Longitudinal Changes in OCT-Derived Ocular Parameters in Healthy Rhesus Macaques

PB00127

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Purpose: Limited literature on normal age-related changes in the rhesus macaque (Macaca mulatta) eye constrains its utility as an experimental disease model. In this longitudinal, observational study, we determined the rate of change of OCT-derived ocular measurements across time in a cohort of healthy animals.

Methods: Clinical ophthalmic examination and in vivo spectral-domain OCT scans (Bioptigen Envisu, Leica, Chicago, IL) of the macula, optic nerve head (ONH), and lamina cribrosa (LC) were obtained from 7 animals (3F, 4M; 14 eyes) at 2 time points separated by at least 1 year. Subjects were deemed free from ocular and systemic disease at both time points after reviewing medical records and fundus photographs. Criteria for ocular health included cup-to-disc ratio ≤0.5, intraocular pressure (IOP) ≤22 mmHg, and cup asymmetry <0.2. Macula and ONH scans were segmented automatically using OCTExplorer 3.8.0 and corrected manually when needed, to measure peripapillary retinal nerve fiber layer (RNFL) and macular ganglion cell inner plexiform layer (GCIPL) thicknesses globally and by quadrant, while accounting for axial length. LC microstructure and ONH macrostructure were quantified using software of our own design. Mean baseline values and rates of change across the cohort were calculated using mixed-effects models, which accounted for repeated measurements and the use of both eyes in the animals. These rates were then compared to a zero-slope reference.

Results: Mean baseline age, weight, and IOP were 14.6 yr, 9.4 kg, and 19.1 mmHg, respectively. There was no significant change in mean weight ($p=0.45$) or IOP ($p=0.58$) over the study period. Significant rates of change ($p<0.05$) were detected for RNFL (all regions) and GCIPL (all regions expect superior quadrant) thicknesses, minimum rim width (MRW), and cup depth (Table 1, Figure 1). No significant changes were detected for any LC microstructural parameter or for disc area.

Conclusions: Significant thinning of the RNFL, GCIPL, and MRW, as well as a significant increase in cup depth, occur due to physiologic aging in healthy rhesus macaques. These results set the foundation for defining abnormal in vivo changes in M. mulatta ocular structures.

Deep Learning for Standardized Vessel Segmentation in Vis-OCT Imaging

PB0039

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Purpose: Visible-Light (Vis-) OCT provides high-resolution retinal imaging and enables the measurement of oxygenation level within the vasculature. However, automated vessel segmentation remains challenging due to microvascular complexity and image variability. In this study, we developed and evaluated a novel deep learning model for Vis-OCT retinal vessel segmentation. Our model was trained on Vis-OCT en face images using binary vessel maps generated by an SLO-based segmentation tool as ground truth labels.

Methods:24 retinal and optic nerve head (ONH) images acquired with a prototype Vis-OCT device from 19 subjects (10 healthy, 9 glaucomatous) were used in this study. The dataset was split into training (70%), validation (10%), and evaluation (20%) subsets. (17/2/5 split). En face Vis-OCT images were first segmented using SLOctolyzer, and binary vessel maps served as ground truth labels. Images were resized to 512×512 pixels, normalized, and augmented with random horizontal and vertical flips, ±30 degree rotations, and intensity adjustments. A U-Net++ model with a ResNet34 encoder was trained for 500 epochs using binary cross-entropy (BCE) loss and Dice (DSC) loss, optimized with Adam and a 50-epoch learning rate scheduler. Performance was assessed using DSC coefficient, AUC score, sensitivity, and specificity.

Results: Evaluation of model performance on an external test set containing 5 images revealed high average DSC (0.8017 ± 0.0512), AUC (0.9778 ± 0.0121), sensitivity (0.7654 ± 0.0981), and specificity (0.9821 ± 0.00036) across all images. The model performed similarly on macula scans (3 images) compared to ONH scans (2 images) in DSC (0.7897 ± 0.0552 vs. 0.8198 ± 0.0573; p = 0.6127).

Conclusions: Our deep learning model, trained on Vis-OCT en face images with SLO-based binary vessel maps, demonstrated high segmentation accuracy, achieving high DSC and AUC scores. By automating vessel segmentation in Vis-OCT, this method establishes a standardized approach that may improve the reliability and reproducibility of microvascular analysis, which is essential for assessing oxygenation-related changes in retinal imaging.

The Hypotenuse of the Vertical Optic Nerve Head Cup as an Indicator of Glaucoma Progression

PB0048

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Purpose: To evaluate the hypotenuse of the optic nerve head cup (HOC) for detecting progression in glaucomatous eyes and its association with other functional and structural parameters.

Methods: We retrospectively reviewed optical coherence tomography (OCT) scans (Cirrus HD-OCT; Zeiss,Dublin, CA) of the optic nerve head (ONH) and macula, and Humphrey SITA Standard 24-2 visual field (VF) of patients with glaucoma and healthy controls with ≥4 visits and ≥2 years of total follow-up and ≥90 days between visits. We analyzed functional VF parameters and structural OCT. HOC measurements used horizontal B-scans and involved identifying the cup center in En-Face view and measuring its length from the innermost portion of the descending fibers at the plane of the Bruch's membrane opening and its depth from the mid-portion of the length segment to the deepest point of the middle third of the cup. We calculated HOC (Center-H) using the Pythagorean theorem and repeated this 5 B-scans above and below the cup center. The HOC values were averaged (AVG-H). Cups with depth of 0 µm were excluded. 25% of eyes were re-measured by an ophthalmologist to test reproducibility using the within-subject coefficient of variation (WSCV). A linear mixed-effect model was used to analyze baseline associations and longitudinal rates of change.

Results:88 eyes of 68 patients (13 healthy vs. 75 glaucoma/glaucoma suspects) were included. Mean age was 59.0±15.9 years and mean follow-up was 3.2±1.1 years. HOC reproducibility showed a WSCV=3.89-6.39%. Baseline variables differed significantly between the healthy and glaucoma/suspect groups (Table 1). All structural-functional associations and structural-structural associations were significant at baseline (all $p<0.001$). Longitudinally, the rates of change of all parameters were significant in the glaucoma group except for RNFL ($p=0.655$), while the rates of change of all parameters were not significant in the healthy group except for RNFL ($p=0.049$) (Table 2); however, the difference between the rates of change between the two groups were only significant for average CDR and AVG-H ($p= 0.004$ and <0.001, respectively).

Conclusions:HOC demonstrated significantly different longitudinal changes between healthy and glaucoma eyes and may be an additional biomarker for detecting and monitoring glaucoma progression

OCT Cluster Analysis of the Peripapillary Nerve Fiber Layer: A Novel Strategy for Deviation Map Quantification

PB0049

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Purpose: Localized damage is a hallmark of glaucoma. The aim of this study is to generate clusters of peripapillary retinal nerve fiber layer (RNFL) thickness based on individual superpixel measurements and their coordinates and evaluate their association with the functional clusters from fundus perimetry and with the sectorial measurements from the OCT.

Methods: Subjects referred for optic neuropathy evaluation (glaucoma, glaucoma suspects and neuro-ophthalmological conditions) who underwent both Compass Fundus Perimetry (CFP) (Icare; Vantaa, Finland) and DRI-Triton Swept-Source (SS) OCT (Topcon; Tokyo, Japan) were included. CFP mean deviation (MD), Fundus Perimetry Deviation Index (FPDI) and six standard clusters were used for the analysis (figure 1 A and 1B). SS-OCT global and sectoral circumpapillary (cp)RNFL, ganglion cell plus inner plexiform layers (GCL+), GCL+ plus macular RNFL (GCL++) and six peripapillary RNFL clusters were analyzed. Optic nerve heads were divided into sectors according to the Garway-Heath map and six peripapillary RNFL clusters were generated based on the superpixels available in a 26x26 coordinate map (figure 1C). The average RNFL thickness of each cluster was calculated. The association between parameters was analyzed using Spearman correlation analysis and univariate and multivariate generalized estimated equations (GEE) accounting for age and signal strength.

Results:73 subjects (125 eyes), with a mean age of 56.1 ± 16.8 years, qualified for the study. The mean ± SD MD and FPDI were -1.78 ±4.50 dB and 93.34 ± 13.40 %, respectively. The average cpRNFL, GCL+ and GCL++ were 95.99 ± 18.36 mm, 66.95 ± 8.78 mm and 102.19 ± 12.84 mm, respectively. The association between the average of the six clusters from the CFP and the SS-OCT was significant both in the univariate and multivariate analysis ($p<0.001$), except for cluster 5 in the multivariate analysis. The sectorial analysis comparing the clusters and the correspondent cpRNFL, GCL+ and GCL++ sectors was performed using Spearman correlation analysis (Table 1).

Conclusions: The structural cluster analysis using the quantitative data from the entire peripapillary RNFL area showed significant association with the functional clusters and with the sectoral averages of RNFL, GCL+ and GCL++. This novel approach has potential to be incorporated into clinical practice to detect and monitor localized damage.

Repeatability of OCT-Based Measurements of Lamina Cribrosa Microstructures Under Different IOP Settings.

PB0050

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Purpose: To determine the repeatability of in-vivo OCT-based measurements of the lamina cribrosa (LC) microstructure obtained in different IOP levels.

Methods: Three adult rhesus macaques, each with one eye with experimental glaucoma and a contralateral control eye, underwent two consecutive optic nerve OCT scans (Bioptigen Envisu; Leica, Chicago, IL) per eye at multiple time points. The animals were sedated using an intramuscular ketamine injection and xylazine to minimize movements. Images were acquired at baseline (naïve) and at varying IOP levels (5, 15, and 30 mmHg) through a gravity-controlled anterior chamber cannulation. Scans were registered using 3D Slicer software, and LC microstructural measurements were obtained from a shared region on both scans at each IOP level using thresholding segmentation. The within-subject coefficient of variance was calculated to determine measurements' repeatability across pressure levels.

Results: Mean naïve IOPs for experimental eyes was 17.4mmHg and control eyes 13.6mmHg. Beam thickness, pore diameter and BPR all showed excellent repeatability across the different IOP levels with WSCV≤0.1 (Table 1). Average pore area showed a substantially worst level of repeatability compared with the other parameters. Repeatability at 5 and 15mmHg was consistently worse than other settings across all parameters.

