (149)] (p=0.47) compared to before LTFU.

Conclusions
DME patients had a significant worsening in visual acuity and CFT after LTFU. After restarting anti-VEGF therapy, CFT was found to improve to statistically similar levels as prior to LTFU. However, while visual acuity was found to improve it did not attain levels seen prior to LTFU. These findings suggest that prolonged treatment breaks lead to reduced long term visual potential independent of macular edema and reinforces the importance of treatment adherence in DME.

Disclosure Block: Douglas Matsunaga, None; Connie M. Wu, None; Anthony Obeid, None; Turner David Wibbelsman, None; Jason Hsu, None.
Prevalence and Associated Factors for Thyroid Eye Disease (TED) in the AAO IRIS® Registry

**Track:** Poster  
**Scientific Section:** Eye - Unique cohorts: Epidemiology, quality of life and performance outcomes

**Author Block:** Leslie Hyman¹,³, Robert Penne¹,³, Danielle Fujino², Deepak Ramesh¹,³, Qiang Zhang¹,³, Scott Kelly², Flora Lum², Sukhminder Singh²

¹Wills Eye Hospital, Philadelphia, Pennsylvania, United States; ²American Academy of Ophthalmology, California, United States; ³Ophthalmology, Thomas Jefferson University, Pennsylvania, United States.

**Purpose**

Thyroid eye disease (TED) studies, to date, have focused on select populations. The AAO IRIS® Registry allows estimates of TED prevalence and associated factors in a large population of ophthalmology patients in the United States.

**Methods**

Individuals in the IRIS Registry (2013-2018) ≥18 years of age were included. TED was identified by ICD (ICD-9: 242.00, ICD-10: E05.00). Prevalence was estimated overall, by age (categorically), sex, ethnicity (Asian [A], White [W], Black [B], Hispanic [H], Other[O]), geographic region (Midwest[MW], Northeast[NE], South[S], West[W]), and smoking status (never, former, current). Prevalence rate differences were compared using χ² tests. Adjusted odds ratios (OR) and 95% Confidence Intervals (CIs) were estimated using multivariable logistic regression.

**Results**

82,663 cases of TED were identified. Overall prevalence was 0.16% (16/100,000), and varied by age (p<0.0001): lowest rates for ages ≤35 years (y) (0.11%), highest for ages 35-59 y (0.23%), with consistent prevalence within 5-year groupings, decreasing to 0.13% in persons > 60y. Prevalence was higher in females (0.22%) vs males (0.07%) (p<0.0001), varied by ethnicity (p=0.0001) (lowest in H [0.10%], highest in AA [0.23%]), intermediate rates for A[0.14%], W[0.18%] and O[0.16%] and by geographic region (highest in the MW (0.19%) vs other regions (0.14-0.15%) (p<0.0001). Prevalence was higher in current smokers (0.26%) vs former (0.19%) or never smokers (0.15%) (p<0.0001). In a multivariable model examining associations between TED and the above factors as covariates, age (18-35y (reference), 36-60y: OR (95% CI) 1.9 (1.9, 2.0), >60y: 1.0 (1.0,1.1), female sex: 3.2 (3.2,3.3), ethnicity: W (ref), B: 1.2 (1.2,1.3), H: 0.5 (0.5,0.6), A: 0.8 (0.8,0.9), O: 0.9 (0.83, 0.96), smoking status (never (ref), former: 1.48 (1.4,1.5), current 1.77: (1.7,1.8)) and geographic region (S (ref), MW: 1.3 (1.3,1.4), NE: 1.1(1.1, 1.1), W: 1.1 (1.1, 1.2)) were significantly associated with TED.

**Conclusions**

This is the first study to provide data on TED prevalence and associated factors from a large national clinical population. Associations with female sex and current smoking are consistent with prior reports. The consistent higher prevalence across ages 35 – 59 years vs older/younger age groups, higher prevalence in AAs, and geographic variation are new observations that offer insights for further investigation.

**Disclosure Block:** Leslie Hyman, None; Robert Penne, None; Danielle Fujino, None; Deepak Ramesh, None; Qiang Zhang, None; Scott Kelly, None; Flora Lum, None; Sukhminder Singh, None.

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Abstract Number: 5425 - B0349
WILLS EYE 2020 ARVO ABSTRACTS

Paper Sessions

Primary Presenter: Collaborators from other Institutions
Results of a phase 1b/2 trial of intravitreal (IVT) sepofarsen (QR-110) antisense oligonucleotide in Leber congenital amaurosis 10 (LCA10) due to p. Cys998X mutation in the CEP290 gene

Track: Paper Session
Scientific Section: Retina - Gene therapy and stem cells


Purpose
LCA10 is a severe, degenerative inherited retinal disease resulting in childhood blindness, which has no treatment. The most common causative mutation is p.Cys998X in the CEP290 gene. Safety, pharmacokinetics (PK), and efficacy of sepofarsen, an RNA antisense oligonucleotide, in subjects with LCA10 were evaluated.

Methods
In a 12-month, multicenter, open-label, multiple-dose escalation, phase 1b/2 study (NCT03140969), subjects (N=11) aged 8–44 years received sepofarsen at loading/maintenance dose of 160/80 µg (n=6) or 320/160 µg (n=5) via 1–4 IVT injections in the eye with worse best corrected visual acuity (BCVA). Primary endpoint: frequency and severity of ocular adverse events (AEs) in the treated (TE) and untreated contralateral (CE) eyes. Secondary endpoints included serum PK, non-ocular AEs, and change in functional and anatomic ophthalmic findings.

