The American Ophthalmological Society

ONE HUNDRED AND FIFTY-FOURTH ANNUAL MEETING

David J. Wilson .......................................................... PRESIDENT
Hans E. Grossniklaus ............................................ EXECUTIVE VICE PRESIDENT
Emily Y. Chew ...........................................................EDITOR OF THE TRANSACTIONS

COUNCIL
Woodford S. Van Meter
Marco A. Zarbin
Timothy W. Olsen
Edward G. Buckley
Julia A. Haller

MAY 17–20, 2018
MONARCH BEACH RESORT
DANA POINT, CALIFORNIA
THE ONE HUNDRED AND FIFTY-FOURTH ANNUAL MEETING
of the Society will be held at
Monarch Beach Resort
Dana Point, California
Thursday through Sunday
May 17–20, 2018

COMMITTEE ON PROGRAMS
Eduardo C. Alfonso, Chair
Preston H. Blomquist
Ivan R. Schwab
Jayne Weiss
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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 2018 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.
6. Obtain information and tools through multiple facets to help ophthalmologists deliver high and efficient quality of care.

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 2018 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 17: 1:30–5:00 PM
- Friday, May 18: 6:30 AM–12:00 PM
- Saturday, May 19: 6:00 AM–12:00 PM
- Sunday, May 20: 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 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 11.75 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.

**MEMBERS ELECTED AT THE 2017 MEETING**

| Jurij Bilyk         | Philadelphia, PA |
| Bertil Damato*     | San Francisco, CA |
| Anat Galor         | Miami, FL         |
| David Garway-Heath | London, United Kingdom |
| Anne Hanneken      | San Diego, CA     |
| Jennifer Lim*      | Chicago, IL       |
| Shan Lin           | San Francisco, CA |
| Colin McCannel     | Los Angeles, CA   |
| Joan O’Brien*      | San Francisco, CA |
| Nida Sen           | Bethesda, MD      |
| Justine Smith*     | Adelaide, Australia |
| Carlo Traverso     | Genova, Italy     |
| Fredericus van Kuijk | Minneapolis, MN   |

*Provisional Member

**IN MEMORIAM**

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

| Matthew D. Davis, MD | Madison, WI | Joined 1973 |
| H. MacKenzie Freeman, MD | New York, NY | Joined 1978 |
| William Spencer, MD | Alameda, CA | Joined 1972 |
| Robert Steinert, MD | Irvine, CA  | Joined 1997 |
| Stewart Wolff, MD   | Baltimore, MD| Joined 1972 |
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.

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

HUANG, David
L – Optovue
O – Optovue
P – Optovue
S – Optovue

KINOSHITA, Shigeru
P – Senju Pharmaceutical Co.

KRUEGER, Ronald
C – Alcon

MCCULLEY, Timothy
C – Genentech

ROSENBLATT, Mark
C – Alcon, Santen Pharmaceutical

SARRAF, David
C – Amgen, Bayer, Genentech, Novartis, Nuvelution, Optovue
S – Allergan, Heidelberg, Genentech, Optovue, Regeneron

SPAETH, George
P – SPARCS Contrast Sensitivity Center

TERRY, Mark
P – Bausch and Lomb Surgical
S – Bausch and Lomb Surgical, Moria

WEISS, Jayne*
C – Spark Therapeutics

CHAN, Clement
S – Roche-Genentech, Regeneron

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L – Optovue
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SPAETH, George
P – SPARCS Contrast Sensitivity Center

TERRY, Mark
P – Bausch and Lomb Surgical
S – Bausch and Lomb Surgical, Moria

WEISS, Jayne*
C – Spark Therapeutics
NO FINANCIAL RELATIONSHIPS TO DISCLOSE RELEVANT TO MEETING PARTICIPATION:

ALFONSO, Eduardo*                 MENDEZ, Amber
ARCHER, Steven                   MIELER, William F.
ARNOLD, Anthony                  MILLER, Joseph
BLOMQUIST, Preston*              NEWMAN, Steven
BRODSKY, Michael                 OLSHEN, Timothy
BUCKLEY, Edward                  PARIKH, Ravi
BULLOCK, John D.                 PARKE, David
CHAMBERLAIN, Winston             PARSAA, Cameron
CHAN, Robison Vernon Paul        PASQUALE, Louis
DAMATO, Bertil                   PATON, David
DOUGLAS, Raymond                  ROSALES, Erik
ESMAELI, Bita                    SCHWAB, Ivan*
GALOR, Anat                      SEBAG, J.
GELENDE, Henry                   SMALL, Kent
HANNEKEN, Anne                   STAMPER, Robert
HILLIER, SIAN                    STEIN, Joshua
HIRST, Lawrence                  SUMMERS, C. Gail
HOLLAND, Edward                  TAYLOR, Hugh
JAGER, Martine                   THOMPSON, John
KOKAME, Gregg                    TSANG, Stephen
LIM, Jennifer                    VAN METER, Woodford
LISCH, Walter                    WILSON, M. Edward
LOLLETT, Ivonne                  WILSON, Steven
MANSBERGER, Steven               WRIGHT, Kenneth
MAUMENEE, Irene                  YOUNG, Terri

