The American Ophthalmological Society

ONE HUNDRED AND FIFTY-FIFTH ANNUAL MEETING

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MAY 16–19, 2019
THE GREENBRIER
WHITE SULPHUR SPRINGS, WEST VIRGINIA

The American Ophthalmological Society

Office of the Executive Vice President
Atlanta, GA
May 2019

THE ONE HUNDRED AND FIFTY-FIFTH ANNUAL MEETING
of the Society will be held at

The Greenbrier
White Sulphur Springs, West Virginia
Thursday through Sunday
May 16–19, 2019

COMMITTEE ON PROGRAMS

Preston H. Blomquist, Chair
Ivan R. Schwab
Jayne S. Weiss
Peter A. Netland

The American Ophthalmological Society

THE ONE HUNDRED AND FIFTY-FIFTH ANNUAL MEETING

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TARGET AUDIENCE

Ophthalmologists involved in academic practice, private practice, training programs, research, or administrative health care.

MEETING OBJECTIVES

The objectives of the 2019 Annual Meeting are to:

1. Discuss important new advances in the etiologies, diagnosis, and treatment/prevention of eye diseases.
2. Identify basic and clinical vision research that can be transformed into improved clinical care.
3. Assess the role of new technologies in the evaluation and treatment of eye diseases.
4. Describe factors that impact the effective delivery of the highest quality eye care for the public.
5. Identify clinical, scientific, and ethical issues confronting the profession.

FDA STATUS DISCLAIMER

Some material on recent developments may include information on drug or device applications that are not considered community standard, that reflect indications not included in approved FDA labeling, or that are approved for use only in restricted research settings. This information is provided as education only so physicians may be aware of alternative methods of the practice of medicine, and should not be considered endorsement, promotion, or in any way encouragement to use such applications. The FDA has stated that it is the responsibility of the physician to determine the FDA status of each drug or device he or she wishes to use in clinical practice, and to use these products with appropriate patient consent and in compliance with applicable laws.

The Society provides the opportunity for material to be presented for educational purposes only. The material represents the approach, ideas, statement, or opinion of the presenter and/or author(s), not necessarily the only or best methods or procedure in every case, nor the position of the Society. The material is not intended to replace the physician's own judgment or give specific advice for case management. The Society specifically disclaims any and all liability for injury or other damages of any kind for any and all claims that may arise out of the use of any technique demonstrated or described in any material by any presenter and/or author(s), whether such claims are asserted by a physician or any other person.

FINANCIAL DISCLOSURE

The relevant financial disclosures of all presenting authors, staff, and members of the Committee on Programs are listed on pages 7–8 in the program book. Conflicts, if noted, were managed prior to the presenter being included in the program. If the presenter has a

financial disclosure related to the specific presentation, the disclosure will be stated verbally and presented on the first slide of their presentation. Audience participants are required to state their financial disclosure before they join a discussion of a paper or poster.

PARTICIPATION AND CONSENT TO BE RECORDED

The entire 2019 Annual Meeting will be recorded for subsequent posting on the Society's website, including discussion. Approaching the microphone to discuss a presentation is considered implicit consent to the participant's discussion being included in this recording. Attendees who do not wish to be recorded should refrain from approaching the microphone.

REGISTRATION

Members and guests should check in at the AOS registration desk on the first day of the meeting to receive meeting information. Those who have not pre-registered and paid their registration fees or dues may do so at this time. Registration will be available at the following times:

Thursday, May 16: 1:30–5:00 PM
Friday, May 17: 6:30 AM–12:00 PM
Saturday, May 18: 6:00 AM–12:00 PM
Sunday, May 19: 6:30–10:00 AM

ACCREDITATION STATEMENT

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American Academy of Ophthalmology and the American Ophthalmological Society. The American Academy of Ophthalmology is accredited by the ACCME to provide continuing medical education for physicians.

CREDIT DESIGNATION STATEMENT

The American Academy of Ophthalmology designates this live activity for a maximum of 12 *AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

BYLAWS

The following Bylaws are published each year in the program as a reminder to the members of the Society:

ARTICLE IX, Section 3 – Any member who shall be absent from meetings for three consecutive years without acceptable excuse shall be dropped from the roll, except for Honorary Members, Emeritus Members, Members of twenty years standing or those then serving in the armed forces. An excuse for absence is acceptable only when a member is ill, or when there

is illness of a member of his or her immediate family, and may not be considered approved until received in written form and acted upon by the Council. The Council shall have the authority to approve other excuses only upon a finding of exceptional circumstances. This Bylaw shall be printed in every call for the Annual Meeting.

CANDIDATE'S WHOSE THESES WERE ACCEPTED SINCE THE 2018 ANNUAL MEETING

Jorge Alio	Alicante, Spain
J. Fernando Arevalo	Baltimore, MD
Yvonne Buys	Toronto, ON, Canada
Zelia Correa	Baltimore, MD
Amani Fawzi	Chicago, IL
David Gamm	Madison, WI
Neeru Gupta	Toronto, ON, Canada
James William Harbour	Miami, FL
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Richard Rosen	New York, NY
Johanna Seddon	Boston, MA
Carla Jean Siegfried	Saint Louis, MO
Richard Spaide	New York, NY
Michael Stewart	Jacksonville, FL
Fotis Topouzis	Thessaloniki, Greece
Edward Wladis	Slingerlands, NY
Tien Wong	

IN MEMORIAM

The Executive Vice President has received notice of the deaths of the following members during the past year:

R. Rand Allingham, MD	Durham, NC	Joined 2008
Richard F. Brubaker, MD	Rochester, MN	Joined 1982
Andrew Ferry, MD	Richmond, VA	Joined 1973
John T. Flynn, MD	New York, NY	Joined 1983
David A. Johnson, MD, PhD	Wilmington, NC	Joined 2006

FINANCIAL DISCLOSURES

The following are the relevant healthcare-related financial disclosures of those involved in the preparation or presentation of this AOS event. The AOS Committee on Programs gathered this information to plan the program and has attempted to manage relevant conflicts of interest to present a balanced program. The presenter will indicate on the first slide and verbally at the beginning of the talk, if any of the financial disclosures listed has a relationship to the specific presentation. Participants that might speak from the floor are required to state their financial disclosures before they speak.

CATEGORY	CODE	DESCRIPTION
Consultant/ Advisor	C	Consultant fee, paid advisory boards or fees for attending a meeting (for the past 1 year)
Employee	E	Employed by a commercial entity
Lecture Fees	L	Lecture fees (honoraria), travel fees or reimbursements when speaking at the invitation of a commercial entity (for the past 1 year)
Equity Owner	O	Equity ownership/stock options of publicly or privately traded firms (excluding mutual funds) with manufacturers of commercial ophthalmic products or commercial ophthalmic services
Patents/Royalty	P	Patents and/or royalties that might be viewed as creating a potential conflict of interest
Grant Support	S	Grant support for the past 1 year (all sources) and all sources used for this project

AZAR, Dmitri
O – Novartis
E - Alphabet Verily Life

CHIANG, Michael
C – Clarity Medical Systems, Novartis
O – Inteleretina, LLC

DAVIS, Janet
C – Abbvie, Allergan

GARDNER, Thomas
S – Zebra Biologics

GROSSNIKLAUS, Hans
P – Clearside Biomedical

HARBOUR, J. William
C – Castle Biosciences, Inc.
P – Castle Biosciences, Inc.

JABS, Douglas
S – Allergan, Bausch & Lomb

KEANE, Pearse
C – DeepMind

MCCULLEY, Timothy
C – Genentec

NAYAK, Amod
C – Artificial Learning System (Artelus)

NGUYEN, Quan Dong
C – Bayers, Eyepoint, Genentech, Gilead, Regeneron, Santen
S – Genentech, Gilead, Regeneron

OLSEN, Timothy
O – iMacular Regeneration LLC

REYNOLDS, James
C – Novartis

SEDDON, Johanna
C – THEA Pharmaceuticals
E – Gemini Therapeutics, Inc.