Results
There were 8 cases of cataract; 6 needed surgery. In the 320/160 µg group, 2 cases of mild cystoid macular edema (successfully treated) and 2 cases of subclinical retinal thinning occurred. No events led to subject withdrawal. Serum levels of sepofarsen were below the level of quantification for all subjects. Pooled dose group data showed significant improvement in TE from baseline (BL) to M12 vs CE in mean BCVA (-0.55 [standard error of the mean 0.26] vs -0.12 [0.07] logMAR; p<0.05), red full-field stimulus threshold (FST; -0.91 [0.18] vs -0.16 [0.16] log cd/m²; p<0.01), and blue FST (-0.79 [0.23] vs 0.02 [0.11] log cd/m²; p<0.02). The 160/80 µg dose group showed significant improvement in TE at M12 vs BL in mean BCVA (-0.93 [0.43] logMAR vs BL; p<0.01), red FST (-0.66 [0.14] log cd/m² vs BL; p<0.01), and blue FST (-0.63 [0.31] log cd/m² vs BL; p<0.01) and CE (+2.7 [1.11] levels vs BL; p<0.05). P-values are based on a mixed model repeated measurement analysis over all visits.

Conclusions
Although sepofarsen treatment is associated with cataract development, it is well tolerated and shows improvement in BCVA, FST, and mobility course. The 160/80 µg dose has a more favorable benefit:risk profile than 320/160 µg. The phase 2/3 trial is ongoing.
Abstract Number: 1158

Disease Activity Assessments with Brolucizumab vs Aflibercept in Patients with nAMD in HAWK and HARRIER

Track: Paper Session
Scientific Section: Retina – AMD Clinical Trials

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Purpose
To compare the presence of disease activity (DA) over 96 weeks in HAWK and HARRIER, two Phase III, prospective trials that assessed the efficacy and safety of brolucizumab (Bro) vs aflibercept (Afl) in treatment-naïve patients with nAMD.

Methods
Patients were randomized 1:1:1 to Bro 3mg (n=358), 6mg (n=360) or Afl 2mg (n=360) in HAWK, or 1:1 to Bro 6mg (n=370) or Afl 2mg (n=369) in HARRIER. After 3 monthly loading doses, Bro patients received 12-week (q12w) dosing unless DA was present (as identified by masked investigator) at any predefined disease activity assessment (DAA) visit and resulted in permanent 8-week (q8w) dosing; Afl was dosed at fixed q8w. DAA occurred at Weeks 16, 20, 32, 44, 56, 68, 80, 92 with additional DAA at Weeks 28, 40, 52, 64, 76, and 88 in HARRIER only. All patients continued with planned DAA until the study end based on DAA guidance described in the study protocol, where ultimately the masked investigator took the final treatment decision based on their clinical judgment. The first DAA at Week 16 allowed for head-to-head comparison between treatment arms for q8w dosing need.

Results
At Week 16, DA presence and therefore q8w dosing need was statistically significantly lower with Bro vs Afl in both HAWK (Bro 3mg=28.1%; Bro 6mg=24.0% vs Afl=34.5%; p<0.03 for both) and HARRIER (Bro 6mg=22.7% vs Afl=32.2%; p=0.002). DA presence was higher with Afl vs Bro (HAWK/HARRIER: Afl=22.2% / 19.6% vs Bro 3mg=14.9% / 0%; Bro 6mg=13.6% / 15.7%) across all DAA from Week 16 through 96. Further, qualitative analysis of all DAA in HAWK/HARRIER showed that across all treatment arms (given the masked investigator assessment), in 71.4% / 67.7% of the cases anatomical signs of DA were present either alone (35.8% / 41.9%) or in combination with function (35.6% / 25.8%).

Conclusions
Together, the functional and anatomical DA evaluations in HAWK and HARRIER indicate that nAMD patients treated with Bro 6mg q12w/q8w have lower risk of DA occurrence than Afl and thereby better disease control.

De-condensed structure of post-replicative chromatin is essential for cell reprogramming in fibrotic disease

Purpose
The epigenetic mechanisms that underlie reprogramming to a myofibroblast cell type that induces the lens fibrotic disease, Posterior Capsule Opacification (PCO) are not understood. Here, we examined if the structure of nascent chromatin is important during progenitor cell reprogramming to a myofibroblast cell fate, and if it is possible to manipulate the state of condensation of nascent chromatin in order to prevent reprogramming to a fibrotic phenotype.

Methods
An ex-vivo mock cataract surgery PCO model was used to study cell reprogramming to an αSMA+ myofibroblast fate, which is observed by 72hr post-injury. The fibrotic phenotype was examined by immunofluorescence, western blot and/or RT-PCR analysis. The chromatin assembly assay (CAA) was used to study how chromatin structure is re-established shortly after replication during the time of cell reprogramming. To manipulate nascent chromatin state to block the fibrotic outcome, the function of the ubiquitously transcribed tetratricopeptide repeat X chromosome (UTX) H3K27me3 demethylase was inhibited in both the ex-vivo surgery and pediatric human lens explant models.

Results
CAA revealed a delay in the accumulation of H3K27me3 on nascent DNA in 28hr post-injury, while accumulation of this modified histone was rapid in 48hr after injury. Since H3K27me3 marks the most condensed structure of chromatin in the genome, this signifies a de-condensed state of nascent chromatin during progenitor cell reprogramming into myofibroblasts. This de-condensed state of nascent chromatin may be attributed to an accumulation of UTX on nascent DNA. Thus, UTX may be essential to create a ‘window of opportunity’ for binding of Myocardin-Related Transcription Factor-A (MRTF-A) to nascent DNA, a TF known to induce αSMA expression. Indeed, binding of MRTF-A occurred prior to the induction of αSMA mRNA expression at 48hr post-injury. Pharmacological inhibition of UTX activity induces accumulation of H3K27me3 to nascent DNA, leading to condensation of nascent chromatin, which prevents MRTF-A recruitment to DNA. Blocking UTX function prevents the emergence of αSMA+ myofibroblasts in both the ex-vivo mock cataract surgery model and human pediatric lens explants.