*Members of the Committee on Programs
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>1:30–5:00 PM</td>
<td>Registration</td>
<td>Monarch Ballroom Promenade</td>
</tr>
<tr>
<td>2:00–3:30 PM</td>
<td>New Member Spotlight Presentations</td>
<td>Monarch Ballroom 2</td>
</tr>
<tr>
<td>6:00–7:30 PM</td>
<td>Reception Welcoming New Members (black tie optional)</td>
<td>Grand Lawn</td>
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**THURSDAY, MAY 17**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
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<td>Registration</td>
<td>Monarch Ballroom Promenade</td>
</tr>
<tr>
<td>7:00–11:00 AM</td>
<td>Spouse/Personal Guest Hospitality Lounge</td>
<td>Aegean</td>
</tr>
<tr>
<td>9:30–10:30 AM</td>
<td>Spouse/Personal Guest Lecture</td>
<td>Aegean</td>
</tr>
<tr>
<td>2:00–5:00 PM</td>
<td>Tennis Tournament (men/women/mixed doubles)</td>
<td>Tennis Club</td>
</tr>
<tr>
<td>5:45–7:30 PM</td>
<td>Reception &amp; 4th Annual Artistic Soirée (business casual)</td>
<td>Monarch Ballroom 1</td>
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**FRIDAY, MAY 18**

<table>
<thead>
<tr>
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<tr>
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<td>Registration</td>
<td>Monarch Ballroom Promenade</td>
</tr>
<tr>
<td>7:00–8:00 AM</td>
<td>Spouse/Personal Guest Yoga (incl. with registration, sign up required)</td>
<td>Miraval Spa/Beach</td>
</tr>
<tr>
<td>7:00–11:00 AM</td>
<td>Spouse/Personal Guest Hospitality Lounge</td>
<td>Aegean</td>
</tr>
<tr>
<td>12:30–2:00 PM</td>
<td>Emeritus Luncheon (by invitation)</td>
<td>Aegean</td>
</tr>
<tr>
<td>12:30–5:00 PM</td>
<td>Golf Tournament (men/women)</td>
<td>Monarch Beach Golf Links</td>
</tr>
<tr>
<td>6:00–6:45 PM</td>
<td>Reception</td>
<td>Pacific Ballroom Promenade</td>
</tr>
<tr>
<td>7:00–9:00 PM</td>
<td>Banquet (black tie optional)</td>
<td>Pacific Ballroom 1 &amp; 2</td>
</tr>
<tr>
<td>9:00–11:00 PM</td>
<td>Live Band &amp; Dancing</td>
<td>Pacific Ballroom 1 &amp; 2</td>
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**SATURDAY, MAY 19**

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**SUNDAY, MAY 20**

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<tbody>
<tr>
<td>6:30–10:00 AM</td>
<td>Registration</td>
<td>Monarch Ballroom Promenade</td>
</tr>
<tr>
<td>6:30–8:00 AM</td>
<td>Breakfast (with members)</td>
<td>Monarch Ballroom Promenade</td>
</tr>
</tbody>
</table>
# American Ophthalmological Society