Conclusions: Repeatability of LC parameters is related to IOP level at the time of imaging and should be considered when evaluating structural changes. The worse repeatability of pore area may be attributed to its computation as a two-dimensional parameter in parallel stacks, in contrast to other parameters, which are calculated in three dimensions.

Structural and Functional Progression Before and After Trabeculectomy Stratified by Postoperative IOP Level

PB0053

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Purpose: This study examines the structural and functional rates of progression before and after trabeculectomy, and whether these trends differ among subjects who achieve consistently lower postoperative IOP (≤18mmHg) at all visits.

Methods: Subjects with glaucoma from a tertiary care center were included if they underwent trabeculectomy surgery and had ≥2 OCT scans of the optic nerve head and macula (Cirrus HD-OCT; Zeiss, Dublin, CA) and ≥2 visual field (VF) tests (Humphrey Field Analyzer; Zeiss) before and at least 6 months after surgery, with a minimum of 4 OCT and VF tests per eye. Rates of structural and functional change per year before and after surgery were determined using a mixed effects model, adjusting for IOP, age, baseline measurements, and signal strength. To examine whether trends differed among subjects who achieved consistently lower postoperative IOPs, an additional sub-analysis was conducted using the same model for those whose IOP was ≤18mmHg across all visits postoperatively.

Results: There were 71 eyes in the analysis for the entire cohort and 53 eyes in the analysis for those with IOP≤18 mmHg postoperatively. Average IOP was 16.4 mmHg before and 13.2 mmHg after surgery for the entire cohort, and 16.4 mmHg and 12.6 mmHg, respectively, for the lower IOP group. The rates of change before surgery for the entire cohort, for all structural and functional parameters, were statistically significantly different than a no change slope in the direction consistent with glaucoma progression (Table 1). The rates of progression after surgery were not significant for cup-to-disc ratio (CDR), ganglion cell inner plexiform layer (GCIPL), visual field index (VFI), and mean deviation. Significantly slower rates of change postoperatively were detected for CDR, GCIPL, and VFI. Sub-analysis for the lower IOP group shows similar results, with significantly slower rates of change postoperatively for CDR, GCIPL, and VFI (Table 2). While the absolute value of the magnitude of progression for RNFL is larger after surgery in the IOP≤18mmHg group the difference between the two rates is not statistically significant.

Conclusions: Rates of structural and functional progression for CDR, GCIPL, and VFI becomes significantly slower after trabeculectomy in the entire cohort and in those with consistently lower postoperative IOP (≤18mmHg).

A machine learning approach to detect RNFL progression from electroretinograms (ERG) in an experimental glaucoma model.

PB0060

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Purpose: Experimental glaucoma models offer insights into the impact of elevated intraocular pressure (IOP) on disease progression. Retinal nerve fiber layer (RNFL) thinning, measurable with OCT, is a key structural biomarker, while electroretinography (ERG) assesses retinal function. However, ERG recordings exhibit substantial measurement variability and tend to show more consistent abnormalities in later stages of disease. We propose a machine learning (ML) approach that integrates ERG and IOP features to predict RNFL progression.

Methods: Chronic IOP elevation was induced in one eye of 4 healthy adult rhesus and 4 cynomolgus macaques. Subjects underwent periodic ophthalmic exams, including IOP measurement (Tonopen; Reichert, Depew, NY), spectral-domain OCT imaging of the optic nerve head region (Bioptigen Envisu; Leica, Chicago, IL), and Photopic negative response (PhNR) ERG (Diagnosys, Lowell, MA). Retinal layers were segmented with Iowa Reference Algorithms (Iowa Institute of Biomedical Imaging, Iowa City, IA) and corrected for errors and axial length. RNFL progression was defined by linear regression showing a significant ($p<0.05$) negative change from baseline. Conventional ERG and 12 custom wavelet features were extracted and used to train a ML classifier to identify, based on ERG, eyes which had significant RNFL thinning from baseline. A balanced random under-sampling ensemble model with cross-validation was implemented using decision tree learners. Shapley analysis identified feature influence on prediction.

Results: PhNR waveform features were extracted from 548 high-quality recordings from 16 eyes (8 animals). Summary statistics of baseline characteristics are reported in Table. An ERG-only ML model predicting significant RNFL progression from baseline achieved 96.0% accuracy, F1-score of 97.7%, and Matthews Correlation Coefficient (MCC) of 0.833. BT (Shapley=0.235), a-wave amplitude (Shapley=0.149), and PhNR time (Shapley=0.109) were the leading features. An ERG+IOP ML model marginally improved accuracy to 97.6%, F1-score to 98.6%, and MCC to 0.904 with IOP being the most influential feature (Shapley=0.485). Confusion matrix and ROC curves further illustrate models' strong predictive performance (Figure).

Conclusions:ML enables accurate classification of structural change from ERG-derived features, suggesting its potential to enhance comprehensive disease assessment.

Comparison of Novel Deep Learning and Existing Automated Techniques for Lamina Cribrosa Pore Segmentation

PB0062

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Purpose: Existing LC microstructural analysis methods are resource intensive. This study evaluates the performance of a novel deep learning (DL) model trained to automatically segment lamina cribrosa (LC) pores in OCT scans as compared to currently used techniques.

Methods:300 2D spectral-domain optic nerve head (ONH) OCT slices (Bioptigen Envisu; Leica, Chicago, IL) from 100 healthy non-human primate (NHP) eyes were segmented using four **Methods:** manual Difference of Gaussian (DoG) filter, Contrast-Limited Adaptive Histogram Equalization (CLAHE), and DL model trained on manual segmentations. The Simultaneous Truth and Performance Level Estimation (STAPLE) algorithm generated consensus segmentations from a weighted combination of these methods, which were then used to retrain the DL model with U-Net++ and an EfficientNet-B7 encoder. Training employed Binary Cross-Entropy with Logits Loss, the Adam optimizer (initial learning rate (LR): 0.001), and a step-based scheduler reducing LR by 0.1 every 10 epochs. Early stopping after 5 epochs of no validation loss improvement mitigated overfitting. A 5-fold cross-validation split (80:20 training-validation) was used. Horizontal, vertical, and combined flipping were applied to augment the training data. Model performance was evaluated against gold-standard manual segmentation on 15 ONH OCT slices from healthy NHP subjects that were excluded from the training set and compared to automated thresholding and DoG segmentation methods. 2D LC microstructural parameters were compared between the manual and each automated segmentation method using two-tailed paired t-tests.

Results: No significant difference was observed between the DL and manual methods for 7 of 10 2D LC microstructural parameters (Table 1). Significant differences were detected between the DL and manual methods for average beam diameter ($p = 0.017$), circularity, and solidity ($p < 0.001$). Significant differences were detected for 7 of 10 LC parameters between automated thresholding and manual methods, and for 9 of 10 parameters between automated DoG and manual methods.

Conclusions: The DL model achieves accuracy comparable to manual segmentation for most LC microstructural parameters and performs more similarly to manual methods than the presently studied automated segmentation techniques. Further training is required to refine pore shape characteristics.

In Vivo 3D Mapping of Lamina Cribrosa Stretch Distribution

PP0010

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Purpose: Understanding the biomechanical properties of the lamina cribrosa (LC) is essential for comprehending its role in the context of glaucomatous damage. However, no information is currently available regarding the in vivo distribution of forces within the lamina volume. In this study, we present in vivo stretch distribution maps of the LC under varying IOP conditions.

Methods: Six eyes from six adult rhesus macaques were analyzed: five healthy eyes and one eye with naturally occurring glaucoma. The LC was imaged using OCT (Bioptigen Envisu; Leica, Chicago, IL), while modulating IOP to 15 and 30 mmHg through a gravity-controlled fluid reservoir connected to a cannula placed in the anterior chamber. LC stretch was derived from 3D displacement fields calculated using Thirion's demon algorithm extracted from the transition between OCT images acquired at the two pressure settings. Two distinct LC depths – anterior and posterior slices - were analyzed, and stretch distribution maps were generated for each LC depths.

Results:A heterogenous distribution of stretch was observed in all eyes, varying in magnitude, location, and size with high stretch often aligning with lamina vascular walls. Two representative stretch maps from a healthy eye and an eye with naturally occurring glaucoma (mean age: 16.6 ± 7.1 years), are shown in Figure 1. The overall mean stretch values were 1.054 and 1.056 for the healthy and glaucomatous eye, respectively, with stretch values ranging from 1.000 to 1.284. The distance between anterior and posterior slices were 98.6µm and 52.8µm, respectively. The healthy eye showed stretch predominantly around the pores, while the glaucomatous eye exhibited more localized regions of elevated stretch, forming clusters at specific LC locations, including the temporal inferior region. Stretch distribution also varied with depth in both eyes.

Conclusions: In-vivo LC biomechanical stretch exhibited an eye-specific pattern, varying with the LC depth, between eyes and among animals. In this cohort, healthy and glaucomatous eye displayed distinct stretch patterns, which may be linked to the underlying glaucomatous pathophysiology. Future studies will explore the relationship between the stretch in healthy and glaucomatous eyes, as well as the association between specific stretch locations and subsequent retinal ganglion cell axonal loss.

Risk factors for corneal graft rejection or failure after penetrating keratoplasty in eyes with previous incisional glaucoma surgery

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Purpose
Penetrating keratoplasty (PK) for corneal pathology is sometimes necessary in eyes that have already undergone incisional glaucoma surgery (IGS) such as trabeculectomy or glaucoma drainage device (GDD) implantation. The effect of IGS on corneal graft outcomes is unclear. This study evaluated risk factors for corneal graft rejection or graft failure in patients with previous IGS.

Methods
Patients who underwent PK and had existing IGS between May, 2007 and September, 2018 at a single cornea practice were identified. Multivariable Cox regression models were used to predict the risks of graft failure or rejection. Covariates included age, sex, intraocular pressure (IOP), maximum post-transplant IOP, glaucoma medications, diabetes, smoking status, prior PK, prior endothelial keratoplasty (EK), lens status, and time to rejection or failure.