Conclusions
Pharmacological inhibition of UTX activity may provide an effective strategy to manipulate nascent chromatin structure leading to a block in fibrotic transcriptional reprogramming.
Lens resident immune cells: mediators of sterile injury and immediate responders to cataract surgery wounding

Track: Paper Session
Scientific Section: Lens - Posterior capsule opacification (PCO)

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Purpose
The goal of these studies is to determine if the avascular lens contains resident immune cells and to investigate the potential response of lens resident immune cells to sterile injury caused by cataract surgery wounding.

Methods
To identify lens resident immune cells, uninjured mouse and chicken whole eye cryostat sections as well as human pediatric cataract surgery lens tissue were labeled for immune cell markers (CD45, β2 integrin or Major Histocompatibility Complex (MHC)II). To determine the response of lens resident immune cells to sterile injury, ex vivo mock cataract surgery cultures were prepared from isolated chick lenses and labeled for immune cell markers and vimentin following injury. All samples were analyzed by high resolution confocal imaging and 3D structural images were created by Imaris software using z-stack confocal images to reveal the spatial organization of resident immune cells within the lens tissue.

Results
3D structural images revealed that CD45+ resident immune cells were nestled among the lens equatorial epithelium in the E18.5 mouse lens. Professional antigen presenting resident immune cells expressing MHCII were found interdigitated among the lens equatorial epithelium of E15 chick lenses, which have the potential to engage an adaptive immune response. 3D structural views of the ex vivo lens mock cataract surgery model also showed MHCII+ resident immune cells with extended dendritic tails inserted between the lens epithelial cells. In response to sterile injury induced by cataract surgery, vimentin enriched CD45+ resident immune cells with an activated morphology appeared to be emerging from niches located among the lens epithelium. Similarly, in human lens tissue CD45+ resident immune cells were observed extending dendritic-like processes between the lens epithelial cells. Furthermore, in response to mock cataract surgery vimentin-rich CD45, β2 and MHCII positive resident immune cells migrated and populated the wounded edge of the ex vivo cultures where they can mediate the repair response to sterile injury.

Conclusions
These studies provide the first evidence that resident immune cells are a shared feature of lens tissue where they are poised to be the first responders to injury/pathogenesis as well as the initiators of an adaptive immune response to maintain lens tissue homeostasis.

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A Phase 1b/2 Open-label Clinical Trial to Evaluate the Safety and Efficacy of AU-011 for the Treatment of Choroidal Melanoma

Track: Paper Session
Scientific Section: Anatomy and Pathology/Oncology - Uveal Melanoma

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Purpose
Choroidal melanoma (CM) is the most common primary ocular malignancy. Most small CMs are treated with radiotherapy which is associated with several adverse effects including vision loss. The safety and efficacy of AU-011, a novel targeted investigational therapy for the treatment of CM, is being evaluated in an open-label, multi-center, dose escalation and expansion trial.

Methods
Subjects with a clinical diagnosis of CM with tumor thickness 1.2 - 3.4 mm and largest basal diameter ≤ 16 mm received intravitreal administration of a viral-like particle bioconjugate (AU-011) at doses of 20 µg, 40 µg, or 80 µg followed by light-activation with a 689 nm laser at a fluence of 50 J/cm². Regimens consisting of 1, 2 or 3 weekly treatments with AU-011 each followed by 1 or 2 laser applications have been evaluated in 8 escalation cohorts and 1st expansion. Enrollment is ongoing in the 2nd expansion with subjects receiving two cycles of three weekly treatments with 80 µg /2 laser administrations separated by 12 weeks.

Results
50 subjects have been treated in the trial. Interim results show local tumor control in 33/50 (66%) subjects (23/29 [79%] at therapeutic dose) and maintenance of visual acuity in 46/50 (92%) subjects (27/29 [93%] at therapeutic dose) with up to 24 months follow up. Linear regression was used to estimate tumor growth rates using tumor thickness measurements before and after treatment in subjects with historical documented growth (n=19). Tumor control was seen in 15/19 subjects and the post-treatment growth rate was significantly reduced compared to their historical growth rate (p=0.0056; paired t-test). There has been one treatment-related SAE of severe vision loss. Expected AEs related to treatment including intraocular inflammation and increased IOP were clinically manageable.

Conclusions
Interim results from this ongoing trial show preliminary safety and efficacy of AU-011. The therapy was well tolerated with maintenance of vision and tumor control in majority of subjects. AU-011 may offer an alternative to radiotherapy for treating small melanomas and high-risk indeterminate lesions and further studies are planned to confirm the safety and efficacy.
Disclosure Block: Prithvi Mruthyunjaya, Aura Biosciences Code C (Consultant), Castle Biosciences Code C (Consultant), Amy C. Schefler, Aura Biosciences Code C (Consultant), Ivana K. Kim, None; Christopher Bergstrom, None; Hakan Demirci, None; Tony Tsai, None; Abdhis R. Bhavsar, None; Antonio Capone, None; Brian Marr, Aura Biosciences Code C (Consultant), Tara A. McCannel, None; Cameron Javid, None; Peter G. Hovland, None; Michael I. Seider, None; Cadmus Rich, Aura Biosciences Code E (Employment), Carol L. Shields, Aura Biosciences Code C (Consultant)
Abstract Number: 4047

Inter-Eye Symmetries of Visual Field Defects in Glaucoma

Track: Paper Session
Scientific Section: Glaucoma - Visual fields, psychophysics, and electrophysiology

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Purpose
To study the inter-eye symmetries of visual field (VF) defects through artificial intelligence.

Methods
From a multi-centered dataset, we selected the most recent reliable 24-2 Humphrey VF pairs from both eyes tested on the same date with mean deviation (MD) ≥ -12 dB. VF defects were quantified by decomposing VFs into 16 archetype (AT) patterns consisting of 1 normal (AT 1) and 15 defect patterns (ATs 2 to 16), as detailed in our prior work (Fig. 1a). Coefficients describing the contribution of each VF AT to the overall VF pattern were correlated between worse and better eyes as defined by MD. The presence of VF defects (AT coefficients > 10%) in the better eye was modeled from the AT coefficients of the worse eye by logistic regression. The optimal models selected by stepwise regression were evaluated by the area under the receiver operating characteristic curve (AUC). We specifically provide model details for inter-eye prediction of the most common type of glaucomatous central vision loss: superior paracentral loss (AT14).