SHERWOOD, Mark
S – Allergan

NO FINANCIAL RELATIONSHIPS TO DISCLOSE RELEVANT TO MEETING PARTICIPATION:

AKPEK, ESEN
AREF, AHMAD
ARNOLD, ANTHONY
AUGSBURGER, JAMES
BLACK, BRADLEY
*BLOMQUIST, PRESTON
BULLOCK, JOHN D.
CLARK, ROBERT
CORREA, ZELIA
EDWARD, DEEPAK
EYDELMAN, MALVINA
FINGERT, JOHN
FISH, GARY EDD
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HILLIER, SIAN
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KERR, NATALIE
KUMAR, AMAN
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LISCH, WALTER
MAUMENEE, IRENE
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*NETLAND, PETER
NEWMAN, STEVEN
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PASQUALE, LOUIS
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PAULOS, MICHAEL
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ROSALES, ERIK
*SCHWAB, IVAN
SHIELDS, CAROL
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SOMMER, ALFRED
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TRAVERSO, CARLO E.
WALLACE, DAVID
*WEISS, JAYNE
WILSON, DAVID
WRIGHT, KENNETH

**Members of the Committee on Programs*

RECOGNITION

We would like to thank Dr. Lawrence Yanuzzi and the Macula Foundation for their support of the Artificial Intelligence and Machine Learning Symposium

American Ophthalmological Society

Spouse/Personal Guest Schedule

THURSDAY, MAY 16

1:30–5:00 PM	Registration	*Chesapeake Bay*
2:00–3:30 PM	New Member Spotlight Presentations	*Crystal Room*
6:00–7:30 PM	Reception Welcoming New Members (black tie optional)	*Crystal Room*

FRIDAY, MAY 17

6:30 AM–12:00 PM	Registration	*Chesapeake Bay*
7:00–11:00 AM	Spouse/Personal Guest Hospitality Lounge	*Spring Room*
12:30–1:30 PM	Lunch Lecture (advance registration required)	*Chesapeake Room*
1:30–4:30 PM	Golf Tournament (men / women)	*Old White TPC*
5:45–7:30 PM	Reception & 5th Annual Artistic Soiree (business casual)	*Colonial Lounge*

SATURDAY, MAY 18

6:00 AM–12:00 PM	Registration	*Chesapeake Bay*
7:00–11:00 AM	Spouse / Personal Guest Hospitality Lounge	*Spring Room*
9:30–10:30 AM	Tour of the Greenbrier's Fine Art Collection	*Spring Room*
12:30–2:00 PM	Emeritus Luncheon (by invitation)	*Spring Room*
1:00–4:00 PM	Tennis Tournament (men/women/mixed doubles)	*Har-Tru Tennis Courts*
1:00–4:00 PM	Skeet Shooting	*Kate's Mountain*
6:00–6:45 PM	Reception	*Trellis Lobby*
7:00–9:00 PM	Banquet (black tie optional)	*Cameo Ballroom*

SUNDAY, MAY 19

6:30–10:00 AM	Registration	*Chesapeake Bay*
6:30–8:00 AM	Breakfast (with members)	*Chesapeake Bay*

American Ophthalmological Society

Meeting Schedule

THURSDAY, MAY 16

12:00–1:30 PM	New Member Luncheon (by invitation)	*Spring Room*
1:30–5:00 PM	Registration	*Chesapeake Bay*
2:00–3:30 PM	New Member Spotlight Presentation	*Crystal Room*
6:00–7:30 PM	Reception Welcoming New Members (black tie optional)	*Crystal Room*

FRIDAY, MAY 17

6:30 AM–12:00 PM	Registration	*Chesapeake Bay*
6:30–7:30 AM	Breakfast	*Chesapeake Bay*
7:30–8:00 AM	Verhoeff Lecture	*Chesapeake Room*
8:00–10:05 AM	Friday Symposium: Artificial Intelligence and Machine Learning	*Chesapeake Room*
10:05–10:35 AM	Coffee Break and Guided Poster Session	*Garden Room*
10:35 AM–12:15 PM	Scientific Program – Paper Session	*Chesapeake Room*
12:30–1:30 PM	Lunch Lecture (advance registration requried)	*Chesapeake Room*
1:30–4:30 PM	Golf Tournament (men/women)	*Old White TPC*
5:45–7:30 PM	Reception & 5th Annual Artistic Soiree (business casual)	*Colonial Lounge*

American Ophthalmological Society

Meeting Schedule

SATURDAY, MAY 18

6:00 AM–12:00 PM	Registration	*Chesapeake Bay*
6:00–8:00 AM	Breakfast	*Chesapeake Bay*
6:30–7:15 AM	Executive Session (Active members only)	*Chesapeake Room*
7:30–10:10 AM	Knapp Symposium: Ocular Inflammation: Putting Out Fire	*Chesapeake Room*
10:10–10:50 AM	Coffee Break and Guided Poster Session (35 minutes)	*Garden Room*
10:50 AM–12:30 PM	Scientific Program – Paper Session	*Chesapeake Room*
12:30–2:00 PM	Emeritus Luncheon (by invitation)	*Spring Room*
1:00–4:00 PM	Tennis Tournament (men/women/mixed doubles)	*Har-Tru Tennis Courts*
1:00–4:00 PM	Skeet Shooting	*Kate's Mountain*
6:00–6:45 PM	Reception	*Trellis Lobby*
7:00–9:00 PM	Banquet (black tie optional)	*Cameo Ballroom*

SUNDAY, MAY 19

6:30–10:00 AM	Registration	*Chesapeake Bay*
6:30–8:00 AM	Breakfast	*Chesapeake Bay*
7:30–10:30 AM	Scientific Program – Paper Session	*Chesapeake Room*

FRIDAY, MAY 17

Verhoeff Lecture

A NEW APPROACH TO VEGF DRIVEN RETINAL VASCULAR LEAKAGE IN INHERITED AND ACQUIRED RETINAL VASCULAR DISEASE

Michael Trese, MD · Beaumont Health · Royal Oak, MI

2019 Friday Symposium

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

INTRODUCTION

Marco Zarbin, MD, PhD · Rutgers-New Jersey Medical School · Newark, NJ

AI: WHAT IS IT? HOW DOES IT WORK? APPLICATIONS TO ORNITHOLOGY AND OPHTHALMOLOGY

Pietro Perona, PhD · Caltech · Pasadena, CA

DEEPMIND PROJECT: APPLICATION OF AI TO RETINAL DISEASE

Pearse Keane, MD, FRCOphth · Moorfields Eye Hospital · London, United Kingdom

APPLICATION OF AI TO RETINOPATHY OF PREMATURITY

Michael Chiang, MD · Oregon Health & Science University · Portland, OR

APPLICATION OF AI TO GLAUCOMA

Michael Goldbaum, MD · University of California, San Diego · San Diego, CA

REGULATORY ISSUES REGARDING AI INCORPORATION INTO CLINICAL PRACTICE

Malvina Eydelman, MD · Center for Devices and Radiological Health · Washington, DC

OTHER APPLICATIONS OF AI IN MEDICINE AND OPHTHALMOLOGY

Dimitri Azar, MD · UIC College of Medicine · Chicago, IL

AUDIENCE Q & A

SATURDAY, MAY 18

2019 Knapp Symposium

OCULAR INFLAMMATION: PUTTING OUT FIRE

INTRODUCTION

Preston H. Blomquist, MD
University of Texas Southwestern Medical Center
Dallas, TX

ADVANCED OCULAR IMAGING IN THE MANAGEMENT OF UVEITIS

Quan Dong Nguyen, MD, MSc
Stanford University
Palo Alto, CA

EVIDENCE-BASED TREATMENT FOR NONINFECTIOUS UVEITIS

Douglas A. Jabs, MD, MBA
Mount Sinai School of Medicine
New York, NY

NEW DIRECTIONS FOR TREATMENT OF OCULAR INFLAMMATION

Janet L. Davis, MD
Bascom Palmer Eye Institute
Miami, FL

THE GUT MICROBIOME AND ITS RELATION TO OCULAR INFLAMMATION

Jerry Niederkorn, PhD
University of Texas Southwestern Medical Center
Dallas, TX

AUDIENCE Q & A

AOS 2019
Paper Abstracts

The following abstracts of papers selected to be presented at the meeting are printed in presentation order. The order of presentations has been arranged as follows by the Committee on Programs. Scientific sessions will be held in Chesapeake Room.

Papers presented at this meeting may be published in other medical journals after this meeting PROVIDED THE AUTHORS ADHERE TO THE STRICT GUIDELINES IN THE AUTHOR INSTRUCTIONS LISTED AT aosonline.org AND CONSULT WITH THE EDITOR OF THE TRANSACTIONS.