Results
Of 168 eyes that underwent PK and had prior IGS, 34 (20.2%) had trabeculectomies and 134 (79.8%) had GDD implantation. In eyes with trabeculectomies, 5 (14.7%) had graft rejection and 16 (47.1%) had graft failure. In eyes with GDDs, 41 (30.6%) had graft rejection and 83 (61.9%) had graft failure. Maximum post-operative IOP was associated with increased risk of graft failure (HR=1.07; 95% CI=1.02-1.12; p=0.010), while history of prior EK appeared protective against graft failure (HR=0.30; 95% CI=0.10-0.88; p=0.028). In subset analysis of eyes with GDDs, diabetes was associated with higher risk of graft rejection (HR=3.05; 95% CI=1.03-9.01; p=0.045) and smoking status was associated with higher risk of graft failure (HR=5.78 95% CI 1.23-27.16, p=0.026). Further subset analysis showed that both trabeculectomy and GDD implantation in the same eye was more strongly associated with graft failure than either surgery alone (75.8% vs 47.1%, p=0.024).

Conclusions
In eyes with PK and prior IGS, maximum post-operative IOP was significantly associated with graft failure, while a history of prior EK seemed protective against graft failure. In eyes GDD implantation, diabetes and smoking status predicted poorer graft prognosis. The presence of both trabeculectomy and GDDs was associated with more graft failure than either surgery alone. The identification of these post-operative risk factors can help predict graft outcomes and potentially guide patient selection and counseling for PKs in those with previous IGS.

Long-Term Outcomes of Pars Plana Vitrectomy and Scleral-Fixated Intraocular Lens Using Gore-Tex Sutures

249 - A0516

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Purpose
There is a paucity of long-term data on the use of Gore-Tex sutures for scleral fixation of intraocular lenses (IOLs). This study evaluates the long-term visual and anatomical outcomes, as well as complications, following combined pars plana vitrectomy (PPV) and scleral fixation of IOLs using Gore-Tex sutures. To our knowledge, this 8.5-year retrospective review is the longest of its kind to date.

Methods
Single-center retrospective review of 40 eyes of 40 patients who underwent combined PPV and scleral fixation of IOL with Gore-Tex sutures between 2012 and 2016. Inclusion criteria required at least seven years of follow-up. Data collected included patient demographics, surgical history, operative details, and visual acuity outcomes. Primary endpoints were visual acuity and postoperative complications.

Results
The mean patient age was 65.3 years (range 32–91) with 74% male patients. The mean follow-up duration was 103 months (range 85-129). Patients had undergone an average of 1.8 prior surgeries (range 0–5), with vitrectomy for retinal detachment being the second most common prior procedure (48%) after cataract surgery. Indications for surgery included subluxed or dislocated IOL (66%), complicated cataract (21%), and aphakia (13%). The Akreos AO60 (Bausch and Lomb) lens was used in 97% of cases. Mean visual acuity improved from 20/340 (1.22 logMAR) preoperatively to 20/80 (0.59 logMAR) at three months postoperatively (p=0.013). There was no significant difference between visual acuity preoperatively and at the last follow-up: 20/200 (1.01 logMAR; p=0.49). Postoperative complications occurred in 13 cases (33%), including corneal edema (10%), tilted IOL (10%), and suture exposure (7.7%). One case of suture exposure resulted in endophthalmitis. The average time to suture exposure was 68 months (range 59–82). Reoperations were required in six patients (15%).

Conclusions
Scleral fixation of IOLs using Gore-Tex sutures demonstrates significant initial visual improvement and a relatively low rate of suture-related reoperations over an 8.5-year follow-up period. This study provides the longest follow-up data currently available, offering critical insights into the long-term durability and viability of Gore-Tex sutures for scleral IOL fixation.

Disparities in presentation and initiation of anti-VEGF therapy for neovascular age-related macular degeneration: An analysis of the Academy IRIS® Registry

298 - B0160

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Purpose

To investigate disparities in presentation and initiation of anti-vascular endothelial growth factor (anti-VEGF) therapy in patients with neovascular age-related macular degeneration (nAMD)

Methods

This retrospective cohort study analyzed data from the American Academy of Ophthalmology IRIS® Registry (Intelligent Research in Sight) and included patients diagnosed with nAMD (ICD-10 codes) between 10/01/2016 and 10/31/2021. The primary outcome was treatment initiation, i.e. receiving ≥1 anti-VEGF injection within 12 months of nAMD diagnosis. Mean age at presentation was compared across demographic groups via one-way ANOVA. Multivariable Poisson regression models were used to examine associations between treatment initiation and demographic characteristics and presenting visual acuity (VA).

Results

Among 918,759 nAMD patients (61.5% female, 82.3% White), male, Black, and Hispanic patients presented with nAMD at younger ages (p<0.001,Table 1). 719,204 (78.3%) patients initiated anti-VEGF treatment within a year. In multivariable regression analysis (Table 2), Black (Rate Ratio[RR]=0.91, 95%CI:0.89–0.93;p<0.001) and Asian patients (RR=0.95, CI:0.93–0.97;p<0.001) were less likely to initiate treatment compared to White patients. Hispanic patients were 4% less likely to initiate treatment than non-Hispanic patients (RR=0.96, CI:0.95–0.98;p<0.001). Patients of ≥60 years (vs 50-59) had higher treatment initiation as were patients from West US (vs South). Similar results were observed among 701,309 patients with VA data. Patients with VA of <20/40–20/200 were more likely to initiate treatment (RR=1.14, CI:1.12–1.15) than those presenting with 20/20 or better VA while those with hand motion (RR=0.72, CI:0.69–0.75) and light perception or worse vision (RR=0.49, CI:0.44–0.54;all p<0.001) were less likely.

Conclusions

Over 20% of nAMD patients did not initiate treatment within a year of diagnosis. Efforts to improve treatment uptake might prioritize groups with lower initiation rates, including Black, Hispanic, and low-vision patients.

Association between Structural Changes in the Optic Nerve Head and Lamina Cribrosa Microstructure in an Experimental Glaucoma Animal Model

Abstract Number: 361 - B0286

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Purpose

Alterations to the optic nerve head (ONH) and lamina cribrosa (LC) have been described in glaucoma. We evaluate the association between in-vivo, longitudinal morphological changes in the ONH and LC microstructure in non-human primates with experimentally induced ocular hypertension.

Methods

Chronic elevated IOP was induced in one eye of each of 4 healthy adult rhesus macaques by laser photocoagulation of the trabecular meshwork. Serial OCT (Bioptigen Envisu; Leica, Chicago, IL) images of the ONH and LC were acquired longitudinally using an enhanced depth imaging protocol as the animals transition from health to fully expressed experimental glaucoma. All imaging was performed with IOP fixed to 15 mmHg by anterior chamber cannulation during imaging. LC microstructure was quantified using a previously described thresholding method. Retinal nerve fiber layer thickness (RNFLT) was measured using Iowa Reference Algorithms. OCT images were resampled radially from the disc center at 15 degree intervals, the anterior surface of the ONH was segmented using thresholding, and Bruch's membrane opening (BMO) was labeled manually. Disc area, cup area, and minimum rim width (MRW) were computed using software of our own design. Linear mixed-effect models were used to estimate the yearly rate of change and the association between rates of change in RNFLT and ONH, and LC parameters were calculated using linear regression.

Results

The animals ranged in age from 6-12 years and were followed for 236-547 days with a mean cumulative IOP difference of 3638.1 mmHg (SE = 438.1). Experimental eyes demonstrated an increase in cup area and cup-to-disc ratio (CDR) and decrease in RNFLT, disc area and MRW (Table 1). No significant changes in ONH parameters were detected in control eyes, and no significant rate of change was detected in any LC parameter in both experimental and control eyes. A significant association between average LC pore area and RNFLT, cup area, CDR and MRW in experimental eyes and a significant difference in the associations between control and experimental eyes for these parameters is present (Table 2). No association was detected between ONH parameters and beam volume and BPR.

Conclusions

In this experimental glaucoma model, structural changes are more prominent in the prelaminar RNFL and ONH than in the LC. Future sectoral analysis of the LC is anticipated.

Minimum IOP Change Required to Induce Ocular Structural Changes Beyond OCT Measurement Variability

366 - B0291

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Purpose

Many glaucoma studies involving retinal and optic nerve imaging animal models include adjusting IOP to a specific level while imaging in order to eliminate the acute effects of elevated IOP on ocular structures. This study aims to identify the IOP threshold that results in structural changes exceeding the inherent measurement variability of OCT imaging. Determining this threshold will help establish whether acute IOP adjustments are necessary before acquiring structural data in order to ensure comparability of images obtained under different IOPs.

Methods

Four adult, experimental glaucoma rhesus macaques underwent repeated imaging using the Bioptigen Envisu OCT (Leica, Chicago, IL) at both inherent (unadjusted) IOP and a fixed IOP=15mmHg. To set IOP to 15mmHg, an anterior chamber cannula connected to a fluid column was used. A total of 56 sessions during which paired scans were acquired at inherent and fixed IOP settings were analyzed. Parameters studied were macular ganglion cell inner plexiform layer (GCIPL) thickness, peripapillary retinal nerve fiber layer (RNFL) thickness, and lamina cribrosa (LC) microstructural parameters, including beam thickness, pore diameter, beam-to-pore ratio (BPR), and average pore area. A linear mixed-effects model was used to assess the association between the changes in structural parameters and the difference in IOP, accounting for repeated measurements from the same eye. Repeated scans acquired at fixed IOP level in the same sessions were used to determine measurement reproducibility.

Results

Measurement errors for average pore area and GCIPL thickness were 140.02μm2 and 3.14μm, respectively. Average pore area significantly increased with increased IOP, whereas GCIPL thickness showed a marginally positive association (Table 1; Figure 1). No statistically significant associations were identified between changes in IOP and RNFL thickness. When considering the measurements error, IOPs above 27 mmHg resulted in change of LC pore area that exceeded measurement variability and IOP>22mmHg or <10mmHg resulted in change in GCIPL thickness.

Conclusions

IOP levels affect LC pore area measurements and GCIPL thickness but not RNFL thickness. Adjusting IOP to a predetermined level may be necessary to ensure comparability depending on which parameter is measured.

Predicting change in visual field mean deviation (MD) using Normalized Compression Distances between 3D OCT images and Machine Learning

Abstract Number: 415 - B0358

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Purpose

Estimating the change in visual field (function) between pairs of OCT images (structure) of the retina is a key challenge in ophthalmology. We develop a metric distance based on lossless file compression to measure similarity between pairs of OCT images. To validate its applicability, the distance is used to predict changes in MD between OCT image pairs.