Results
64,447 pairs of VFs from 64,447 patients (61.0 ± 16.6 years) were selected. The MDs for the worse and better eyes (r = 0.77, p < 0.001) were -3.4 ± 3.2 dB and -1.6 ± 2.3 dB, respectively. The inter-eye correlations of AT coefficients ranged from -0.34 to 0.70 (Fig. 1b), with strongest correlations either with the same or normal VF pattern. The AUCs predicting the presence of 15 VF defects in the better eye based on ATs of the worse eye ranged from 0.69 (AT 3, superonasal step) to 0.92 (AT 6, near total loss). Fig. 2a shows that AT 14’s presence in the better eye can be predicted by 9 AT features in the worse eye (AUC = 0.89): AT 7 (central scotoma), AT 8 (superior altitudinal defect), AT 14 (superior paracentral loss), AT 15 (nasal hemianopia) and AT 16 (inferior paracentral loss) from the worse eye were positively correlated with AT 14 in the better eye, while AT 1 (normal VF), AT 2 (superior peripheral defect), AT 4 (temporal wedge) and AT 11 (concentric peripheral defect) showed negative correlations. Fig. 2b shows an example of high likelihood of AT 14 in the better eye predicted by the worse eye for every reliable VF pair in a 3 VF series. While the first and last VFs of the better eye have 14.1% and 10.4% AT 14, the defect (1.0% AT 14) was missed in the second VF.

Conclusions
VF ATs from the patient’s worse eye can be used to predict and therefore confirm a VF defect in the better eye.
Disclosure Block: Bettina Teng, None; Dian Li, Adaptive Sensory Technology Code R (Recipient), Lucy Shen, Topcon Code C (Consultant), Research Funding Code F (Financial Support), Louis R. Pasquale, Eyenovia-Advisory Board Member Code S (Non-remunerative), Alcon-Speaker Code S (Non-remunerative), Bausch+Lomb Code C (Consultant), Verily Life Sciences Code F (Financial Support), Michael V. Boland, Heidelberg Code C (Consultant), Pradeep Y. Ramulu, None; Sara Wellik, None; Carlos Gustavo De Moraes, None; Jonathan S. Myers, None; Siamak Yousefi, None; Thao D. Nguyen, None; Eun Young Choi, None; Hui Wang, None; Peter J. Bex, United States PCT/US2014/052414 Code P (Patent), Tobias Elze, United States PCT/US2014/052414 Code P (Patent), Adaptive Sensory Technology Code R (Recipient), Mengyu Wang, Adaptive Sensory Technology Code R (Recipient), Tobias Elze, United States PCT/US2014/052414 Code P (Patent), Adaptive Sensory Technology Code R (Recipient), Mengyu Wang, Adaptive Sensory Technology Code R (Recipient)
Abstract Number: 4329

Characterizing Macrophage-Like Cells in the Living Human Retina using Clinical OCT

Track: Paper Session
Scientific Section: Retina - Imaging the posterior segment - Clinical

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Purpose
Retinal macrophages play important roles in immune and defense regulation. Here we examine macrophage-like cells imaged in the living human retina using a clinical OCT system.

Methods
17 controls and 1 patient each with diabetic retinopathy, retinal vein occlusion, and multiple sclerosis were imaged using a clinical SD-OCT system (Avanti RTVue-XR; Optovue). Ten 3x3mm scans centered at 9° temporal to the fovea and ten 4.5x4.5mm scans at the ONH were obtained and averaged. A 3µm OCT-reflectance (OCT-R) slab located above the ILM surface was used for macrophage-like cell density and nearest neighbor distance (NND) measurements (Fig. A1 & B1). An OCT-angiography (OCT-A) located between the ILM and 48µm below the ILM was overlaid with the respective OCT-R slab (Fig. A2 & B2). Cell density and NND measurements were performed on a 500x500µm ROI near the center of the temporal retina and at the supero- and infero-temporal of the ONH OCT-R images. Axial length was obtained for ocular magnification correction of each eye.

Results
In controls, ramified macrophage-like cells with uniform spatial distribution were visualized on the OCT-R images. Motility was observed between images collected on the same day and those collected 3 days apart (Fig. C). There was considerable individual variation in cell density and NND. Mean±SD cell densities measured at the temporal and ONH were 81±26 cells/mm² (range: 44-156 cells/mm²) and 59±16 cells/mm² (range: 32-92 cells/mm²), respectively. Similarly, mean±SD NND measured at the temporal and ONH were 71.5±15.6 µm (range: 52.0-108.8 µm) and 89.5±13.0 µm (range: 62.1-130.5 µm), respectively. Non uniform spatial distribution and altered morphology of the macrophage-like cells were identified in patients with retinopathies.

Conclusions
Our findings showed uniform spatial distribution and morphology of macrophage-like cells on the surface of the ILM with apparent motility over time in healthy controls. Their distribution and morphology suggests an origin of macrophage-like cells such as microglia or hyalocytes. Further studies should focus on the functions and dynamics of these cells in controls and patients with retinopathies.

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Opticology Code I (Personal Financial Interest), Guardion Code Code I (Personal Financial Interest), GlaucoHealth Code I (Personal Financial Interest), Regeneron Code C (Consultant), Bayer Code C (Consultant), Diopsys Code C (Consultant), Teva Code C (Consultant), Toco Yuen Ping Chui, None;
Clinical Imaging of Macrophage-Like Cells in Eyes with Diabetic Retinopathy Using *En Face* OCT-Reflectance

**Track:** Paper Session  
**Scientific Section:** Retina - Imaging the posterior segment - Clinical

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**Purpose**  
Retinal macrophages and microglia are closely involved in the regulation of the vasculature and inflammatory responses. Here, we examined the distribution and morphology of the macrophage-like cells in healthy and diabetic eyes visualized using clinical OCT.