Papers are limited to 7 minutes and the first discussant to 3 minutes.
General discussion will be limited to 9 minutes.

Please note the following program key:

Bold = *AOS Member*
* = *Presenter*
♦ = *Financial Disclosure*

(Presenters will indicate their financial disclosure verbally and in the first slide.)

PA-01 10:35–10:55 AM

PROSPECTIVE COMPARISON OF RESIDENT SURGICAL OUTCOMES OF FEMTOSECOND LASER ASSISTED CATARACT SURGERY VERSUS CONVENTIONAL PHACOEMULSIFICATION SURGERY

James McCulley*, Preston Blomquist, Brock Hansen

Purpose: This study is the first IRB approved prospective randomized study of Femtosecond Laser Assisted Cataract Surgery (FLACS) versus Conventional Phacoemulsification Surgery (CPS) of resident outcomes at an academic institution.

Methods: Patients were screened to ensure inclusion criteria and no exclusion criteria. 143 patients were identified, consented and randomly assigned to FLACS (74) or CPS (63). PGY4 surgeons had previously completed 50 CPS.

A comprehensive ophthalmic exam was done including uncorrected and best spectacle corrected visual acuity (UCVA and BSCVA), dilated fundus exam, posterior segment OCT, corneal endothelial cell count and corneal topography were obtained at all visits (pre-op and post-op 1, 7, 30, 90 days). Patient and surgeon questionnaires were administered at post-op visits. Surgical procedures were filmed to determine intraocular surgical times of each step of the procedure. Intraocular irrigation fluid used and cumulative dissipating energy (CDE) were determined.

Results: Cataract density was comparable between the groups ($p>0.5$). UCVA and BSCVA were similar at each post-operative visit. Total intraocular time was similar; however, there was less time for capsulorrhexis with FLACS but greater time for corneal wound management and cortical clean up ($p=0.04$). Irrigation fluid use and CPE were similar as was endothelial cell loss. Patient surgical assessments were similar. Residents were less comfortable with cortical removal and corneal wound management but more comfortable with nuclear removal in the FLACS. 74% considered FLACS training essential. There was a total of three intraoperative complications of vitreous loss; one in the CPS group and two in the FLACS group.

Conclusion: In resident hands, FLACS is safe and effective and was shown to be non-inferior to CPS. Resident surgeon opinion is that FLACS should be a part of their training with a substantial number anticipating future use in practice.

Discussant: **Jayne Weiss**

PA-02 10:55–11:15 AM

ARAVIND PSEUDOEXFOLIATION STUDY: FIVE YEAR POSTOPERATIVE RESULTS

Aravind Haripriya, Chandrasekaran Shivakumar, Madhu Shekhar, Kalpana Narendran, Rengaraj Venkatesh, Ravilla Ravindran, **Alan Robin***

Purpose: To compare both five-year visual outcomes and post-operative complication rates over the first five post-operative years in eyes with and without pseudoexfoliation (PEX) undergoing cataract surgery.

Methods: Prospective comparative interventional study at the Aravind Eye Care System. One thousand eyes with PEX and 500 eyes with no ocular pathology other than cataract underwent cataract surgery. At baseline we performed specular microscopy, perimetry, IOP, and fundus evaluations. After the first year we followed subjects yearly. All eyes were randomized to either one piece or three-piece acrylic IOLs and the PEX eyes were also randomized to receiving a CTR. We excluded any preexisting clinical zonular dialysis or phacodonesis and pupils <4 mm. Primary variables were IOL decentration and PCO. Secondary variables were development of glaucoma and endothelial cell loss.

Results: Follow-up was 76% at five years. The PEX group was older and had denser cataracts ($p<0.001$). There was no significant difference in decentration between one (4.9%) and three-piece IOLs (4.5%) ($p=0.799$) or with (4.25%) or without (5.10%) CTRs ($p=0.581$). Posterior capsulotomies were required in 7.9% of PEX compared with 4.5% of controls $P=0.029$. The incidence of new glaucoma was 7.4% in the PEX groups compared to 1.8% in the control group ($p<0.0001$). Endothelial cell loss from baseline was comparable between groups, 6.9% in the PEX group compared to 6.4% ($p=0.427$).

Conclusion: This is the first large-scale long-term prospective comparative study of cataract surgery in eyes with PEX. We found that PEX does not cause an increased risk of IOL decentration or endothelial cell loss. PEX had more PCO requiring capsulotomy. This was not influenced by IOL design or CTR. CTR was unnecessary in PEX eyes without phacodonesis. Because of a 4X increased incidence of glaucoma, it is imperative that PEX eyes obtain long term follow-up.

Discussant: **Alfred Sommer**

PA-03 11:15–11:35 AM

MACHINE LEARNING FOR PREDICTION OF APPOINTMENT LENGTH AND FOR SCHEDULING OPTIMIZATION IN OPHTHALMOLOGY

Michael Chiang*, Wei-Chun Lin, Isaac Goldstein, Michelle Hribar

Purpose: Ophthalmologists are pressured to see more patients in less time, and efficient patient scheduling to optimize workflow is a significant challenge. We have recently shown that clinical volume and patient wait times may be improved using scheduling templates based on computer simulation models, which assign patients to "short", "medium", or "long" slots based on appointment length. A method for automatically predicting appointment length would be extremely useful. In this study, we investigate a machine learning model for predicting appointment length using existing clinical and demographic data from the electronic health record.

Methods: This study was performed in the pediatric ophthalmology clinic at OHSU Casey Eye Institute. Data from 3049 office visits (2015-2018) from seven pediatric ophthalmologists were used in multiple linear regression and random forest machine learning models with 11 features (including prior average exam time, ICD-10 diagnosis code, age, dilation of eyes, patient language, etc.). Appointment length was predicted to be: short (shortest 20%), medium (middle 60%), or long (longest 20%). For evaluation, seven ophthalmologists predicted appointment lengths before scheduling each patient based on clinical and social factors. Accuracy of machine learning models was evaluated by comparison to the actual exam lengths.

Results: The R2 of the multiple linear regression was 23%, and 21% of variability in appointment length could be explained by the random forest model. Random forest classification had an accuracy of 63% in classifying predicted appointment length (short vs. medium vs. long). In comparison, accuracy of expert provider predictions was 51% ($p<0.05$). Area under receiver operating characteristic curves for prediction was 0.764 in the multiple linear regression model and 0.747 in the random forest model.

Conclusion: Machine learning methods can predict patient exam lengths with comparable or better accuracy than physicians. This has the potential to improve clinical scheduling and efficiency in the future.

Discussant: **Gary Edd Fish**

PA-04 11:35–11:55 AM

PROSPECTIVE STUDY OF NON-MELANOMA SKIN CANCER AND THE RISK OF EXFOLIATION GLAUCOMA

Louis Pasquale*, Jae Hee Kang, **Robert Ritch, Janey Wiggs**

Purpose: To evaluate the relation between non-melanoma skin cancer, as a potential marker of personal UV exposure, and risk of exfoliation glaucoma (XFG).

Methods: We included 79,102 women in the Nurses' Health Study and 41,200 men in the Health Professionals Follow-up Study who were 40+ years old, free of glaucoma and cataract and reported eye exams. Participants were followed biennially with mailed questionnaires from 1980 (women) / 1986 (men) to 2014. Prior to 1984 (women) / 1988 (men), we asked about any history of non-melanoma skin cancer; from 1984 (women) / 1988 (men) onwards, we asked separately about a history of basal cell carcinoma (BCC) or squamous cell carcinoma (SCC). We included SCCs that were confirmed with primary histopathology reports by participants' physicians and we included all self-reported BCCs and early (<1984/<1988) self-reports of any combined non-melanoma skin cancers (as most were likely to be BCCs). For participants with multiple skin cancers, we identified the earliest occurring type. Incident cases of XFG (362 women and 83 men) were confirmed with medical records. Using pooled data, we estimated multivariable-adjusted hazard ratios (HRs; 95% confidence intervals [CIs]) from Cox proportional hazards models.

Results: We observed strong associations between any history of non-melanoma skin cancer and XFG: the multivariable-adjusted HRs were 1.74 (95%CI=1.38, 2.20) for any of the 3 types of reports, 1.66 (95%CI=1.27, 2.17) for BCC, 2.40 (95%CI=1.13, 5.11) for SCC and 1.87 (95%CI=1.18, 2.95) for early reports of combined non-melanoma skin cancer. While no interaction was observed with latitude of residence or glaucoma family history, we observed that this association was stronger in those older than 65 years versus those 65 years or less (p for interaction=0.0002).