Methods

We analyze 319 pairs (215 OS pairs) of 3D OCT images of the optic nerve head (ONH) from 85 eyes (46 OS; 37 male). The images were taken from Spectral Domain OCT (Zeiss, Dublin, CA). Each pair comprises baseline and follow-up scans of the same eye. We also use MD values measured at the same time as the OCT scans' acquisition. Figure 1 illustrates our image enhancing techniques and machine learning model building. First, the images are denoised using a 3D non-local means algorithm. To enhance retinal layers and ONH structures, Laplacian of Gaussian (LoG) filters with various kernel sizes are applied to the scans. The filtered images were then compressed separately and in pair using a 3D image compression algorithm called FLIF (free lossless image format). The NCD was computed by comparing the sizes (in bytes) of the compressed images. Finally, a nonparametric probabilistic machine learning model based on Gaussian Process Regression predicts change in MD between baseline and follow-up images given baseline MD, patient baseline age, and the NCD.

Results

Figure 2 shows the outcome of our model in predicting MD change (mean = -1.13 dB, SD = 0.9) given the NCD (mean = 0.905, SD = 0.014), baseline MD (mean = -7.44 dB, SD = 10.33), and patient baseline age (mean = 60.4 years, SD = 16.6). Median of absolute error is 0.05 dB across 319 image pairs (R^2 = 0.996). 74.9% (239 pairs) of the image pairs have absolute error of less than 0.5 dB, and 57.4% (183 pairs) of the image pairs have absolute error of less than 0.01 dB. Time duration from baseline to follow-up spans up to 50.6 months (mean = 15.6, SD = 11.3).

Conclusions

Changes in 3D appearance between OCT images captured using the normalized compression distance can predict changes in VFMD with high accuracy potentially reducing the frequency of visual field tests. In future work, we intend to use the NCD as an important parameter to improve prediction and tracking of glaucoma progression, alleviating patient burden, and enhancing clinical decision-making.

An automated deep learning approach for 3D segmentation of Schlemm's Canal in healthy and glaucomatous eyes

568 - A0205

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Purpose

Chronic impairment of aqueous humour drainage from the anterior chamber of the eye can lead to elevated IOP in primary open-angle glaucoma (POAG). Schlemm's Canal (SC) serves an important role in the conventional outflow pathway and exhibits structural anomalies in POAG. 2D segmentations from OCT volumes are limited in fully capturing SC's irregular cylindrical shape. Therefore, a more robust segmentation is preferred. We propose an automated deep learning-based image processing pipeline for 3D segmentation of SC in POAG and healthy eyes.

Methods

Subjects underwent comprehensive clinical examination and anterior segment (AS) imaging with swept-source OCT (Plex Elite; Zeiss, Dublin, CA). Multiple raster scans centered on the limbus, were acquired in a 6x6x6mm (500x500x3072 voxels) region, while subjects fixated nasally and temporally. Raw OCT volumes underwent 3D non-local means filtering (Hydra Image Processor) and motion correction. A Laplacian of Gaussian (LoG) filtered OCT image was generated. SC segmentation ground truth (GT) was manually labeled by an experienced grader. An attention gated U-Net model with realistic data augmentation was trained on Raw OCT, Denoised OCT, LoG OCT, and GT label inputs. Leave-one-out-cross-validation (LOOCV) was used to assess model performance. Dice similarity coefficient (DSC) and t-Test comparison between automated and manual segmentation SC volumes were calculated.

Results

Fifteen AS-OCT scans acquired in fifteen eyes (11 POAG, 4 Healthy) were used for model training. SC was clearly visible in 72% of denoised B-scans. The algorithm successfully tracked the location of SC throughout the OCT volume 86.7% of the time (Figure). Average DSC was 0.404±0.170(Max: 0.720). SC volume measures were highly variable within and between segmentation methods. The study was not powered to detect differences in volume between automated and manual SC segmentations (p=0.088).

Conclusions

The proposed automated 3D SC segmentation algorithm can track SC to a high-degree and segment the SC with moderate accuracy, despite SC's high structural variability. This tool has shown the potential to improve metric characterization of SC. Building on this work may provide further insight into IOP dysregulation in POAG and, in turn, improve glaucoma management.

A Novel Deep Learning Model for Automated Lamina Cribrosa Pore Segmentation

601 - A0238

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Purpose

The lamina cribrosa (LC) is implicated in glaucoma pathogenesis, where its microstructural changes may serve as indicators of glaucomatous damage. Current LC microstructural analysis methods are resource-intensive and non-standard. This study evaluates a novel deep learning (DL) model designed to automatically segment LC pores in OCT scans.

Methods

300 2D spectral-domain optic nerve head (ONH) OCT slices (Bioptigen Envisu; Leica, Chicago, IL) were extracted from scans of 100 healthy non-human primate (NHP) eyes. All slices underwent LC pore segmentation using four **Methods:** manual, Difference of Gaussian filter, Contrast-Limited Adaptive Histogram Equalization (CLAHE), and DL model trained on manual segmentations only. The four segmentations of each slice were combined using the Simultaneous Truth and Performance Level Estimation (STAPLE) algorithm to generate consensus segmentations, which were used to retrain the DL model with U-Net++ and a pre-trained EfficientNet-B7 encoder. Training utilized Binary Cross-Entropy with Logits Loss, the Adam optimizer (initial learning rate: 0.001), and a step-based scheduler reducing the learning rate 0.1 every 10 epochs. Early stopping after 5 epochs of no validation loss improvement mitigated overfitting. The dataset was divided using 5-fold cross-validation, with an 80:20 training-validation split. Model performance was tested against manual segmentation on 15 ONH OCT slices from healthy and glaucomatous NHP subjects that were not used in the training set. The two segmentation methods were compared using Digital Image Correlation Engine (DICe) analysis.

Results

The mean Dice coefficient for segmentation accuracy of the DL model compared to manual segmentation was 0.627 (range: 0.518 – 0.745) in healthy subjects and 0.613 (range: 0.424 - 0.737) in glaucomatous subjects. These findings, supported by visual analysis of the segmentations, suggest the model may merge adjacent pores in regions of low signal quality (Figure 1).

Conclusions

The DL model demonstrates moderate segmentation accuracy to manual segmentation. Further training of the model on a larger dataset is needed to improve pore distinction and pore shape characteristics in low image quality regions.

Chloroprocaine hydrochloride ophthalmic gel anesthesia for intravitreal injection

1130 - B0245

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Purpose
To determine the preference of patients who were anesthesized with chloroprocaine hydrochloride ophthalmic gel (Iheezo ˃) prior to intravitreal anti-vegf injection when compared to a historical standard anesthesia prep consisting of proparacaine hydrochloride.

Methods
We performed a retrospective single-center, consecutive chart review of patients who received chloroprocaine hydrochloride ophthalmic gel prior to intravitreal injection at the Retina Service of Wills Eye Hospital (Philadelphia, PA, USA) between May 1, 2024 and June 1, 2024. These patients, who had previously received at least 4 prior intravitreal injections with a proparacaine hydrochloride solution prep, were asked following their injection which anesthetic they preferred. Comprehensive chart reviews documented anesthestic preference between chloroprocaine hydrochloride ophthalmic gel and proparacaine hydrochloride solution.

Results
A total of 81 of eyes of 81 patients met inclusion criteria for the study. Among the 81 patients that received chloroprocaine hydrochloride ophthalmic gel, 49% (n=40) of patients preferred chloroprocaine hydrochloride ophthalmic gel (p= 0.0136) over the standard proparacaine hydrochloride prep, 20% (n=16) of patients preferred the previous proparacaine hydrochloride standard prep and 31% (n=25) of patients had no preference between the two anesthetic preps. There were no significant adverse events reported.

Conclusions
While not all patients preferred chloroprocaine hydrochloride ophthalmic gel, 80% found it to be equivalent to or better than proparacaine hydrochloride solution. This study suggests that there may be a role for chloroprocaine hydrochloride ophthalmic gel when anesthetizing eyes for intravitreal injections.

The Association between Neighborhood Area Deprivation Index (ADI) and *Functional* or *Structural* Parameters at Presentation for Patients who underwent Minimally Invasive Glaucoma Surgery (MIGS)

1680 - B0415

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Purpose

To evaluate the association between socioeconomic status, represented by patient's ADI and functional and structural parameters at initial evaluation for subjects who underwent MIGS.

Methods

Medical records of subjects with glaucoma who underwent MIGS in a tertiary care center in Pennsylvania were retrospectively reviewed (2008-2017). Subjects were included if they had ≥1 preoperative visual field (VF) test (Humphrey Field Analyzer; Zeiss, Dublin, CA). Subgroup analysis included those with ≥1 Macular and Optic Nerve Head OCT (Cirrus, HD-OCT, Zeiss). Baseline data were obtained from the first recorded visit. ADI was used as a socioeconomic proxy, with higher scores matching to greater levels of deprivation. Addresses were geocoded to census tracts and matched to their corresponding ADI. Univariate and multivariate regressions adjusting for race, gender, and age were employed to evaluate the association between ADI and baseline *functional* (Visual Field Index [VFI] and Mean Deviation [MD]) and *structural* (Cup Volume [CV], Average Cup-to-Disc Ratio [CDR], Disc Area [DA], Rim Area [RA], Retinal Nerve Fiber Layer [RNFL], and Ganglion Cell-Inner Plexiform Layer [GCIPL]) parameters.

Results

43 eyes met the criteria for functional analyses (49% females, 65% White and 30% Black). Procedures performed included ab-interno trabeculotomy (70%), iStent *inject* trabecular micro-bypass (Glaukos) (16%), and limited goniotomy (14%). Univariate analysis for functional parameters showed a higher ADI was associated with a lower VFI at presentation (p=0.036) (Table 1), though this relationship lost significance in multivariable analysis. Males had a lower MD (p=0.043) while Black subjects had lower VFI (p=0.009) and MD (p=0.017) at presentation. 37 eyes met the criteria for structural analyses. Univariate analysis showed no significant association between ADI and structural parameters (Table 2). Multivariate analysis showed that males have larger CV and smaller RA.

Conclusions

For patients who underwent MIGs, living in a neighborhood with greater deprivation is associated with a lower visual function at baseline, though this is not significant after controlling for race, gender and age. Lower baseline visual function in Black subjects may suggest racial disparities play a more critical role than socioeconomic status alone.

Socioeconomic Status and Functional Parameters *at Presentation* and *at the Visit Before Surgery* for Patients who underwent Tube Shunt Surgery

1692 - B0427

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Purpose

To investigate whether there is a relationship between socioeconomic status, as measured by a subject's Neighborhood Area Deprivation Index (ADI), and their functional assessments *at presentation* and *at the preoperative visit* in patients undergoing tube shunt surgery.