**Methods**  
13 diabetic retinopathy patients and 17 controls were imaged using a clinical SD-OCT system (Avanti RTVue-XR; Optovue). Ten 3x3mm scans centered at 9° temporal to the fovea were acquired and averaged. A 3µm OCT-Reflectance (OCT-R) slab located above the ILM surface was used for macrophage-like cell density and nearest neighbor distance (NND) measurements (Fig. top row). Measurements were performed in control and diabetic eyes on a 500x500µm ROI near the center of the OCT-R. An OCT-Angiography (OCT-A) located between the ILM and 48µm below the ILM was overlaid with the respective OCT-R (Fig. bottom row). Scans were corrected for axial length.

**Results**  
In the control eyes, horizontally ramified macrophage-like cells were visualized distributed uniformly on the surface of the ILM (Fig. A1 & A2). In diabetic eyes, clusters of cell with less slender appearance were observed (Fig. B1 & C1). These cells appeared to adhere to the surface of the larger blood vessels and cluster above areas of retinal disruption (Fig. B2 & C2). In the control eyes, mean±SD cell densities and NND were 81±26 cells/mm² (range: 44-156 cells/mm²) and 71.5±15.6 µm (range: 52.0-108.8 µm), respectively. In diabetic eyes, mean±SD cell densities and NND measured at the locations with clustered cells were 157±53 cells/mm² (range: 104-224 cells/mm²) and 53.2±10.8 µm (range: 45.2-69 µm), respectively.

**Conclusions**  
Macrophage-like cells imaged with commercial OCT showed non-uniform distribution and altered morphology in diabetic eyes. Our findings suggest that these cells migrated towards locations with retinal damage. Further investigation of their dynamic interactions with retinal vessels and/or retinal neurons at such locations may provide insight on the origin of these cells.

**Disclosure Block:** Richard B. Rosen, OptoVue Code C (Consultant), Boehringer-Ingelheim Code C (Consultant), Astellas Code C (Consultant), Genentech-Roche Code C (Consultant), Guardion Code I (Personal Financial Interest), GlaucHealth Code I (Personal Financial Interest), Opticology Code I (Personal Financial Interest), Regeneron Code C (Consultant), Bayer Code C (Consultant), Teva Code C (Consultant), Maria Virginia Castanos Toral, None; Davis Zhou, None; Tatyana Milman, None; Reilly L. Allison, None; Rishard Weitz, Cellview Code I (Personal Financial Interest), Rachel E. Linderman, OptoVue Code C (Consultant), Joseph Carroll, OptoVue Code F (Financial Support), Toco Yuen Ping Chui, None;
Bilateral Visual Improvement with Unilateral Gene Therapy for Leber Hereditary Optic Neuropathy (LHON)

Purpose
To assess the clinical efficacy of a single intravitreal injection of rAAV2/2-ND4 (GS010), an investigational gene therapy for Leber hereditary optic neuropathy (LHON) caused by the m.11778G>A mitochondrial DNA (mtDNA) mutation. LHON is a mitochondrial inherited disease that preferentially targets retinal ganglion cells causing severe bilateral visual loss. The m.11778G>A mtDNA mutation in the MTND4 gene accounts for 75% of all LHON cases. rAAV2/2-ND4 is a gene therapy enabling allotopic expression and delivery of the wild-type ND4 protein to mitochondria of retinal ganglion cells.

Methods
RESCUE (NCT02652767) and REVERSE (NCT02652780) are Phase III, randomized, double-masked, sham-controlled trials in which LHON subjects with the m.11778G>A mutation received a single unilateral intravitreal injection of rAAV2/2-ND4. Visual function, retinal anatomy and quality-of-life measures were monitored for 96 weeks following administration. A concurrent study on 3 non-human primates with an equivalent unilateral injection was performed.

Results
In REVERSE subjects, rAAV2/2-ND4-treated eyes gained on average +15 ETDRS letters at Week 96 compared with baseline. Sham-treated eyes showed an improvement of +13 ETDRS letters, counter to the expected natural history of the disease. In RESCUE subjects, mean best-corrected visual acuity (BCVA) worsened to a nadir in both eyes, followed by a bilateral improvement from Week 48 to Week 96. On average, rAAV2/2-ND4-treated eyes in RESCUE gained +26 ETDRS letters at Week 96 compared with their nadir BCVA. A clinically relevant response (CRR) from the nadir was observed in at least one eye of 78% of REVERSE subjects and 63% of RESCUE subjects. In comparison, a natural history study reported that only 28% of LHON subjects with the m.11778G>A mutation had a spontaneous CRR from the nadir in at least one eye. The presence of viral vector DNA in the fellow un-injected eye was demonstrated in the non-human primates.
Conclusions
Final results of RESCUE and REVERSE showed clinically meaningful improvements of visual function. The transfer of rAAV2/2 ND4 to the sham-treated eye could explain the unexpected improvement in the contralateral eye.

Poster Sessions

Primary Presenter: Collaborators
Nittany Nomogram: A Method to Predict Refractive Astigmatism after Cataract Surgery Based on Pre-operative Biometry

Track: Poster  
Scientific Section: Lens - Cataract surgery II

Author Block: Neal Kansara¹, Zachary Landis¹-², Catherine Seeger¹, Andrew Luo¹, Jack Quillen¹, Tara O'Rourke¹, Brett Ernst³, Ingrid U. Scott¹, Seth Pantanelli¹

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Purpose
To develop a method of predicting refractive astigmatism (RA) after cataract surgery using pre-operative biometry data.