Conclusion: A history of non-melanoma skin-cancer was associated with higher risk of XFG, consistent with an etiologic role of UV exposure in this condition.

Discussant: **Joshua Stein**

PA-05 11:55 AM–12:15 PM

RANIBIZUMAB FOR THE TREATMENT OF RETINOPATHY OF PREMATURITY (ROP): 24-WEEK RESULTS FROM THE RANDOMIZED, MULTI-CENTER, OPEN-LABEL RAINBOW STUDY

James Reynolds*

Purpose: The primary objective was to demonstrate superior efficacy of intravitreal ranibizumab (RBZ) 0.2 mg vs laser in pre-term infants based on the treatment success criteria measured at or until 24-weeks.

Methods: RAINBOW was a randomized, multi-center, open-label, 3-arm, parallel-group clinical trial. Pre-term infants weighing <1500 grams at birth and having bilateral ROP with one of the retinal findings in each eye (Zone I, Stages 1+, 2+, 3/3+ disease; Zone II, stage 3+ disease; or AP-ROP) were included and randomized 1:1:1 to receive intravitreal RBZ-0.2 mg/RBZ-0.1 mg/laser. Treatment success criteria was measured at or until 24 weeks following initial treatment and include: survival and no intervention until 24 weeks; absence of active ROP at 24 weeks and unfavorable structural outcomes at/before 24 weeks.

Results: Of the 225 randomized patients (RBZ-0.2, n=74; RBZ-0.1, n=77; laser, n=74), treatment success was seen in 56/70 (80.0%) patients with RBZ-0.2, 57/76 (75.0%) with RBZ-0.1, and 45/68 (66.2%) following laser. Success rates were clinically relevant (treatment difference: RBZ-0.2/laser [OR]: 2.19 [95% CI: 0.993, 4.824]; one-sided P=0.0254, marginally above the pre-specified P=0.025). Patients received a mean of 2.4/2.5 RBZ injections in the RBZ-0.2/RBZ-0.1 groups. Overall, 12 (5.5%; RBZ-0.2/RBZ-0.1/laser=4/4/4) patients died during the study. Over 24 weeks, the rate of safety events was low.

Conclusion: Highest treatment success (80%) was observed in the RBZ-0.2 group. RBZ-0.2 mg-treated patients were twice more likely to achieve treatment success versus laser (considered clinically relevant). Overall, RBZ treatment was found to be well-tolerated with no new safety findings.

Discussant: **David Wallace**

PA-06 10:50–11:10 AM

ARE RISK FACTORS FOR GROWTH OF CHOROIDAL NEVI ASSOCIATED WITH MALIGNANT TRANSFORMATION? ASSESSMENT WITH A VALIDATED GENOMIC BIOMARKER

J. William Harbour*

Purpose: To test the hypothesis that widely used clinical risk factors for growth of choroidal nevi are associated with malignant transformation.

Methods: Fine needle biopsy for assignment of gene expression profile (class 1 or class 2) was performed in 207 choroidal melanocytic tumors <3.5 mm in thickness. The class 2 profile was employed as a validated biomarker for malignant transformation. The following data were collected: patient age and sex, tumor diameter and thickness, distance of posterior tumor margin from the optic disc, and the presence or absence of serous retinal detachment, orange lipofuscin pigment, drusen, retinal pigment epithelial fibrosis, retinal pigment epithelial atrophy, visual symptoms, and documented tumor growth.

Results: Clinical features associated with the class 2 profile included patient age >60 years and tumor thickness >2.25 mm (Fisher exact test, P=.002 for both). Documented growth was not associated with the class 2 profile (P=.5). The odds ratio of a tumor having the class 2 profile was 2.8 (95% confidence interval, 1.3-5.9) for patient age >60 years old and 3.5 (95% confidence interval, 1.4-8.8) for tumor thickness >2.25 mm. For patients with both risk factors, the "number needed to treat" to identify one patient with a class 2 tumor was 4.3 (P=.0002). No other clinical feature or combination of features was associated with the class 2 profile.

Conclusion: None of the widely used choroidal nevus risk factors for tumor growth, nor documented growth itself, is pathognomonic of malignant transformation as defined by class 2 gene expression profile. Patient age and tumor thickness may be helpful for identifying small choroidal melanocytic tumors that are more likely to have the class 2 profile. Observation for growth prior to treatment continues to be reasonable for most patients with suspicious choroidal nevi.

Discussant: **James Augsburger**

PA-07 11:10–11:30 AM

INVISIBLE INTRAOCULAR TUMORS: DETECTION WITH MULTIMODAL IMAGING

Jerry Shields*, **Carol Shields**

Purpose: To review our experience with detection of intraocular tumors that were not clinically visible with indirect ophthalmoscopy.

Methods: Review of clinical and subclinical imaging features of subclinical ocular tumors.

Results: There were a total of 10 patients with clinically normal fundus who were discovered to have a benign or malignant tumor(s) on multimodal imaging. The clinically-invisible tumor diagnoses in symptomatic patients included choroidal melanoma in a patient with ocular melanocytosis, choroidal hemangioma, and choroidal metastasis, all of whom demonstrated shallow subfoveal fluid. The invisible tumor diagnoses in asymptomatic patients included several cases of retinal hemangioblastoma in patients with von Hippel Lindau syndrome and several cases of invisible retinoblastoma in children with known retinoblastoma in the same or opposite eye, and invisible iris microhemangiomatosis. The imaging method most likely to detect invisible tumor was optical coherence tomography (OCT) with structural depiction of the mass in the choroid or retina. Other useful imaging modalities included fluorescein and indocyanine green angiography for both retinal and choroidal subclinical tumors as well as autofluorescence, particularly for hidden choroidal tumors.

Conclusion: In this era of multimodal imaging, detection of symptomatic and asymptomatic subclinical intraocular tumors is possible. This will allow earlier diagnosis and prompt treatment in selected cases.

Discussant: **Hans Grossniklaus**

PA-08 11:30–11:50 AM

VALIDATED PREDICTION MODELS FOR MACULAR DEGENERATION PROGRESSION AND PREDICTORS OF VISUAL ACUITY LOSS IDENTIFY HIGH RISK INDIVIDUALS

Johanna Seddon*, Bernard Rosner

Purpose: To determine predictive factors and risk scores for conversion from non-advanced to advanced age-related macular degeneration (AMD), geographic atrophy (GA), neovascular disease (NV), and loss of vision, and to validate the model for AMD progression in an external cohort.

Methods: Progression to advanced AMD was evaluated using stepwise survival analysis. Risk scores including genetic, demographic, behavioral, and ocular factors were derived for three advanced AMD endpoints and were validated and calibrated in a large independent cohort. Vision loss of 15 or more letters was evaluated as a new endpoint in genetic analyses.

Results: Eight common and rare variants in genes CFH, C3, ARMS2, COL8A1, and HSPH1/B3GALTL conferred a significantly higher risk of transition to advanced AMD. Three loci (C2, CFB, RAD51B) were associated with lower rate of progression. A protective effect was suggested for CTRB1 and PELI3. The age-adjusted area under the curve (AUC) for the composite model including 13 loci model was 0.900 over 12 years (0.896 in the validation cohort). Generally, progressors had a higher risk category and non progressors had a lower risk category when genetic factors were considered. Furthermore, there was heterogeneity between models for GA and NV. The model was calibrated in the validation cohort. Determinants of visual loss included age, education, BMI, smoking, and several common and rare genetic variants.

Conclusion: Eyes with the same baseline macular grade had a wide range of estimated probability of subsequent progression and visual loss based on the validated risk score. Identifying high risk individuals at an earlier stage using predictive modeling could lead to improved preventive and therapeutic strategies in the era of precision medicine.

Discussant: **Timothy Olsen**

PA-09 11:50 AM–12:10 PM

DETERMINATION OF BRUSHFIELD SPOTS AND WÖLFFLIN IRIS NODULES USING NEAR INFRARED LIGHT

Cameron Parsa*, Lavinia Postolache

Purpose: Brushfield spots have long been noted in the great majority of patients with Down syndrome and lightly colored eyes, yet their significance has remained entirely enigmatic. Similar, smaller spots, termed Wölfflin nodules, are also noted in over 20% of those with lightly colored eyes in the normal population, again with etiology unknown.