Methods

Medical records of glaucoma patients who underwent Tube Shunt Surgery (Ahmed Glaucoma Implant (AGI), Baerveldt Glaucoma Implant (BGI), or both) at a tertiary care center in Pennsylvania were retrospectively analyzed. Subjects were included if they had more than one preoperative visual field (VF) test (Humphrey Field Analyzer; Zeiss, Dublin, CA). Data were collected from the first visit and the latest visit prior to the surgery date. ADI served as a proxy for socioeconomic status, with higher scores indicating greater deprivation. Addresses were geocoded to census tracts and matched to their corresponding ADI scores. Univariate and multivariate regression analyses, controlling for race, gender, and age, were conducted at two time points (initial presentation and the visit prior to surgery) to examine the relationship between ADI and functional measures, including Visual Field Index (VFI) and Mean Deviation (MD).

Results

The sample contained 90 eyes. 57% were women, and 69% of eyes came from white and 31% were from black subjects. In the cohort, 30 received AGIs, 50 received BGIs, and 10 received both tubes. Univariable analysis for functional parameters showed an increased ADI was associated with a lower VFI/MD *at initial presentation*; however, this relationship was no longer significant in multivariable analysis (Table 1). In addition, Black subjects had a lower VFI at presentation. When evaluating the parameters *at the visit preceding surgery*, there was no significant association between ADI and functional parameters in either univariate or multivariable analysis (Table 2). However, in multivariable analysis, Black subjects had a lower VFI and MD.

Conclusions

Our univariate results reveal that for subjects who eventually underwent tube shunt surgery, living in an area with more deprivation is associated with reduced visual function at initial presentation, although this disparity no longer persists by the visit preceding the surgery.

Readability of retina patient education materials generated with a large language model

1727 - B0462

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Purpose

Assess the utility of large language models to improve the readability of patient education materials

Methods

PDF documents from the American Society of Retina Specialists' Retina Health Fact Sheets website were downloaded in November of 2024 [ASRS fact sheet]. There were 41 fact sheets, each representing a medical or surgical vitreoretinal condition. The large language model Generative Pre-trained Transformer 4 (GPT-4) was accessed through ChatGPT in November of 2024 to generate patient education materials on the same 41 conditions. The language model was prompted with the following questions: What is this condition? How is this condition treated? Will I lose my vision from this condition [GPT-4 response]? The model was then prompted to adjust the output to a sixth grade reading level [GPT-4 enhanced response]. The model was also prompted to enhance the readability of each of the ASRS fact sheets to a sixth grade reading level [ASRS enhanced]. The various responses for each of the 41 conditions were then analyzed through an online readability calculator [https://readabilityformulas.com]. The Average Reading Level Consensus Calc scores were recorded.

Results

The mean Average Reading Level Consensus Calc (ARLCalc) scores for the ASRS Fact Sheet was 12.85 (±0.89), which was different than that of the ASRS enhanced [9.37 ±1.09, $p<0.001$], GPT-4 [12.37 ±0.97, $p=0.02$], and GPT-4 enhanced [8.66 ±0.87, $p<0.001$] responses respectively. The average word count for the ASRS Fact Sheets, ASRS enhanced, GPT-4 response, and enhanced GPT-4 responses 967.2 (±563.9), 537.1 (±147.4), 368.6 (±59.3) and 271.8 (±49.7), respectively. The average sentence length (words) for the ASRS Fact Sheets, ASRS enhanced, GPT-4 response, and enhanced GPT-4 responses was 19.6 (±3.41), 14.5 (±3.2), 14.78 (±3.04), and 14.88 (±2.19), respectively. The average number of syllables per word for the ASRS Fact Sheets, ASRS enhanced, GPT-4 response, and enhanced GPT-4 responses was 1.75 (±0.07), 1.56 (±0.06), 1.83 (±0.10), and 1.49 (±0.07), respectively.

Conclusions

Large language models may be utilized as a tool to improve the readability of patient-facing text, which may improve the accessibility and impact of these materials. Careful review of patient education materials by specialty-trained authorship committees remains the gold standard for providing accurate medical information to patients.

Normative OCT-Derived Ocular Parameters and Their Relationship to Image Quality and Demographic Features in Healthy Rhesus Macaques

Abstract Number: 1948 - A0046

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Purpose

Rhesus macaques (*Macaca mulatta*) are common animal models in ophthalmic research. However, the availability of large-scale normative ocular datasets from this species is limited. In this cross-sectional, observational study, we characterize select OCT-derived ocular features in healthy rhesus macaques and investigate their associations with demographic traits and image quality.

Methods

Demographic data and *in vivo* spectral-domain OCT scans (Bioptigen Envisu, Leica, Chicago, IL) of the macula, optic nerve head (ONH), and lamina cribrosa (LC) were obtained from 52 healthy animals. Image quality was rated subjectively on a scale of 1-5, with 90 eyes deemed to have satisfactory (≥3) quality scores for all three regions. Macula and ONH scans were segmented automatically using OCTExplorer 3.8.0 and corrected manually, when needed, to measure macular retinal nerve fiber layer (RNFL), macular ganglion cell inner plexiform layer (GCIPL), and peripapillary RNFL thicknesses globally and by quadrant. Measured axial length (AL) was accounted for when assessing thickness. LC microstructure was quantified using previously-reported software of our own design. Linear mixed-effects models (LMM) were used to assess the association between OCT-derived ocular parameters and factors such as age, sex, weight, IOP, AL, body length, and image quality, with subsequent Benjamini-Hochberg multiple comparison adjustment.

Results

Descriptive statistics for all parameters are detailed in Table 1. Select results from the LMM are included in Table 2. Significant differences were observed in mean ($p=0.050$) and maximum ($p=0.050$) LC beam thickness by sex. On average, males exhibited a mean beam thickness 3.32±1.22 μm thinner and a maximum beam thickness 5.77±2.05 μm thinner than females. All LC parameters were strongly associated with image quality (each $p<0.001$). No other significant associations between variables were detected.

Conclusions

In a large cohort of healthy rhesus macaques, demographic features had minimal impact on OCT-derived ocular measurements, with the exception of the impact of sex on LC beam thickness. LC microstructure measurements are significantly influenced by image quality, which should be routinely assessed before analysis.

Do Cynomolgus and Rhesus Macaques Have Similar Retinal and Optic Nerve Head Structure and Biomechanics?

Abstract Number: 1949 - A0047

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Purpose

The close evolutionary relationship and anatomical and functional similarities between human and non-human primate (NHP) eyes make them an ideal animal model for ocular research. Occasionally, multiple NHP species are used interchangeably for practical reasons. In the context of glaucoma and biomechanics research, cynomolgus (Macaca fascicularis) and rhesus (Macaca Mulatta) macaques have often been used. In this study we examine if the physical differences between these species are accompanied with ocular structural and biomechanical difference.

Methods

Four healthy adult rhesus and 4 cynomolgus underwent the measurement of IOP (Tono-Pen AVIA Vet Reichert, Depew, NY), central corneal thickness (CCT) and axial length (AL; Escalon, Sonomed, Lake Success, NY) and OCT (Bioptigen Envisu; Leica, Chicago, IL) imaging. OCT imaging was obtained in vivo at both 15 and 30mmHg by cannulating the anterior chamber of the eyes and adjusting the height of a column of fluid. Macula (ganglion cell inner plexiform layer (GCIPL)) thickness, peripapillary (retinal nerve fiber layer (RNFL)) thickness and lamina cribrosa (LC) microstructure (beam-to-pore ratio (BPR)), were measured at the 15mmHg setting. IOP modulation enabled the estimation of LC biomechanical properties from the corresponding OCT scans. Univariate analyses were applied to compare demographic, structural, and biomechanical parameters between species. Structural and biomechanical measurements were also compared using multivariate linear mixed effect model while adjusting for sex, age, weight, IOP, AL, CCT and inter-eyes correlations.

Results

Rhesus were statistically significantly heavier than Cynomolgus. They also had higher IOP, longer AL and thicker CCT. No significant differences were detected in GCIPL and RNFL thickness or BPR and average stretch in univariate analysis (Table 1). When accounting for the co-variables in the multivariate analysis, significant differences between species were detected for GCIPL and RNFL thicknesses. No significant difference was detected for the biomechanics in either analysis.

Conclusions

Structural measurements from the retina and peripapillary regions of cynomolgus and rhesus cannot be treated interchangeably, though some of the LC structural and biomechanical parameters are similar in the two species.

Proportion of Eyes Achieving Absence of Diabetic Macular Edema and Very Good Vision: A Post Hoc Analysis of the Diabetic Retinopathy Clinical Research Network Protocol AC

2394 - B0081

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Disclosures: Bita Momenaei: Code N (No Commercial Relationship) | Raziyeh Mahmoudzadeh: Code N (No Commercial Relationship) | Mirataollah Salabati: Code N (No Commercial Relationship) | Hannah J. Lee: Code N (No Commercial Relationship) | Jason Hsu: Consultant: Bausch + Lomb, Gyroscope Therapeutics, and Iveric Bio: Code C (Consultant/Contractor): none; Grant support: Aldeyra Therapeutics, Genentech/Roche, and Iveric Bio: Code F (Financial Support): none

Purpose
To evaluate central foveal thickness (CFT) and visual acuity (VA) changes by applying bevacizumab-to-aflibercept switch criteria to aflibercept-first eyes and comparing four groups: aflibercept-only, aflibercept switch-eligible, bevacizumab-only, and bevacizumab switched to aflibercept.

Methods
Of 312 eyes, 28 were excluded due to loss to follow-up, death, or insufficient visits. Absence of diabetic macular edema (DME) was defined as achieving normal CFT thresholds of ≤320 µm (men) and ≤305 µm (women) on Spectralis, and ≤305 µm and ≤290 µm, respectively, on Cirrus. Very good vision was defined as VA≥20/25 or ≥80 ETDRS letters.