Methods
A training database was assembled between November 2014 and June 2018, which included consecutively operated eyes that underwent pre-operative optical biometry (IOLMaster), cataract surgery with placement of a monofocal intraocular lens by, or supervised by, a single surgeon, and post-operative manifest refraction greater than 1 month after surgery. Eyes with clinically significant corneal disease, prior refractive surgery, or a post-operative best-corrected visual acuity worse than 20/40 were excluded. A nomogram was developed that predicted RA from pre-operatively obtained biometry. A separate, similar testing database was assembled from a second surgeon and used to assess the performance of the new nomogram and compare it to that of the Barrett Toric Calculator's net astigmatism prediction. Outcome measures included the difference vector (DV) magnitude (defined as the vector added difference between actual and predicted RA), proportion of eyes with a DV magnitude < 0.5 diopter (D), and proportion of eyes in which the astigmatism class (e.g. against-the-rule [ATR], with-the-rule [WTR], or oblique) was predicted correctly.

Results
The training and testing databases consisted of 230 and 687 eyes, respectively. The mean DVs for all eyes (0.17 D and 0.21 D), ATR anterior corneal astigmatism (ACA) (0.26 and 0.41 D), WTR ACA (0.09 and 0.21 D), and oblique ACA (0.16 and 0.02 D) were similar for the Nittany Nomogram (v2.06) and Barrett Toric Calculator. The proportion of eyes that had a DV magnitude < 0.5 D were 51.7% and 51.3% for the Nittany Nomogram and Barrett Toric Calculator, respectively. The proportion of eyes for which the two nomograms predicted the astigmatism class correctly was 62.5% and 65.7%, respectively.

Conclusions
The newly developed Nittany Nomogram performs similarly to the Barrett Toric Calculator with respect to predicting net astigmatism based on pre-operative biometry values. Further validation is needed, especially on eyes with oblique and higher magnitudes of corneal astigmatism.

Disclosure Block: Neal Kansara, None; Zachary Landis, None; Catherine Seeger, None; Andrew Luo, None; Jack Quillen, None; Tara O'Rourke, None; Brett Ernst, None; Ingrid U. Scott, None; Seth Pantanelli, None.
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Retinal hemorrhage after pediatric neurosurgical procedures

Track: Poster
Scientific Section: Eye - The pediatric eye: Observations and interventions

Author Block: Caroline Chung¹, Alex V. Levin², Brian Forbes¹,³, Gil Binenbaum¹,³


Purpose
Neurosurgical procedures may be considered potential confounding causes of retinal hemorrhage (RH) in children being evaluated for abusive head trauma. We sought to determine the prevalence and patterns of RH attributable to neurosurgical intervention in children.

Methods
Retrospective cohort study of children undergoing neurosurgery who had postoperative indirect ophthalmoscopy within 7 days. Some children were also examined pre-operatively. Primary outcomes were prevalence and patterns of RH attributable to neurosurgery. Medical records were reviewed to identify confounding coexistent diseases.

Results
573 eyes of 267 children (mean age 6.2 years, range 0.1–18), who underwent 289 neurosurgical procedures (101 craniectomy, 57 burr-hole related, 103 ventricular/cerebrospinal-fluid drain implants, 8 spinal surgery, and 20 other), were studied. Retinal examinations occurred at mean 3.1 days post-operatively (178 at 0-3 days, 111 at 4-7 days). RH’s were seen in 32 (11%) cases, but in every case they were either already present on pre-operative examination (13 cases) or matched the pattern of a co-existent known cause of RH, including head trauma with unambiguous history and non-ocular signs (13), hydrocephalus-related increased intracranial-pressure with papilledema-associated peripapillary RH (5), and ROP-ridge-associated RH (1). No RH could be attributed only to neurosurgery.

Conclusions
Neurosurgery is unlikely to cause RH or be a significant confounding factor in the interpretation of retinal hemorrhage patterns in child abuse evaluations. While children undergoing child abuse evaluations may have intracranial hemorrhage requiring neurosurgery that occurs before a dilated retinal examination can be performed, our data suggest that neurosurgery itself is unlikely to produce RH.

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Risk factors for tumor recurrence following primary intravenous chemotherapy (chemoreduction) for retinoblastoma in 869 eyes of 551 patients

Track: Poster
Scientific Section: Anatomy and Pathology/Oncology - Retinoblastoma

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Purpose
Primary intravenous chemotherapy (chemoreduction) is an effective treatment for retinoblastoma, but recurrence is not uncommon. We performed a retrospective, observational study to identify risk factors for retinoblastoma recurrence following chemoreduction.

Methods

Results
There were 869 eyes of 551 patients with retinoblastoma managed with chemoreduction. Follow up in 556 eyes revealed new tumor (n=118, 21%), main tumor recurrence (n=355, 64%), subretinal seed recurrence (n=244, 44%), and/or vitreous seed recurrence (n=162, 29%), requiring management with focal therapy (transpupillary thermotherapy, cryotherapy) (n=294, 53%), intra-arterial chemotherapy (n=125, 22%), intravitreal chemotherapy (n=36, 6%), plaque radiotherapy (n=120, 22%), external beam radiotherapy (n=57, 10%), and/or enucleation (n=49, 9%). Of all recurrences, 62% were detected by 1 year, 86% by 2 years, 94% by 3 years, 98% by 5 years, 99% by 10 years, and 100% by 15 years. Risk factors for recurrence on univariate analysis (odds ratio (OR) [95% confidence interval]) included younger age at diagnosis (OR 1.02 [1.01-1.03] per 1 month of age, p=0.003), more advanced International Classification of Retinoblastoma (ICRB) group (OR 1.27 [1.13-1.43], p<0.001), greater number of tumors on presentation (OR 1.12 [1.02-1.24], p=0.01), greater tumor basal diameter (OR 1.05 [1.03-1.08] per 1 mm increase, p<0.001) and thickness (OR 1.08 [1.04-1.12] per 1 mm increase, p<0.001), shorter tumor distance to foveola (OR 1.13 [1.08-1.18] per 1 mm decrease, p<0.001) and optic disc (OR 1.18 [1.12-1.24] per 1 mm decrease, p<0.001), and initial presentation with subretinal seeds (OR 2.27 [1.64-3.15], p<0.001), subretinal fluid (OR 1.68 [1.25-2.25], p=0.001), and anterior chamber seeds (OR 5.22 [1.08-25.33], p=0.04). Factors significant on multivariate analysis included age, ICRB group, distance to optic disc, and subretinal seeds.