Methods: Iris images of 43 children with Down syndrome, and of 43 control children, were analyzed. Differences in iris features using white and near-infrared light, and the presence or absence of Brushfield spots and Wölfflin nodules were noted. A review of the literature was performed.

Results: Brushfield spots were detected overall in 67% of children with Down syndrome with near-infrared light, compared to 21% using white light alone ($p<0.001$). The incidence of these nodules are nearly equal in darker as in lighter colored irides. Wölfflin nodules were also more commonly detected using infrared light. Peripheral iris hypoplasia was present in 62% of children with Down syndrome, but in only 23% of those without ($p=0.001$). Contraction furrows were less frequent in children with Down syndrome (16%) compared to controls (74%) ($p<0.001$).

Conclusion: Infrared light unveils the presence of Brushfield spots and Wölfflin nodules in dark irides, previously noted in lightly colored irides alone. A high prevalence of peripheral iris thinning is also present in children with Down syndrome, along with a heretofore-unreported reduction in iris contraction furrows. These congenital features, once used to diagnose Down syndrome prior to the advent of karyotyping, may yet hold new significance. Based on a modern understanding of Down syndrome and the triallelic expression of the involved genes, we propose a pathophysiologic mechanism for the variable development of such iris nodules in Down syndrome, as well as in the general population, and what their presence may specify.

Discussant: **Irene Maumenee**

PA-10 12:10–12:30 PM

SMALL CHOROIDAL MELANOMA MANAGED BY PLAQUE RADIOTHERAPY IN 1780 CASES: VISUAL OUTCOME AND MILLIMETER INCREMENTAL RISK FOR METASTASIS

Carol Shields*, Kareem Sioufi, Archana Srinivasan, Maura DiNicola, Emil Say, **Jerry Shields**

Purpose: To analyze plaque radiotherapy for small choroidal melanoma (<3.5 mm thickness) for visual acuity outcome and melanoma-related metastasis.

Methods: Retrospective noncomparative review of 1780 consecutive patients.

Results: The mean patient age at melanoma diagnosis was 58 years (median: 50, range: 10-93 years), most were female (51%) and Caucasian (98%). Visual acuity was 20/40 or better in 72% and the mean entering visual acuity was 20/40. The mean tumor basal dimension was 8.8 mm (median 8.0, range 2.0-20.0 mm) and mean tumor thickness was 2.6 mm (median 2.7, range 0.2-3.4 mm). Mean distance to the foveola was 3.4 mm (median 2) and to the optic disc was 3.7 mm (median 3). Following plaque radiotherapy, the Kaplan-Meier rate of visual acuity loss (≥3 Snellen lines) at 1, 3, 5, 10, 15, and 20-years was 9.5%, 27.0%, 39.2%, 48.9%, 55.0%, and 58.2%, whereas poor visual acuity (≤20/200) was 7.1%, 24.4%, 39.2%, 53.5%, 61.9%, and 67.4%. Regarding melanoma-related metastasis, the rate was 0.2%, 1.7%, 4.5%, 8.8%, 16%, and 19.5%. Using 1.0 mm thickness increments the 15-year risk for metastasis was 25% (0-1.0 mm thickness) 8.8% (1.1-2.0 mm), 15.5% (2.1-3.0 mm), and 28.0% (>3.0 mm thickness). The greater relative risk (RR 1.83) for metastasis in thinnest tumors likely represented more aggressive diffuse (flat) melanoma. By multivariate analysis, clinical features predictive of melanoma-related metastasis included increasing patient age (RR 1.32/decade), tumor diameter (1.15/mm), tumor thickness (2.22/mm), symptoms of photopsia (2.45), and prior treatment before plaque radiotherapy (3.31).

Conclusion: Small choroidal melanoma treated with plaque radiotherapy demonstrates 10-year risk for visual acuity loss at 48.9% and systemic metastasis at 8.8%. Each millimeter of increasing thickness and diameter contributed risk for metastatic disease.

Discussant: **William Mieler**

PA-11 7:30–7:50 AM

VISUAL IMPAIRMENT IN PATIENTS WITH GIANT CELL ARTERITIS TREATED WITH TOCILIZUMAB IN REAL-WORLD CLINICAL PRACTICE

Timothy McCulley*, Jinglan Pei, Páris Sidiropoulos, Christine Birchwood, Jennie Best, John Stone, Sebastian Unizony

Purpose: The GiACTA trial demonstrated the efficacy of tocilizumab (TCZ) in giant cell arteritis (GCA). However, the effectiveness of TCZ for prevention of specific GCA-related visual manifestations is currently unknown. The incidence of GCA-related visual manifestations was analyzed in patients treated with TCZ in a real-world setting.

Methods: Retrospective analysis of GCA patients treated with TCZ at MGH (2010-2018). Disease flares were assessed among patients with and without visual impairment at diagnosis. Flares and new GCA-related visual manifestations including diplopia, transient blurred vision, amaurosis fugax and permanent vision loss due to anterior ischemic optic neuropathy (AION) or central retinal artery occlusion (CRAO) were assessed before and after TCZ initiation.

Results: Of 60 GCA patients followed for a median (IQR) of 1.7 (0.7-2.9) years, 22 (36.6%) had visual impairment at diagnosis (AION/CRAO, n=8 [13.3%]; blurred vision, n=18 [30.0%]; amaurosis fugax, n=11 [18.3%]; diplopia, n=2 [3.3%]). On follow-up, 15 of 22 (68.2%) patients with and 28 of 38 (73.7%) without visual impairment at diagnosis had ≥1 disease flare. TCZ treatment was associated with significantly reduced incidence of flare and with longer time to flare (HR=0.22; 95% CI 0.10-0.50; P<0.001). Before TCZ initiation, new visual manifestations (AION, n=2; blurred vision, n=12; amaurosis fugax, n=4; diplopia, n=2) developed in 16/102 (15.7%) disease flares occurring in 43 of 60 (71.7%) patients. In contrast, after TCZ initiation, new visual manifestations (AION, n=0; blurred vision, n=3; amaurosis fugax, n=1; diplopia, n=0) developed in only 3/37 (8.1%) disease flares. Disease flares (18 of 60 patients [30%]) were less common following TCZ initiation.

Conclusion: Similar incidence of disease flare was observed between GCA patients with or without baseline visual manifestations. TCZ treatment was associated with significantly reduced number of flares and decreased incidence of new visual manifestations. No permanent vision loss (e.g., AION) was observed after TCZ initiation.

Discussant: **Anthony Arnold**

PA-12 7:50–8:10 AM

CASE FOR GANGLION CELL SEGMENTATION

Steven Newman*

Purpose: OCT has been arguably the greatest advance in ophthalmology since the slit lamp 100 years ago. It allows quantitation of the various aspects of the eye including the retina, nerve fiber layer, and optic pathways. The standard use of OCT in neuro-ophthalmology and glaucoma has been to look at nerve fiber layer. There are several instances where ganglion cell analysis may be far more useful, stable, and reproducible.

Methods: A retrospective review of 130 cases of comparison of ganglion cell analysis with nerve fiber layer and psychophysical evaluation.

Results: In many cases the ganglion cell analysis shows pathology earlier than nerve fiber layer abnormalities. Ganglion cell analysis is far less prone to several forms of artifact including masking of the optic nerve damage by compression induced edema. There are, however, some major residual disadvantages as the current algorithms available are prone to artifact of registration.

Conclusion:

1. Ganglion cell analysis avoids masking effect of disc edema when there is compression of the optic nerve in the orbital apex.
2. Some forms of optic neuropathy, such as Leber's Optic Neuropathy, primary affects the ganglion cells, and is much more obvious on ganglion cell analysis.
3. Ganglion cell damage may be more robust, and while anatomic measures, such as nerve fiber layer, tend not to recover in the same fashion that psychophysics do, remodeling of nerve fiber layer often leads to increased thickness from previous thinning.
4. In spite of the advantages of ganglion cell segmentation, the current algorithms available have a significant incidence of artifact. Attempts at improving this, such as manual segmentation analysis, may be one step on the way of improving this, but obviously there are some residual weaknesses in the current ganglion cell analysis available.