Results
Baseline CFT and VA were comparable between groups. In the aflibercept-only group, 95% (93/98) achieved absence of DME vs. 84% (37/44) in the bevacizumab-only group (P=0.05). The mean time to normal CFT was 12 and 14 weeks, respectively (P=0.44). Among eyes achieving normal CFT, worsening occurred in 60% and 62% (P>0.99), after a mean of 38 and 29 weeks, respectively (P=0.35). In the aflibercept switch-eligible group, 53% (25/47) achieved absence of DME vs. 66% (63/95) in the bevacizumab-switch group (P=0.15). The mean time to normal CFT was 33 and 41 weeks, respectively (P=0.12). Among eyes achieving normal CFT, worsening occurred in 72% and 67% (P=0.8), after a mean of 24 and 18 weeks, respectively (P=0.08). In the aflibercept-only group, 79% achieved VA ≥20/25 vs. 84% in the bevacizumab-only group (P=0.5), after a mean time of 22 and 24 weeks, respectively (P=0.96). Among eyes achieving very good vision, worsening occurred in 81% and 78% (P=0.81), after a mean of 14 and 20 weeks, respectively (P=0.04). In the aflibercept switch-eligible group, 47% achieved VA ≥20/25 vs. 57% in the bevacizumab-switch group (P=0.29), after a mean time of 33 and 46 weeks, respectively (P=0.11). Among eyes achieving very good vision, worsening occurred in 100% and 87% (P=0.1), after a mean of 16 and 9 weeks, respectively (P=0.25).

Conclusions
More eyes in the aflibercept-only group achieved absence of DME compared to the other groups. However, no significant differences were found in proportion of eyes that achieved very good vision when comparing aflibercept-only, aflibercept switch-eligible, bevacizumab-only, and bevacizumab switched to aflibercept groups.

Using OCT Angiography to Predict Visual Field Changes in Glaucoma

Abstract Number: 3321

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Purpose

Optical Coherence Tomography Angiography (OCTA) is a non-invasive imaging tool that captures the retinal microvasculature in glaucoma. This study evaluates the ability of macular OCTA parameters to predict future visual field (VF) parameters.

Methods

Subjects were included if they had a qualified 6×6-mm macular OCTA scan (Cirrus HD-OCT; Zeiss, Dublin, CA) with a corresponding VF test (Humphrey Field Analyzer: Zeiss) at baseline and at least 2 subsequent VF tests, within a follow-up period of ≥6 months. Qualified OCTA scans had signal strength >6, with no imaging artifacts or macular or systemic diseases resulting in ocular structural changes. A linear mixed-effects model, adjusted for age and signal strength, utilized baseline OCTA parameters (foveal avascular zone [FAZ] area, FAZ perimeter, FAZ circularity index, vessel density, and perfusion) along with the first two VF tests to predict the third VF test.

Results

A total of 64 eyes of 45 subjects were included (mean age: 59.8±13.8 years). At baseline, mean MD was -4.64±7.33 dB and VFI was 87.19±21.21%. Mean follow-up duration from the first VF test (at baseline) and the third VF test was 670.6±309.3 days. The Spearman correlation coefficient between predicted and observed values for the third VF test were r_s=0.87 for MD and 0.88 for VFI. FAZ circularity index was significantly and positively associated with MD, suggesting that greater FAZ circularity is associated with greater MD (Table 1). FAZ area, perimeter and circularity were significantly associated with VFI, suggesting that smaller FAZ area and greater FAZ perimeter and circularity are associated with greater VFI (Table 2). No significant associations were detected for vessel density and perfusion with both MD and VFI.

Conclusions

Our study demonstrated significant associations between OCTA FAZ variables and longitudinal VF parameters, highlighting their potential role in predicting functional damage in glaucoma. These findings suggest that macular FAZ parameters measured by OCTA may be useful biomarkers in predicting functional damage in glaucoma.

Ultra-responders to faricimab: ≥4-step improvement in diabetic retinopathy severity in YOSEMITE/RHINE

3799 - B0020

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Purpose
Faricimab, a dual angiopoietin-2/vascular endothelial growth factor-A inhibitor, is effective for treatment of patients with diabetic macular edema (DME). In the YOSEMITE/RHINE trials, over 40% of patients with DME achieved ≥2-step improvement in Diabetic Retinopathy Severity Scale (DRSS) from baseline. The purpose of this post hoc analysis was to characterize patients who had ≥4-step improvement in DRSS (ultra-responders).

Methods
YOSEMITE/RHINE (NCT03622580/03622593) were phase 3 trials that evaluated faricimab 6.0mg every 8 weeks (Q8W) and 6.0mg treat-and-extend (T&E) Q4W-Q16W for DME. In this post hoc analysis, patients in the pooled faricimab groups with baseline DRSS score ≥47 were classified as ultra-responders if they achieved ≥4-step improvement in DRSS from baseline at year 1 (week 52) and/or year 2 (week 96). The association between baseline variables and ultra-response was examined using ANOVA and Fisher's exact chi-square tests, and univariate logistic regression was used to generate the odds ratio of being an ultra-responder.

Results
At baseline, 42.2% (506/1199) of patients in the pooled faricimab groups (with ≥1 post-baseline score) had DRSS score ≥47 (8.3% [99/1199] ≥61). At year 1 and year 2, 12.9% (55/428) and 15.6% (59/378) of patients were classified as ultra-responders to faricimab. For patients who were ultra-responders vs non-ultra-responders, the number of faricimab injections through year 1 (mean[SE], 8.9[0.2] vs 9.1[0.1]) and after year 1 (mean[SE], 4.5[0.2] vs 4.4[0.1]) were similar, and gains in best corrected visual acuity (BCVA) letters from baseline at year 1 (mean[95%CI] 12.6[9.6-15.6] vs12.9[11.8-13.9]) and year 2 (mean[95%CI] 15.6[12.6-18.5] vs 14.4[13.3-15.4]) were similar. At year 1, baseline characteristics of worse DRSS (score ≥61) and increase in diastolic blood pressure were associated with ultra-response (Figure). At year 2, baseline characteristics of age <50 years and worse DRSS were associated with ultra-response (Figure).

Conclusions
In YOSEMITE/RHINE at 2 years, almost 16% of eyes experienced an ultra-response (≥4-step improvement in DRSS) to faricimab, accompanied by improvements in BCVA, demonstrating that faricimab can dramatically improve diabetic retinopathy in some patients with DME. Ultra-response was associated with being younger and having worse DRSS score at baseline, which may help physicians identify faricimab ultra-responders.

Microglia-induced neuronal injury attenuation with C1q Inhibition: Outcomes in Geographic Atrophy (GA) and Huntington's Disease (HD)

4105 - A0103

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Purpose
Complement plays a role in both GA and HD. In HD, activation of the classical complement pathway, initiated by C1q binding to substrates on neurons, ultimately leads to microglia-induced neuronal injury and loss. In this study we explore the relationship between preservation of visual acuity and reduction in ellipsoid zone (EZ) loss in GA and evaluate outcomes in HD to better understand the role of C1q inhibition in neuroprotection against loss of neuronal synapses across these neurodegenerative diseases.

Methods
In ARCHER (NCT04656561), 270 patients were randomized 1:1:1 to intravitreal (IVT) administration of ANX007 5 mg monthly (EM), 5 mg every other month (EOM), or matched sham for 12 months. In prespecified analyses, 15-letter best-corrected visual acuity (BCVA) loss at 2 consecutive visits and changes from baseline in ellipsoid zone (EZ) loss and retinal pigment epithelium (RPE) loss were determined. Additional analyses were conducted to evaluate the effect of ANX007 on several other visual and anatomic outcomes. In the ANX005 phase 2 study in HD patients (NCT04514367), 28 patients were treated with IV infusion of ANX005 every 2 weeks (following initial infusion on Days 1 and 5 or 6) and then followed off-treatment for 12 weeks. Clinical function in HD was measured, using the Composite Unified Huntington's Disease Rating Scale (cUHDRS) and the Total Functional Capacity (TFC) scale.

Results
In ARCHER, at 12 months, fewer EM- and EOM-treated eyes had BCVA ≥15 letter loss compared to sham (nominal p=0.0021 and p=0.032, respectively); risk reduction for BCVA ≥15 letter loss was 72% and 48%, for ANX007 EM and EOM vs. sham, respectively. Reduction in EZ loss in pooled EM- and EOM-treated eyes vs sham was 29% (EM and EOM were not statistically different). In HD, Treatment with ANX005 resulted in improved clinical function in HD, based on the cUHDRS and the TFC scale.

Conclusions
ARCHER results suggest that inhibition of C1q with ANX007 conveys a drug-related photoreceptor protective effect that may explain the associated prevention of VA loss. In GA and HD, inhibition with C1q conveys neuroprotective effects, suggesting that anti-C1q therapy may provide neuroprotection against inflammation and neuronal damage and loss induced by downstream complement components.

Retrospective Clinical Analysis of Non-Arteritic Anterior Ischemic Optic Neuropathy (NAION) in Patients Using Semaglutide

4315 - A0407

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Purpose

Semaglutide use has been linked to an increased risk of Non-Arteritic Anterior Ischemic Optic Neuropathy (NAION), independent of medical comorbidities. However, the clinical characteristics and progression of NAION in semaglutide users remain poorly understood. This study aims to fill that gap by reviewing the clinical presentation and outcomes of patients diagnosed with NAION while using semaglutide.

Methods

A retrospective chart review of patients on semaglutide diagnosed with NAION (independently confirmed by two neuro-ophthalmologists) at a tertiary referall center was performed.

Results

Eight eyes from eight patients were included. Six patients were male, and the average age was 61.5 years (SD 7.0 years). All patients had body mass index > 25 and hypertension. All patients started semaglutide less than one year before initial NAION onset (mean 6.3 months, SD 4.7 months). All patients were on one or more antihypertensive medications (mean 1.9 medications, SD 1.0 medications). The average number of anti-diabetic medications was 3.2 (SD 1.3 medications). Seven patients experienced weight loss ≥ 5% of total body weight in the month prior to NAION onset. Four patients had at least one hypotensive blood pressure measurement a week prior to NAION onset. All patients had a cup to disc ratio ≤ 0.15 in the fellow eye. Six patients were treated with steroids and three patients discontinued semaglutide following NAION. Average follow up time was 4 months (SD 2 months), and only one patient had significant improvement in visual field defects following NAION.

Conclusions

All eight patients with NAION while taking semaglutide had other risk factors known to be associated with increased risk of NAION. Rapid weight loss on semaglutide may lead to greater fluctuations in blood pressure, which may predispose susceptible patients to increased NAION risk. Patients experiencing NAION on semaglutide rarely experienced improvement of symptoms with either steroid treatment and/or semaglutide discontinuation.