Conclusions
Retinoblastoma recurrence after chemoreduction is usually detected within the first 3 years of treatment. Younger patients with more advanced, posteriorly located tumor, and subretinal seeds at presentation are at increased risk, but recurrence can often be managed with globe-sparing therapy.

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Use of fundus image registration and flicker for tracking choroidal tumor changes

Track: Poster
Scientific Section: Anatomy and Pathology/Oncology - Intraocular tumors, ocular pathology and complications of therapy

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Purpose
Fundus photography is important in documenting and assessing the progression of uveal tumors and their potential therapeutic ocular complications. The purpose of this retrospective study is to investigate the use of registration and flicker of serial fundus images to detect changes in choroidal tumors that may indicate transformation to malignancy or development of therapy-induced retinopathy.

Methods
Twenty-two eyes from 21 subjects with progression of choroidal tumors or therapeutic complications (e.g., radiation retinopathy) were imaged during multiple visits (minimum of 3 and maximum of 8 visits during follow-up period) using CLARUS™ 500 (ZEISS, Dublin, CA) with true color widefield imaging. A custom registration algorithm was used to register images from consecutive follow-up visits in addition to those from baseline to the latest visit. All the registered pairs had a confidence metric of equal to or greater than 0.7. An animated flicker image with 500ms delay was created for each of the registered pairs. An optometrist graded the side-by-side unregistered images, side-by-side registered images, and flickered fundus images from consecutive patient visits for change in intraocular tumor. Changes were graded on a scale of three: 0 for no change, 1 for possible change, and 2 for change (progression or regression).

Results
Figure 1 shows the results of the analyses. The changes in tumor or therapeutic complications were easier to track in flicker images than the unregistered and registered images in both consecutive visits and baseline to the latest visit. Registered images were marginally better in tracking changes than the unregistered images.

Conclusions
The advantage of flicker in detecting subtle changes in choroidal tumors and therapy-induced retinopathy, using registered fundus images from consecutive patient visits, was demonstrated. Further studies are needed with multiple graders and a more diverse data set for detailed analysis.

Disclosure Block: Susan Su, Carl Zeiss Meditec, Inc. Code C (Consultant), Niranchana Manivannan, Carl Zeiss Meditec, Inc. Code E (Employment), Mary K. Durbin, Carl Zeiss Meditec, Inc. Code E (Employment), Sandor Ferenczy, None; Carol L. Shields, None;
Retinal Detachment Rates and Clinical Outcomes Following Penetrating and Endothelial Keratoplasty

Track: Poster
Scientific Section: Retina - Retinal detachment: Clinical

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Purpose
To evaluate retinal detachment rates and clinical outcomes after penetrating keratoplasty (PK) and endothelial keratoplasty (EK).

Methods
The medical and billing records of a group of academic private practices were electronically queried for all surgical visits during which a PK or EK was performed between April 1, 2012 and August 31, 2018 for this retrospective cohort study. Demographic information and transplant characteristics were recorded for each patient and office visit. An additional query was performed to identify all cases of retinal detachment based on diagnosis and procedure billing codes. Charts of patients with retinal detachment were individually reviewed, and information was collected on prior clinical history, clinical evaluation at presentation, surgical management, visual outcomes, and graft survival rates. The main outcome measure was incidence of retinal detachment following PK or EK.

Results
During the study period, 1,676 PKs and 2,292 EKs for 3,069 patients were performed. The mean age of patients in this transplant cohort was 66.4 (± 17.5) years and 54.6% of patients were female. Fifty-two cases of rhegmatogenous retinal detachment occurred during the study period; forty-one cases occurred after PK and eleven cases occurred after EK. The rate of retinal detachment after EK (11 of 2,292; 0.5%) was significantly lower than that after PK (41 of 1,676; 2.4%) (p < 0.001). Additionally, the odds of developing retinal detachment after PK or EK performed in conjunction with anterior or pars plana vitrectomy were significantly higher than after either PK or EK alone (OR: 8.66; 95% CI: 2.98-25.18; p < 0.001). Nineteen eyes were determined to have inoperable retinal detachments and one did not have sufficient follow up. Therefore, thirty-two eyes were included in the clinical outcomes analysis. Visual acuity outcomes were worse after PK related retinal detachment than EK associated cases although this difference was not statistically significant.

Conclusions
In this large cohort of patients undergoing either PK or EK, rates of retinal detachment were low for both procedures and significantly lower for EK compared to PK. Eyes with retinal detachment after PK had worse visual acuity outcomes and graft prognosis compared to those with retinal detachment after EK.

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Optic disc characteristics of glaucoma eyes with and without high myopia

Track: Poster
Scientific Section: Glaucoma - Clinical imaging I

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Purpose
To characterize structural differences in glaucomatous optic discs in eyes with high, low and no myopia using optical coherence tomography (OCT) and OCT angiography (OCTA).

Methods
All glaucoma patients enrolled in the Diagnostic Innovations in Glaucoma Study with axial length (AL), visual field (VF) measurements and good quality Spectralis OCT ONHRC (optic nerve head radial circle) scans for calculation of minimum rim width (MRW) and retinal nerve fiber layer (RNFL) thickness were included. Participants were classified into 3 myopia groups by AL (mm); no (<24), low (24-26) and high (>26) axial myopia. Optic disc ovality index (OI), tilt and torsion were calculated using custom analysis of segmented OCT volumes. AngioVue OCTA ONH whole image vessel density (wiVD) was also analyzed. Linear mixed models were used to compare eye characteristics between groups, and univariable and age and mean deviation (MD) adjusted models were used to evaluate the association between AL and ocular parameters.