Discussant: **Louis Pasquale**

PA-13 8:10–8:30 AM

SUSTAINED DRUG DELIVERY SYSTEM FOR ANTI-VASCULAR ENDOTHELIAL GROWTH FACTOR (ANTI-VEGF) AGENTS

Jennifer J. Kang-Mieler*, Soohyun Kim, Zhe Wang, Wenqiang Liu, Glenn Yiu, **William F. Mieler,** Sara M. Thomasy

Purpose: Sustained delivery of anti-VEGFs will provide improvement upon current repetitive intravitreal therapy. We have demonstrated that our degradable microsphere-hydrogel drug delivery system (DDS) can release bioactive anti-VEGF in a sustained manner for approximately 200 days in a rodent model. The purpose of this study is to evaluate the efficacy and safety of the released aflibercept from the aflibercept-DDS in a non-human primate model.

Methods: Biodegradable aflibercept-loaded microspheres were suspended within a thermoresponsive hydrogel. Six healthy rhesus macaques were used in an ocular pharmacokinetic (PK) study and three rhesus macaques were used in a biocompatibility study. One eye received a sterile 50 µl intravitreal injection of aflibercept-DDS and the other eye served as a control. For the PK study, the eyes were obtained monthly to measure aflibercept level via ELISA. For the safety study, intraocular pressure (IOP), fundus photography, spectral-domain optical coherence tomography (OCT) and electroretinogram (ERG) were performed monthly. At the endpoint, the eyes were harvested for histology.

Results: The injected DDS can be visualized during the clinical examination. IOP levels remained in a normal range of 12 to 21 mm Hg. External examination of the eyes, corneas, and anterior chambers (including aqueous cell) were normal. There was a small amount of vitreous cells in some animals, but the overall vitreous examination was normal. The intraocular PK of aflibercept, on average, was 0.372 µg/day. There were no changes in the retinal thickness (269±2.3 µV DDS and 267±2.6 µV control). Both dark- and light-adapted ERG responses showed no significant changes in terms of amplitude and timing.

Conclusion: There was no significant adverse effect due to DDS. The aflibercept was released at a sustained manner and remained bioactive. Our DDS appears to be a practical and effective method to deliver bioactive anti-VEGF agents and providing benefits of sustained treatment.

Discussant: **Thomas Gardner**

PA-14 8:30–8:50 AM

THE EFFECTS OF PROSTAGLANDIN ANALOG AGENTS ON HUMAN MEIBOMIAN GLAND EPITHELIAL CELLS

Ahmad A. Aref*, Medi Eslani, Alex Pleet, **William F. Mieler**, Ali Djalilian

Purpose: Prostaglandin analogs remain the first-line medical treatment option in the majority of glaucomatous diseases. It has been estimated that nearly 60% of medically treated patients with glaucoma report ocular surface disease symptoms, including dry eye. We evaluated the effects of prostaglandin glaucoma eye drops, with or without preservatives, on immortalized human Meibomian gland epithelial cells (MGC) in vitro.

Methods: MGCs were first expanded in serum free medium and then differentiated in the presence of 10% serum for 1 week. The cells were exposed to different concentrations of prostaglandin analogs and preservatives for 3 days: preservative-free (PF) latanoprost, benzalkonium chloride (BAK) preserved latanoprost, PF-bimatoprost, BAK-preserved bimatoprost, PF-travoprost, travoprost preserved with SofziaTM, and PF-tafluprost. Phosphate Buffered Saline (PBS) was used as a control. Apo-Tox-Glo TM and MTT assays were used to assess cytotoxicity and viability. LipidTOXTM staining was used to assess the neutral lipid accumulation inside the MGCs.

Results: Viability, cytotoxicity and lipid content of MGCs after exposure to the chemical form of latanoprost, bimatoprost, travoprost, and tafluprost (without any preservatives or additives) was not significantly different from control ($P > 0.1$ for all comparisons). Likewise, exposure to Sofzia preserved travoprost did not have any noticeable effects on the cells. However, exposure to BAK-preserved latanoprost and bimatoprost increased cytotoxicity and decreased viability by almost 4 fold compared to control ($P < 0.001$). MGCs exposed to the corresponding BAK concentrations resulted in a similar level of cytotoxicity compared to BAK-preserved latanoprost and bimatoprost ($P > 0.999$).

Conclusion: These studies demonstrate that the chemical forms of prostaglandin glaucoma medications are not toxic to the MGCs in vitro and do not alter their lipid accumulation. The toxicity observed from these drops is primarily due to BAK as a preservative.

Discussant: **Deepak Edward**

PA-15 8:50–9:10 AM

POSTOPERATIVE COMPLICATIONS OBSERVED AFTER XEN GEL IMPLANTATION FOR GLAUCOMA

Carlo E. Traverso*, Carlo A. Cutolo, Michele Lester

Purpose: The XEN gel implant creates a conduit from the anterior chamber to the subconjunctival space via an ab-interno approach. It was designed with the hope to standardize and facilitate the filtering surgery. We report the complications observed during the follow-up of eyes implanted with the XEN.

Methods: This was a prospective case series carried out at the University Clinica Oculistica, Genova, Italy. Complications were defined as "early" if occurred up to 30 days after surgery and "implant-related" if peculiar to the procedure. Complications occurred after bleb needling were also recorded and analyzed.

Results: Data from 174 consecutive surgeries performed till November 1, 2018 were collected. 124 (71.2%) eyes underwent the procedure and 46 (26.4%) the combined phacoemulsification-XEN procedure. The mean follow-up was 13.4 ± 8.9 months (range: 4 to 35). Needling procedure was performed in 105 (60.3%) eyes. Early complications: flat anterior chamber requiring filling (n=3; 1.7%); numerical hypotony (n=27;15.5%); hyphema > 2mm in height (n=2; 1.1%); Choroidal effusion (none extended to the posterior pole) (n=25; 13.8%). Aqueous misdirection (n=2; 1.2%). Implant-related: endophalmitis with stent exposure (n=1; 0.6%) 3 months after surgery; implant fracture after needling (n= 4; 2.3%); device internal ostium obstruction (n=1; 0.6%) after posterior capsulotomy. Five eyes (2.9%) required additional glaucoma surgeries.

Conclusion: Although the physical characteristics of this implant are designed to avoid hypotony, complications related to overfiltration can be observed in the early postoperative period. In that case, the management is generally similar to that of trabeculectomy. Specific management could be required to prevent implant-related complications and for their treatment. Sight threatening side effects are possible.

Discussant: **Mark Sherwood**

PA-16 9:10–9:30 AM

NON-TANGENT EXTRAOCULAR MUSCLE INSERTIONS AND TELESCOPING LEVER ARMS: REDEFINING FORCE TRANSFER AT THE GLOBE-TENDON INTERFACE

Robert Clark*, Joseph Demer

Purpose: Current biomechanical models of ocular motility simplify calculation of force transfer from extraocular muscle (EOM) to globe by assuming perfect tangency at the tendon insertion and a rotational axis at the center of the globe. This study used magnetic resonance imaging (MRI) to test those assumptions.

Methods: Twenty-eight orthophoric adults underwent high-resolution, axial orbital MRI while fixating targets in abduction and adduction. The measured angle at EOM insertion was compared with the predicted angle assuming an "arc of contact." Axial lengths were measured from images containing the largest globe cross-sections. Globe centers were calculated from area centroids of the largest globe cross-sections omitting corneas. Displacements of lens centers and globe-optic nerve junctions in eccentric gaze were used to calculate rotation axes in orbital coordinates. Lever arms for muscles were calculated as the distances between insertions and axes of rotation.

Results: The average (±SEM) measured angle at EOM insertion was significantly greater than predicted for the medial rectus (MR, 5.0±4.8° versus 0.0±0.0°, P=0.03) and lateral rectus (LR, 4.9±3.0° versus 0.0°±0.0°, P=0.02); this difference converts ~9% of EOM force from rotation to translation. Mean rotational axis was 0.8±0.2mm medial and 0.8±0.3mm anterior to geometric globe center in initial gaze. Globe translation 0.9±0.2mm laterally and 0.5±01mm posteriorly during abduction displaced the rotational axis to 1.7±0.2mm medial and 1.3±0.3mm anterior to globe center in final gaze. This displacement reduced the MR lever arm from 11.4±0.2mm to 10.5±0.3mm and increased the LR lever arm from 12.2±0.2mm to 14.1±0.3mm, markedly increasing LR rotational advantage and requiring commensurately more MR force to balance the LR.