Genetic Susceptibility to Ocular Sarcoidosis: A Comparative Analysis of Genome-Wide Association Studies

4354 - B0009

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Purpose
Sarcoidosis often affects the eye with challenging clinical manifestations requiring skilled management, but genetic factors contributing to ocular involvement are poorly understood. We performed a phenotypic and ethnic analysis of variants established by genome wide association studies (GWAS) to explore pathogenesis of ocular sarcoidosis (OS) and differences in disease phenotype and severity across ethnicities.

Methods
Variants associated with sarcoidosis ($p \leq 10^{-6}$) were identified through GWAS and analyzed by ethnic ancestry and phenotype, including ocular sarcoidosis. Inclusion criteria required sarcoidosis definitions based on ICD codes, with loci supported by immune-related literature highlighted.

Results
169 associations from 30 GWAS were included, with 683 cases of OS (88% African American [AA], 22% European ancestry [EU]; 14,275 healthy controls [HC]) and 25,939 cases of systemic sarcoidosis (8% AA, 85% EU, 7% EA; 1,114,876 HC). 25 loci were unique to OS, including *MAGI1* ($p = 10^{-8}$, OR = 2.0, CI95[1.6-2.6]) and *ANKRD20A5P* ($p = 10^{-10}$, OR = 2.5, CI95[1.9-3.4]) Both were only associated with OS in AA. Nine loci were associated with both OS and other systemic manifestations of sarcoidosis. All of were HLA genes including *HLA-DQB1*, which was observed across AA, EU, and EA (AA: $p = 10^{-7}$, OR = 2.2, CI[1.7,2.9]; EU & EA: $p = 10^{-15}$, OR = 2.1, CI95[1.8,2.5]). 104 loci were associated with non-ocular manifestations of sarcoidosis, including *C1orf141* (AA: $p = 10^{-10}$, OR = 1.24, CI95[1.2-1.3]; EU & EA: $p = 10^{-12}$, OR = 1.87, CI95[1.6-2.2]).

Conclusions
Our study identified multiple loci associated with ocular sarcoidosis (OS), with distinct genetic susceptibility across ethnic groups. These findings provide new insights into the genetic underpinnings of OS, paving the way for future research aimed at improving diagnosis, treatment, and prognostication.

Faricimab for Coats Disease

4701 - A0027

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Purpose
To describe our experience with the off-label use of intravitreal faricimab injections in the care of patients with Coats disease.

Methods
This is a multicenter interventional case series of 11 patients with Coats disease who received faricimab injection(s) (range: 1 to 12 injections) at 3 institutions. Changes in vision, OCT parameters, and exudation were analyzed using paired t-tests. A p-value of <0.05 was considered statistically significant.

Results
Seven (63.6%) patients were male, with median ages of 28 (range 5-67) at time of diagnosis and 37 (11-71) at the time of first faricimab injection. Seven (63.6%) had prior laser treatment, 3 (27.3%) had cryotherapy, 10 (90.9%) had previous intravitreal injections (median 7 injections, range 0-23), none being treatment naïve at the time of their first faricimab treatment. Five of 11 (45.5%) patients had subretinal fluid at treatment initiation, compared to 0/11 (0.0%) at time of last evaluation (p <0.05), though there was no statistically significant change in intra-retinal fluid. The disc diameters of macular exudation decreased with faricimab treatment (p<0.05). Peripheral exudation trended similarly but there was insufficient data for statistical analyses. There was no significant change in visual acuities or disease stage. There were no cases of intraocular inflammation.

Conclusions
This pilot study is the first to describe the effects of faricimab in Coats disease. Faricimab was effective in decreasing macular exudation and subretinal fluid in this heterogeneous study cohort. Further controlled studies would be warranted to investigate the potential benefits of VEGF-A and Ang-2 dual inhibition to promote vascular stability in Coats disease.

The Impact of Prior Selective Laser Trabeculoplasty on Goniotomy Outcomes in Glaucoma Patients

5073 - B0264

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Purpose
To assess the success of goniotomy in glaucomatous eyes that have undergone prior selective laser trabeculoplasty (SLT).

Methods
Adult patients with a past history of SLT that underwent goniotomy at our tertiary referral center from 2018 to 2023 were included along with a matched control group of patients that underwent goniotomy without a past history of SLT. Goniotomy was performed using Kahook Dual Blade (KDB), bent ab interno needle goniectomy (BANG), gonioscopy-assisted transluminal trabeculotomy (GATT), or OMNI. Data on preoperative and postoperative parameters including baseline demographics and history, intraocular pressure (IOP), visual acuity (VA), and number of medications (NOM) were collected. Surgical failure was defined as less than 20% reduction in IOP at 2 consecutive visits after 3 months, IOP > 21 or < 6 mmHg at 2 consecutive visits after 3 months, no reduction in NOM at 2 consecutive visits after 3 months, progression to no light perception (NLP) vision, or any further glaucoma surgery.

Results
25 eyes of 24 patients were included in the study group along with 25 eyes of 25 patients in the control group, with a mean age of 65.6 ± 14.9 years. Patients in the study group had an average of 35.0 ± 47.8 months between SLT and goniotomy (range 1.0-180.1 months). IOP and NOM were similar between groups at baseline. No significant difference was observed in goniotomy technique used between groups. Surgical failure occurred in a total of 14 eyes (56.0%) in the study group and 18 eyes (72.0%) in the control group, with a cumulative survival of 0.780 and 0.594 at 1 year respectively; the difference between survival functions was statistically significant (P=0.044).
Reasons for surgical failure included < 20% reduction in IOP, no reduction in NOM, and further glaucoma surgery. There was no significant association between failure rate and surgical technique or time elapsed between SLT and goniotomy. No significant complications were observed in either group during follow-up.

Conclusions
Goniotomy regardless of technique is safe and well-tolerated in glaucoma patients with a history of SLT and can be considered for the management of these patients.

The Association Between Vasculature and Oxygenation Measured by OCT-Angiography and Visible Light OCT

Abstract Number: 5697 - B0238

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Purpose

Emerging technologies, including OCT-Angiography (OCT-A) and visible light OCT (vis-OCT), are advancing our understanding of the role of vasculature and oxygenation of the optic nerve head (ONH) and macula (MAC). We aim to evaluate the association of vasculature evaluated by OCT-A and oxygenation evaluated by vis-OCT in healthy, glaucoma, and glaucoma suspect groups.

Methods

Subjects with qualified visual fields (VF) (Humphrey Field Analyzer: Zeiss, Dublin, CA), structural OCT (Cirrus HD-OCT; Zeiss), OCT-A and vis-OCT were included. OCT-A scans measured sectoral vessel density and perfusion via 3x3mm^2 scans of ONH and MAC. Rectangle raster 1x1mm^2 scans of ONH were obtained with prototype vis-OCT device. Adaptive spectroscopic analysis was performed using short-time Fourier transformation. Averaged wavelength-dependent OCT amplitudes were fitted to hemoglobin absorption profile using Beer-Lambert's law. For each subject, oxygen saturation (sO_2) from all arteries and veins were averaged. Pearson's correlation coefficients were calculated between OCT-A vessel perfusion and density and vis-OCT averaged arterial sO_2, venous sO_2, and arterial-venous sO_2 difference.

Results

OCT-A and vis-OCT scans were obtained from 7 healthy eyes (6 subjects: 4 males, 2 females, average age: 52±23 years) and 12 glaucoma and glaucoma suspect eyes (10 subjects: 5 males, 5 females, average age: 63±12 years). Average VF mean deviation was 0.50±2.4 dB in the healthy group and -6.64±7.06 dB in the glaucoma group (p=0.007). Average RNFL thickness was 89.7±9.69 µm in the healthy group and 68.5±9.47 µm in the glaucoma group (p=0.001). Significant correlations between arterial sO_2 and full zone and inner zone vessel densities and perfusions were found in the ONH and MAC ($p<0.05$; Table 1 and 2). No significant correlations were found between arterial sO_2 and central zone vessel densities and perfusions. Additionally, no correlation was found between OCT-A parameters and venous sO_2 or arterial-venous sO_2 difference.

Conclusions

Arterial sO_2 was correlated to global vessel density and perfusion, but not to central vessel density and perfusion, indicating the central zone may not be a strong biomarker for vascular change in glaucoma.

Precision, Accuracy, and Adherence for At-Home Clustered Visual Field Testing Using a New Psychophysical Procedure

5727 - B0268

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Purpose

The psychophysical procedure in conventional static automated perimetry is fatiguing, which limits the amount of data that can be collected during a test, and thus the accuracy and precision of the test. A new 10-session test (VVP-10) uses a 6-alternative, optional-choice, natural fixation procedure that was designed to not be fatiguing, for at-home virtual reality (VR) testing (Chia et al, Ophth Glau 2024). We modified this test to use a 3-down-1-up staircase procedure, modeled by Backus et al (ARVO 2024). Here we assess initial results from this test.

Methods

1 glaucoma patient and 3 controls were recruited at Wills Eye Hospital as of data cutoff (12/4/24). Participants were provided with mobile VR headsets (DPVR P1 Pro) and trained in person and with built-in tutorial software. Stimulus positions had the Humphrey (HFA) 24-2 layout. Blind spot locations were identified by a separate 2-minute test, and fixation losses were monitored using the Heijl-Krakau method. Subjects were tasked with completing a “bundle” of 10 test sessions over a 5-day period. Precision was assessed using a resampling procedure to measure standard error, which is possible for longer tests such as this one that collect sufficient data. Accuracy was assessed by comparing responses pointwise with HFA 24-2 SITA Standard tests taken within 3 months. Adherence was the fraction of tests completed at home.

Results

All 4 adult participants completed their bundle of 10 at-home tests, resulting in 8 eyes for analysis. During their bundles, one subject adopted a novel fixation strategy that allowed them to see blind-spot stimuli. The subject was able to correct their behavior and they collected 6 additional sessions. Mean sensitivity had a precision (SE) of 0.18 dB for glaucoma and from 0.15 to 0.26 dB in controls. Pointwise Pearson correlation between the new test and HFA was r = 0.59 to 0.77 in glaucoma, and from r = 0.34 to 0.81 in controls. Measured sensitivity was systematically lower than HFA by 6±1 dB.

Conclusions

Initial results replicate previous findings of high adherence and excellent precision for the at-home test. It is accurate (agrees with HFA) after calibration by 6 dB. Future research will measure the necessary calibration precisely and evaluate how effectively the test can track glaucoma disease progression and stability.