Results
326 glaucoma patients (553 eyes) were classified into 3 groups: no myopia (n=116, VF MD=-6.69 dB), low myopia (n=168, VF MD=-7.1 dB), and high myopia (n=42, VF MD=-8.19 dB) (VF MD differences; p=0.1). Mean (95% CI) OI was significantly lower (more oval) in the high myopia group (0.84 (0.82-0.87)), compared to the low myopia (0.89; (0.87-0.9)) and no myopia group (0.88; (0.87-0.89)) (p=0.01), while disc tilt angle was highest in the high myopia group (9.6° (8.4-10.9)) compared to the no (4.0° (3.3-4.6)) and low myopia group (5.1° (4.5-5.7)) (p<0.001). Disc torsion angle was similar across the 3 groups (22.1°, 22.6°, and 17.7° (p=0.92), respectively) as was mean RNFL thickness (67.0µm, 65.1µm and 64.5µm (p=0.73), respectively). Mean (95% CI) MRW was significantly lower in the high myopia group than in the no- and low-myopia group (170µm (153-188), 198µm (189-208), and 192µm (184-200) respectively, p=0.03). Mean (95% CI) OCTA wiVD was significantly lower in high myopes (38.1% (36.0-40.2)), compared to low myopes (38.7% (37.7-39.7)), and non-myopes (40.2% (39.0-41.4)) (p=0.01). Disc tilt, wiVD and MRW were significantly associated (all p<0.04) with increasing AL in age, and VF MD adjusted multivariable models.

Conclusions
Caution should be exercised when using ONH MRW and vessel density for glaucoma management decisions in high axial myopia as these global structural parameters are associated with AL.

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Clinical utility of the artificial intelligence enabled dashboard for glaucoma monitoring

Track: Poster
Scientific Section: Glaucoma - Data science and machine learning

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Purpose
To validate an artificial intelligence enabled dashboard for monitoring glaucoma using automated visual field (VF) tests.

Methods
We developed the initial dashboard using 13,231 cross-sectional VF tests and applied principal component analysis (PCA) and t-distributed stochastic neighbor embedding (tSNE) to extract global and local characteristics of the patterns of VF loss (Yousefi et al., Image and Vision Computing New Zealand; IVCNZ, 2018:1-6). To validate the dashboard and investigate its clinical utility, we used VF sequences from two independent datasets. The first dataset included 133 eyes of glaucoma patients (each with 10 VF tests collected every week over 10 consecutive weeks) at Moorfields Eye Hospital, London, UK, that were likely stable in such a short time. The second dataset included 154 eyes of glaucoma patients (average 9.3 tests) from the Glaucoma Research Network (GRN) with a consensus by six different algorithms that they were progressing. We projected the sequences of VFs of the eyes in these benchmark datasets and computed the specificity (using Moorfields dataset; Fig. 1) and sensitivity (using GRN dataset; Fig. 2) of the dashboard based on the trajectory direction towards glaucoma worsening and its length.

Results
A total of 125 eyes from the Moorfields benchmark dataset with confirmed non-progression consistently represented no progression on the dashboard, equivalent to specificity of 94%. A total of 119 eyes from GRN with confirmed progression consistently represented progression on the dashboard, equivalent to sensitivity of 77%.

Conclusions
We validated the clinical utility of the artificial intelligence enabled dashboard for glaucoma monitoring using longitudinal VFs from independent datasets. The dashboard had an excellent specificity and reasonable sensitivity. The proposed dashboard could be useful in clinical practice and glaucoma research for monitoring glaucoma on a user-friendly screen.

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**Contrast sensitivity as a home detection tool for diabetic patients**

**Track:** Poster  
**Scientific Section:** Retina - Diabetic retinopathy: medical II

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**Purpose**
Diabetes mellitus affects various aspect of vision. Snellen acuity captures only a limited section of the visual field and fails to test contrast, which has been documented to decrease in diabetic patients. We analyzed results from a novel, internet-based contrast sensitivity (CS) test in patients with varying degrees of diabetic retinopathy. We wished to evaluate its potential as a home monitoring tool.

**Methods**
A prospective cross-sectional study of diabetic patients and controls was performed. 35 eyes with diabetes and 15 eyes with no ocular pathology were selected to take an internet-based CS assessment called Spaeth/Richman Contrast Sensitivity (SPARCS). SPARCS can be accessed by both patients and clinicians online, and has been found reliable when patients test themselves. SPARCS assesses 17 varying contrast levels in five areas of the visual field, both central and peripheral. The diabetic group consisted of patients diagnosed with diabetes, with varying levels of diabetic retinopathy, but with no other known ocular pathology. Diabetic patients were grouped based on the level of diabetic retinopathy, the status of diabetic macular edema (DME), A1C level, and years of diabetes. The control group consisted of healthy patients with no known ocular pathology, other than 1+ out of 4+ cataract. Student t-test and ANOVA were used for statistical analysis in Microsoft Excel.

**Results**
Twenty four of the 35 eyes with diabetes had diabetic retinopathy (DR). CS was significantly decreased in patients with DR, both nonproliferative DR (n=8) and proliferative DR (n=16) compared to the control groups (n=15), with p values of 0.036 and 0.015 respectively. CS was significantly decreased in diabetic patients with current or prior DME (n=12) compared to diabetic patients without DME (n=23), with a p value of 0.041. No statistically significant difference in CS was observed between patients with NPDR or PDR. Having A1C >7 or a >10 years history of diabetes was directly correlated to decreased CS.

**Conclusions**
Visual acuity tends to be affected in late stages of diabetic retinopathy. Early changes in contrast can be detected with SPARCS and has the potential to become an effective home detection tool for diabetic patients.

**Disclosure Block:** Erol Eri Verter, None; yapei Zhang, None; eric Spaeth, SPARCS Code C (Consultant), George Spaeth, SPARCS Code C (Consultant), Kristen Harris Nwanyanwu, None;