Conclusion: Non-tangential EOM insertions convert significant EOM force from rotation to translation. Globe translation associated with eccentric rotational axes lengthens the LR lever arm by 15% and shortens the MR lever arm by 8% during abduction, profoundly changing the rotational balance of the horizontal EOMs.

Discussant: **Bradley Black**

PA-17 9:30–9:50 AM

NOVEL USE OF FIBRIN GLUE ADDED TO HANG-BACK RECESSION AND OUTCOME COMPARISON TO STANDARD FIXED SUTURE RECESSION FOR THE TREATMENT OF HORIZONTAL STRABISMUS

Kenneth Wright*, Majd Arow, Yi Ning Strube

Purpose: Retinal perforation is a dangerous complication of standard rectus recession which requires posterior scleral suturing in thin sclera behind the rectus insertion. Hang-back recession with anterior suturing eliminates this complication, but has disadvantage of variable muscle reattachment including vertical displacement, anterior creep with large recessions and late over correction. Author KW has introduced the novel technique of adding fibrin glue to the hang-back technique to secure the rectus muscle. The purpose of this study is to compare outcomes of hang-back rectus recession with fibrin glue (HBG) to standard fixed suture rectus recession (SFR) in patients with horizontal strabismus.

Methods: Records of 17 consecutive patients with horizontal strabismus who underwent HBG were reviewed and compared to a matched group of 17 patients who had SFR between 2016 and 2018. A "good outcome" was defined as a postoperative deviation < 10 PD at a minimum follow up of 2 months.

Results: Preoperative deviations in the two groups were similar with HBG mean ET 22 PD, XT 28PD and SFR mean ET 26 PD, XT 21 PD. Average postoperative deviation was almost identical at 4 PD for both groups. "Good outcomes" were similar with HBG being 14/17 (82%) and SFR 15/17 (88%). There were no complications in either group.

Conclusion: Hang-back with fibrin glue results are not significantly different than standard fixed suture recession; however, hang-back with fibrin glue has the important advantage of preventing the potential complication of retinal perforation. HBG can be especially useful in patients with thin sclera such as patients with high myopia.

Discussant: **Natalie Kerr**

AOS 2019 Poster Abstracts

Posters will be displayed from Friday, May 17 through Sunday, May 19.

Poster authors will be available to discuss their work
during guided poster sessions scheduled on
Friday, May 17 from 10:05–10:35 AM and on
Saturday, May 18 from 10:10–10:50 AM.

Please note the following program key:

Bold = *AOS Member*
* = *Presenter*
♦ = *Financial Disclosure*

(Posters will indicate relevant financial relationships.)

PO-01

KNOWLEDGE AND ATTITUDE TOWARDS GENETIC COUNSELING AND TESTING AMONG PARENTS OF CHILDREN WITH PRIMARY CONGENITAL GLAUCOMA (PCG)

Deepak Edward*, Abdulwahab Theeb, Rajiv Khandekar, Zuhair Rahbeeni

Purpose: PCG, a major cause of childhood blindness in KSA, is autosomal recessive with CYP1B1 mutations responsible for over 85% of the disease in this conservative society. This questionnaire-based study was conducted to determine the knowledge and attitude to genetic testing and counseling in PCG families.

Methods: Parents of 60 children with PCG were administered a questionnaire-based survey. Demographics of the index child, family pedigrees, and the educational status of the parents, were collected. Their response towards genetic counseling and testing was assessed using 5 questions on knowledge and 5 on attitude. The responses were graded as Good (≥50% percentile) and poor. Correlation between demographic variables and test scores were made using Mann Whitney U test and Freedman P test.

Results: The median age of the index child was 3 years. Most affected children were a product of a consanguineous marriage (72%); affected families had more than three children (68%); however other siblings (18%) or extended family members (23%) were not affected. Over 75% of the parents had a college education. Knowledge regarding genetic counseling was graded good in 73.4% of participants and their attitude was graded good in 90 percent. The knowledge scores or the attitudes scores did not show a significant correlation with variables such other children in the family having PCG, consanguinity, or parents' level of education.

In the small sample size, parents with poor knowledge were not the same with a poor attitude towards genetic counseling nor were poor knowledge or attitude associated with any of the other variables.

Conclusion: The knowledge about genetic testing/counseling regarding PCG and the acceptance of genetic counseling in this conservative society is high. These results suggest that a national program of genetic screening and counseling might be beneficial in reducing the incidence of PCG in the Kingdom.

PO-02

PACHYDRUSEN IN CENTRAL SEROUS CHORIORETINOPATHY AND POLYPOIDAL CHOROIDAL VASCULOPATHY

Timothy Lai*

Purpose: To evaluate the prevalence of pachydrusen in the eyes with central serous chorioretinopathy (CSC) and polypoidal choroidal vasculopathy (PCV).

Methods: Retrospective review of 66 patients with CSC and 31 patients with PCV. The prevalence of pachydrusen is evaluated using color fundus photo and optical coherence tomography. The relationship between pachydrusen and findings on fundus autofluorescence was also analyzed.

Results: In eyes with CSC, the prevalence of pachydrusen was 15.2%. The mean age of CSC patients with pachydrusen was significantly older than CSC patients without pachydrusen (56.3 years vs 45.4 years, P<0.001). In eyes with PCV, the prevalence of pachydrusen was 61.3%. The mean age of PCV patients with pachydrusen was also significantly older than PCV patients without pachydrusen (68.6 years vs 60.0 years, P<0.003). Eyes with pachydrusen was significantly associated with more extensive fundus autofluorescence changes (P=0.04).

Conclusion: Pachydrusen is more prevalent in PCV than CSC. Increasing age and fundus autofluorescence abnormalities are associated with the presence of pachydrusen.

PO-03

THYROID EYE DISEASE RELATED EPIBLEPHARON: A COMPARATIVE CASE STUDY

Timothy McCulley*, Jiawei Zhao, Nickisa Hodgson, Jessica Chang, Ashley Campbell

Purpose: This study describes the clinical features and management of epiblepharon as a manifestation of thyroid eye disease (TED). In a clinic-based population, we compare the frequency and age in Asian and non-Asian patients and discuss pathophysiologic implications.

Methods: This is retrospective single center case-control study involving the retrospective review of a medical record database that identified 172 adult patients (age 19 to 83) with TED that were consecutively evaluated by one author (TJM) between December 2015 and July 2018. Diagnosis was based upon clinical assessment as documented in the medical record. The primary outcome measure was the presence of epiblepharon.

Results: In a cohort of 172 patients (mean age 52; 138 female), three patients with acquired epiblepharon were identified, all of whom were Asian. The proportion of affected Asian patients (3 out of 17, 17.6%) was significantly higher than that of non-Asian patients (0 out of 155, $p<0.001$). Patients with epiblepharon were also significantly younger than those without epiblepharon, 29.7 + 2.1 vs. 48.7 + 13 years of age ($p=0.026$). All three patients underwent surgical correction with lateral canthoplasty and anterior lamellar pre-tarsal fixation with successful outcomes.

Conclusion: Lower eyelid epiblepharon may occur in TED. In our clinic-based population, this finding was significantly more frequent in Asian patients and in younger patients. Relieving horizontal tension in conjunction with anterior lamella pretarsal fixation is an effective method of correcting TED-associated epiblepharon.

PO-04

IS ISOLATED CHOROIDAL MELANOCYTOSIS A SEPARATE CLINICAL ENTITY?

Zelia Correa*, Cassandra Brooks, **James Augsburger**

Purpose: Isolated choroidal melanocytosis (ICM) is a patch of congenital melanocytosis involving the choroid not associated with ocular melanocytosis. Our purpose is to describe clinical features and course of this disorder and distinguish its features from other melanocytic choroidal lesions.

Methods: Retrospective review of patients with ICM encountered in our clinical practice between 1999-2018. Inclusion criteria were basal diameter ≥ 5 mm, completely flat and homogeneous melanotic pigmentation.

Results: The 39 patients identified during the studied interval ranged in age from 2 weeks to 86 years. Two patients had bilateral choroidal melanocytosis that was isolated in one eye but associated with partial iris melanocytosis in the other eye. The arc length largest basal diameter of ICM ranged from under 5 mm to 75 mm (median 34.5 mm). All of the lesions were completely flat by ultrasound. Overlying retina was attached and appeared normal in each of these eyes. None of the flat choroidal lesions exhibited orange pigment or drusen. ICM extended beneath the fovea in 17 eyes, to the optic disc margin in 6 eyes, and completely around the optic disc in two eyes. Three adult patients had a choroidal melanoma arising from the ICM. One child had contralateral unilateral retinoblastoma, one adult had contralateral choroidal melanoma, and three other adults had a contralateral choroidal nevus. None of the ICM changed appreciably in size during follow-up ranging from 6.5 months to 35 years (median 24.1 months).