Analysis of the Lamina Cribrosa: A Comparison of OCT Image Processing Methods

5393 - A0279

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Purpose

The lamina cribrosa (LC), is a complex porous structure within the optic nerve head previously linked to glaucoma. A reliable, automated microstructure segmentation of the entire LC volume is desirable to better understand the lamina's involvement in the glaucomatous process. The purpose of this study is to compare the outcomes of quantitative structural measurements using various image processing methods, including thresholding, Frangi, and difference of Gaussian (DoG), to identify the optimal approach for lamina microstructure segmentation.

Methods

16 eyes from 16 healthy rhesus macaques were included in this analysis. The LC was scanned using OCT (Bioptigen Envisu; Leica, Chicago, IL). A mask was created from each image to isolate a region of interest that was analyzed by the methods to provide automated measurements of LC's beams and pores. Image thresholding was based on predefined threshold levels. Frangi's vesselness filter was previously described. DoG method subtracts different Gaussian blurred versions of an image, aiming to reduce noise while preserving spatial information. 8 LC quantitative parameters were generated: pore count, total pore area, average pore size, pore perimeter, pore circularity, pore solidity, beam to pore ratio, and connective tissue volume fraction. Measurements obtained by these methods (including various threshold levels for the DoG method) were compared with the gold standard (GS) measurements established using STAPLE, an expectation-maximization based algorithm, generated from manual pore segmentations by 3 independent raters. Within-subject coefficient of variation (WSCV) and principal component analysis (PCA) were then calculated.

Results

Higher DoG filter thresholds resulted in smaller pores than in lower threshold levels (Figure1). The lowest variation in measurements compared to the GS, indicated by the lowest WSCV, was observed for the Thresholding, DoG0.01, and DoG0.03 filters. PCA further identified the different profiles within the dataset, highlighting DoG0.01 as the method which most closely aligns with the GS (Figure2).

Conclusions

When compared to the STAPLE-generated GS, the quantitative LC parameters generated by the DoG0.01 filter demonstrated the closest alignment across both statistical analyses. These findings offer a step forward in optimizing the challenging analysis of the LC, contributing to a more reliable assessment of this complex structure.

Characteristics of Patients Who Were Dismissed from A Retina Practice

5764 - B0360

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Purpose
The purpose of this study was to examine the characteristics of patients who were dismissed from a retina practice.

Methods
A retrospective chart review of patients who were dismissed from a large academic private retina practice with offices in urban and suburban locations in the Northeast U.S. between 8/1/2017 and 6/30/2024 was done.

Results
Out of 174,250 patients within the study period, 432 (0.25%) were dismissed. The most common reason for dismissal was noncompliance with physician recommendations including medical or surgical treatments in 260 (60.2%) patients, followed by aggressive or inappropriate behavior in 78 (18.1%)— this behavior included verbal abuse, threats, yelling, refusal to follow masking policies, visible intoxication, and sexual harassment. Other reasons include self-termination in 53 (12.3%), lack of confidence in care in 24 (5.6%), financial in 10 (2.3%), and unspecified or other reason in 7 (1.6%). For both dismissed and retained patients, the 4 most common diagnoses were diabetic retinopathy (DR), age-related macular degeneration (AMD), lattice degeneration (LD) and/or retinal break(s), and rhegmatogenous retinal detachment (RRD). The incidences in dismissed vs. retained patients were 116/432 (26.9%) vs. 17,293/173,811 (9.9%) for DR ($p<0.001$), 46/432 (10.6%) vs. 24,536/173,811 (14.1%) for AMD ($p=0.038$), 43/432 (10%) vs. 10,722/173,811 (6.2%) for RRD ($p=0.003$), and 38/432 (8.8%) vs. 17,829/173,811 (10.3%) for LD and/or retinal break(s) ($p=0.34$). The mean (SD) age for the dismissed group vs. retained is 55.2 (24.9) vs. 66.3 (17.1) years ($p<0.001$). The dismissed group had a significantly higher proportion of males compared to the retained group (56.7% vs. 34.8%; $p<0.001$).

Conclusions
Patient dismissals occur rarely; however, some may be due to serious incidents. Dismissed patients were younger, more likely to be male, and more commonly diagnosed with DR, AMD, and RRD. Examining reasons for dismissal and patient characteristics is informative for clinicians and may help guide further discussion.

Intraocular foreign body presentation, management and clinical outcomes: a seven-year experience

6168 - B0223

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Purpose

Characterize the presentation, management, and postoperative outcomes of intraocular foreign bodies (IOFBs) at an urban, tertiary referral center.

Methods

This retrospective study included eyes that underwent IOFB removal between 2017 and 2024 at Wills Eye Hospital. Patients were identified via CPT procedure codes. Baseline clinical and sociodemographic data were collected, as well as surgical parameters for the removal of the IOFB(s). Follow-up clinical data at one day, one week, one month, three months, six months, one year, and final visit were recorded.

Results

127 eyes from 127 patients underwent IOFB removal and closure of ruptured globe during the study period. Males represented 107 (84.3%) of patients compared to 20 (15.7%) females. Mean (standard deviation [SD]) age was 43.3 (±17.4) years; range 7 to 82 years. Among the first 66 patients reviewed, mean (SD) presenting logMAR visual acuity in the affected eye was 1.55 (±1.2). Zone 1 injuries occurred in 52 eyes (78.8%), zone 2 injuries occurred in 11 eyes (16.7%), and zone 3 injuries occurred in 3 eyes (4.5%). Retinal detachment occurred in 24 (36.4%) eyes. Endophthalmitis developed in three (4.5%) eyes. Enucleation was performed on two (3.0%) eyes. Common mechanisms of injury included hammering metal, automobile work, and cutting wood. An IOFB was identified on 62 of 64 (97%) computed tomography scans available for review. Instruments utilized for removal included 0.12 forceps, 18, 19, and 23-gauge forceps, and intraocular magnets. Mean (SD) greatest dimension of the IOFB was 4.6 (±4.9) mm with a maximum of 3.3 cm. IOFB composition consisted of 62 (94%) metallic fragments, followed by 1 (1.5%) glass, 1 (1.5%) plastic, 1 (1.5%) organic, and 1 (1.5%) unspecified material. Mean (SD) logMAR visual acuity in the affected eye was 1.38 (±0.98) at three months, and 0.97 (±0.97) at one year. At final visit, 24 (38.1%) of affected eyes had a visual acuity of 20/40 or better, 17 (27.0%) were count fingers or worse, and 5 (8.0%) were no light perception. There was a mean (SD) follow-up interval of 1.60 (±1.72) years.

Conclusions

Intraocular foreign bodies represent a high-morbidity ocular injury with guarded visual prognosis. Understanding the mechanisms of injury and the severity of ocular outcomes as described in this study highlights the need for eye protection during high-risk activities.

Myopia and Glaucoma: Accounting for OCT Assessed Retinal Thickness

6216 - B0324

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Purpose

Myopic eyes with high axial length pose a challenge in diagnosing glaucoma due to globally thin retina, making it difficult to differentiate between thinning of the retina due to myopia and thinning due to glaucoma. We aim to evaluate a novel parameter: the ratio of ganglion cell complex (GCC) thickness to the remaining macula thickness (RMT) as a diagnostic tool for glaucoma, including in eyes with increased axial length.

Methods

Subjects categorized as glaucoma or glaucoma suspect with a recorded axial length (Lenstar; Haag-Streit; Köniz, Switzerland), a macula OCT scan (Cirrus HD-OCT; Zeiss; Dublin, CA) and a Swedish Interactive Thresholding Algorithm 24-2 visual field (VF) report (SITA Standard; Humphrey Field Analyzer; Zeiss) were enrolled. All scans were qualified, and subjects were excluded if they had systemic comorbidities that might bias the measurements. The OCT measurements that were analyzed were mean Macular Thickness Analysis (MTA), mean macular retinal nerve fiber layer (mRNFL) thickness, and mean ganglion cell-inner plexiform layers (GCIPL) thickness. The RNFL and GCIPL layers thicknesses were added to obtain a value for the GCC thickness. Remaining macula thickness (RMT) was calculated by subtracting the GCC thickness from the full macular thickness and the ratio of GCC to RMT was calculated. A multivariable regression analysis accounting for inter eye correlation, axial length, VF mean deviation (MD), age, sex, race, and signal strength was performed.

Results

Two hundred and thirty-two eyes (149 subjects) qualified for the study. The average age was 59.97±15.49 years (range 19-89). Clinical characteristics of the cohort are referenced in Table 1. Both GCC and MTA were significantly associated with axial length, VF MD, age, and white race (Table 2). RMT was significantly associated with axial length, sex, and signal strength. The GCC to RMT ratio was significantly associated with VF MD and age but not with axial length.

Conclusions

While both GCC and RMT thicknesses are significantly associated with axial length, the ratio of GCC to RMT is not. This novel parameter shows promise in diagnosing glaucoma particularly in the challenging category of myopic eyes.

Endophthalmitis Rates among Medicare Beneficiaries undergoing Retina Surgery between 2016-2022

5853

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Purpose
Determine endophthalmitis incidence among Medicare beneficiaries undergoing retina surgery and assess patient and surgeon-related risk factors for developing postoperative endophthalmitis.

Methods
Retrospective, cross-sectional of Medicare beneficiaries who underwent retina surgery between 2016 and 2022. Individuals who underwent surgery during the 2-year look-back period, those with an endophthalmitis diagnosis 12 months prior to index procedure, those with any intraocular procedure or intravitreal injection 3 months prior to PPV and missing laterality information were excluded. A multivariable logistic regression model was used to evaluate factors associated with occurrence of postoperative endophthalmitis.

Results
369,471 PPVs were performed among Medicare beneficiaries between 2016-2022. The overall endophthalmitis rate was 0.38%. Rates were highest following complex RD repair (N=106/35,605; 0.29%) followed by macular cases (N=456/173,900; 0.26%) and standard RRD repair (N=137/71,786; 0.19%). On multivariable analysis, patient aged ≥85 years, Charlson comorbidity index (CCI) ≥3, macular and complex RD cases had an increased endophthalmitis risk. Surgeon volume was inversely associated with endophthalmitis risk.

Conclusions
The overall endophthalmitis rate following retina surgery was 0.38%. Patient age, CCI and PPV indication (complex RD and macular surgery vs. standard RD) were associated with increased endophthalmitis risk. Surgeon volume was inversely associated with postoperative endophthalmitis risk.