Conclusion: ICM is a distinct clinical entity in the spectrum of uveal melanocytic lesions. Its flat/gray-brown homogenous coloration blends with the normal choroid. ICM must be distinguished from nevus, melanoma, acquired bilateral melanotic hyperpigmentation, and normal pigmentation accentuated by patches of choroidal vitiligo. This disorder appears to predispose affected eyes to develop choroidal melanoma from the hypermelanotic patch.

PO-05

IMPAIRED VISUAL FUNCTION AND MID-PERIPHERAL RETINAL NON-PERFUSION IN DIABETIC MACULAR EDEMA: A BASELINE STUDY

Thomas Gardner*, Amro Omari, Lydia Su, Christopher Sesi, Luis Lesmes, Katherine Joltikov, Naheed Khan, Rajesh Rao, Thiran Jayasundera, Jonathan Silverberg, Tapan Patel

Purpose: At least one third of eyes with diabetic macular edema (DME) do not respond well to treatment. To test the hypothesis that eyes with diabetic macular edema (DME) and extensive mid-peripheral retinal non-perfusion have a worse performance on central and peripheral visual function tests than non-diabetic controls. We have previously shown that tests of retinal function reveal subtle defects in vision in patients with early diabetic retinopathy, but have not evaluated eyes with DME.

Methods: Twenty-three treatment naive patients with DME and 20 age-matched controls were enrolled. Subjects had visual field testing including visual acuity measurement, visual fields using frequency doubling perimetry (FDP), Octopus perimetry, MAIA microperimetry, Quick Contrast Sensitivity (QCSF) and multifocal ERG (mfERG). Subjects also had ultra-widefield fluorescein angiography, and non-perfusion was calculated using a machine-quantified algorithm. Data were analyzed by t tests with Bonferroni correction, and correlated with mid-peripheral non-perfusion using Pearson correlation.

Results: Patients with DME had worse visual acuity than controls and reduced sensitivity on FDP, QCSF, MAIA, mfERG and Octopus static and kinetic perimetry. Although not statistically significant, mid-peripheral non-perfusion was correlated with worse visual function in subjects with DME irrespective of the central macular thickness or macular volume.

Conclusion: Patients with DME have a more severe burden of central and peripheral visual dysfunction that is more sensitively revealed than by visual acuity or OCT findings alone. These findings may provide better means to predict prognosis and response to treatment.

PO-06

THE INDIRECT ILLUMINATION TO DIAGNOSE CORNEAL DISORDERS AT THE SLIT LAMP. DO WE NEED ARTIFICIAL INTELLIGENCE?

Walter Lisch*

Purpose: To show that indirect illumination of the cornea at the slit lamp is necessary to make the correct diagnosis in several corneal disorders. The prerequisite for this, however, is the exact focusing on epithelium, stroma, and endothelium, which measure about 50 micron, 445 micron and 5 micron. Artificial intelligence (AI), integrated as a module in the modern slit lamp, could support the ophthalmologist with regard to this aim.

Methods: To examine 54 patients with different corneal diseases at the slit lamp regarding the five distinct possibilities of image at the slit lamp. To perform indirect illumination of the iris in a used pupil and of the retina by pharmacologically dilated pupil. However, it is essential to focus exactly on the epithelium, the stroma and the endothelium in this investigation.

Results: To present 7 patients with fingerprints and blebs of EBMD, 12 with Meesmann epithelial corneal dystrophy (CD), Lisch epithelial CD and Fabry`s disease, 7 with Lattice CD, type 1 and MGUS-induced lattice-like PPK, 26 with endothelial CD and subepithelial band keratopathy. Finally, 1 patient with Descemet tears, and 1 with forme fruste of keratoconus.

Conclusion: This study shows that indirect illumination of the iris and the retina, as two of five corneal examinations on the slit lamp, can give the final diagnosis of different diseases. It is hoped that artificial intelligence (AI), integrated as a module in the slit lamp, can automatically present and lump together five distinct images of the cornea for every patient. Additionally, AI can act as an assistance during the ophthalmologist`s examination at the slit lamp.

PO-07

ALZHEIMER'S GENE (APBB2) IS ASSOCIATED WITH RISK FOR POAG IN AFRICAN AMERICANS

Carly van der Heide, Chiea Chuen Khor, Tin Aung, Michael Hauser, Robert Mullins, **John Fingert***

Purpose: APBB2 encodes a protein (amyloid beta A4 precursor protein-binding, family B, member 2) that has an important role in Alzheimer's disease - it promotes processing of amyloid precursor protein into beta-amyloid, a neurotoxic peptide. A variant in APBB2, rs59892895, has been associated with POAG in Africans and African Americans. We investigated the hypothesis that this variant confers risk for glaucoma by increasing APBB2 production and promoting toxic beta-amyloid formation in retinal ganglion cells, i.e. that overexpression of a protein previously associated with Alzheimer's disease may contribute to POAG pathophysiology.

Methods: We genotyped our collection of donor eyes using a quantitative PCR assay for rs59892895 and identified African American eyes with (n=3) and without (n=2) the APBB2 risk allele. APBB2 and beta-amyloid protein localization was assessed in retinal tissue sections using immunohistochemistry. APBB2 and beta-amyloid protein levels were compared between African American eyes with (n=3) and without (n=2) the APBB2 risk allele by comparing images obtained from each retina. Caucasian donor eyes (without the APBB2 risk allele) were also analyzed.

Results: APBB2 immunoreactivity was observed diffusely throughout all layers of the neural retina and was more prominent in eyes with the APBB2 risk allele than in control eyes. More robust labeling of beta-amyloid was observed in the retinal ganglion cell layer of the eyes with the APBB2 risk allele.

Conclusion: African American carriers of the glaucoma risk allele in APBB2 (rs59892895) have increased retinal ganglion cell expression of APBB2 protein and increased production of toxic beta-amyloid. These data suggest new parallels between the pathophysiology of glaucoma and Alzheimer's disease where accumulation of beta-amyloid is involved in neurodegeneration. The role of APBB2 and beta-amyloid in glaucoma also suggests new therapeutic targets and potential treatment strategies. We are extending this investigation to include studies APBB2 and beta-amyloid labeling in donor eyes with POAG.

PO-08

THE ZOSTER EYE DISEASE STUDY (ZEDS)

Bennie Jeng*, **Elisabeth Cohen**

Purpose: To evaluate whether or not suppressive valacyclovir treatment, compared with placebo, will delay time to first occurrence by 12 months of treatment of new or worsening Dendriform epithelial keratitis (DEK), Stromal keratitis without ulceration (SK), Endothelial keratitis (EK), Iritis (IR) or, Stromal keratitis with ulceration (SKU) due to Herpes Zoster Ophthalmicus. The overarching goals are to determine if suppressive antiviral treatment will reduce complications of HZO, similar to herpes simplex eye disease, and to develop a new standard of care for HZO.

Methods: ZEDS is a multi-center, double masked, randomized controlled trial (RCT) supported by the National Eye Institute. Immunocompetent adults with a history of a typical HZO rash anytime in the past, and an active episode of specific HZO disease manifestations within one year prior to enrollment are randomized 1:1 to valacyclovir 1000 mg daily or placebo for one year of study treatment and 18 months of follow-up. Planned enrollment is 1050 study participants at 60 participating clinical centers in academic and community practices in the USA and Canada.

Results: As of January 21, 2019, 168 study participants have been screened and consented, 131 have been randomized to study medication, and 14 have completed the 12-month study treatment period at 50 activated centers. New or worsening episodes of DEK, SK, EK, IR or SKU have occurred in 27 study participants. Twelve have been adjudicated by the Clinical Event Review Committee, including eight that are confirmed primary endpoints.

Conclusion: Additional enrollment and completion of study treatment is necessary to obtain significant results and develop evidence-based standard of care of HZO with regard to the efficacy and safety of suppressive antiviral treatment. The support of the ophthalmic community by encouraging enrollment in ZEDS is necessary to accomplish these goals.

Notes

Notes

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