## Meeting Schedule

### THURSDAY, MAY 17

<table>
<thead>
<tr>
<th>Time</th>
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</tr>
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<tbody>
<tr>
<td>12:00–1:30 PM</td>
<td>New Member Luncheon (by invitation)</td>
<td>Aegean</td>
</tr>
<tr>
<td>1:30–5:00 PM</td>
<td>Registration</td>
<td>Monarch Ballroom Promenade</td>
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<td>New Member Spotlight Presentation</td>
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<tr>
<td>6:30–8:00 AM</td>
<td>Breakfast</td>
<td>Monarch Ballroom Promenade</td>
</tr>
<tr>
<td>7:30–9:40 AM</td>
<td>Friday Symposium: Global Outreach</td>
<td>Monarch Ballroom 2 &amp; 3</td>
</tr>
<tr>
<td>9:40–10:20 AM</td>
<td>Coffee Break and Guided Poster Session</td>
<td>Monarch Ballroom 1</td>
</tr>
<tr>
<td>10:20 AM–12:00 PM</td>
<td>Scientific Program–Paper Session</td>
<td>Monarch Ballroom 2 &amp; 3</td>
</tr>
<tr>
<td>12:15–1:45 PM</td>
<td>Social Media Lunch Workshop (incl. with registration, signup required)</td>
<td>Monarch Ballroom 2 &amp; 3</td>
</tr>
<tr>
<td>2:00–5:00 PM</td>
<td>Tennis Tournament (men/women/mixed doubles)</td>
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<td>Reception &amp; 4th Annual Artistic Soirée (business casual)</td>
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<td>Breakfast</td>
<td>Monarch Ballroom Promenade</td>
</tr>
<tr>
<td>6:30–7:15 AM</td>
<td>Executive Session (full members only)</td>
<td>Monarch Ballroom 2 &amp; 3</td>
</tr>
<tr>
<td>7:30–10:10 AM</td>
<td>Knapp Symposium: Wound Healing and the Cornea</td>
<td>Monarch Ballroom 2 &amp; 3</td>
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<tr>
<td>10:10–10:50 AM</td>
<td>Coffee Break and Guided Poster Session (35 min)</td>
<td>Monarch Ballroom 1</td>
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<tr>
<td>10:50 AM–12:30 PM</td>
<td>Scientific Program–Paper Session</td>
<td>Monarch Ballroom 2 &amp; 3</td>
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<tr>
<td>12:30–2:00 PM</td>
<td>Emeritus Luncheon (by invitation)</td>
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<tr>
<td>7:30–9:50 AM</td>
<td>Scientific Program–Paper Session</td>
<td>Monarch Ballroom 2 &amp; 3</td>
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</tbody>
</table>
2018 Friday Symposium
FRIDAY, MAY 18

GLOBAL OUTREACH

INTRODUCTION
Woodford Van Meter, MD
University of Kentucky
Lexington, KY

THE ORIGIN OF ORBIS
David Paton, MD
East Hampton, NY

GLOBAL ORGANIZATIONS
Hugh Taylor, AC, MD, FRACS
University of Melbourne
Carlton, VIC, Australia

GLOBAL RESEARCH
Martine Jager, MD, PhD
Leiden University Medical Center
Leiden, Netherlands

GLOBAL ACCREDITATION
Susan Day, MD
ACGME International
Chicago, IL

GLOBAL CERTIFICATION
George Bartley, MD
Mayo Clinic
Rochester, MN

AUDIENCE Q & A
INTRODUCTION
Woodford Van Meter, MD
University of Kentucky
Lexington, KY

THE REGENERATED CORNEA
May Griffith, PhD
University of Montreal
Montreal, QC, Canada

CORNEAL NERVE REGENERATION
Mark Rosenblatt, MD, PhD, MBA
University of Illinois at Chicago
Chicago, IL

CONJUNCTIVAL REPAIR (PTERYGIUM)
Lawrence Hirst, MBBS(Hons), DO, MPH, MD, DSc, FRANZCO, FRACS
The Australian Pterygium Centre
Graceville, QLD, Australia

EPITHELIAL REPAIR (LIMBAL TRANSPLANT)
Edward Holland, MD
University of Cincinnati
Cincinnati, OH

STROMAL REMODELING (CROSS-LINKING)
Peter Hersh, MD
Cornea and Laser Eye Institute
Teaneck, NJ

ENDOTHELIAL CELL REPAIR
Shigeru Kinoshita, MD
Kyoto Prefectural University of Medicine
Kyoto, Japan

AUDIENCE Q & A
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 Monarch Ballroom 2 & 3.

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 8 minutes and the first discussant to 3 minutes. General discussion will be limited to 8 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.)
PERIPAPILLARY RETINOSCHISIS IS ASSOCIATED WITH OCT SIGNS OF MUELLER CELL ACTIVATION AND PROGRESSIVE GLAUCOMA

Brad Fortune, Kelly Ma, Shaban Demiral, Stuart Gardiner, Steven Mansberger*

**Purpose:** Optical coherence tomography (OCT) imaging can identify retinoschisis of the peripapillary retinal nerve fiber layer (RNFL) in glaucoma patients. We were interested in the pathophysiology and clinical significance of retinoschisis for glaucoma diagnosis and management.

**Methods:** We performed a longitudinal case-control study using data from a cohort of subjects with a diagnosis of glaucoma or glaucoma suspect. We compared functional, structural, and demographic characteristics between the cases with peripapillary retinoschisis and controls without peripapillary retinoschisis.

**Results:** The overall frequency of peripapillary schisis was 6.0% (12 eyes from 10/166 subjects) with 2 cases having bilateral retinoschisis; and 2 eyes having simultaneous retinoschisis in different locations for a total of 15 retinoschisis events. Vitreous traction was detected infrequently (13%, 2/15 events). Retinoschisis occurred most commonly in the superior quadrant (73%, 11/15 events); included a peripapillary blood vessel (100%, 15/15); and showed hyper-reflective structures spanning the schisis whose morphology and spacing are consistent with activated Muller cells (14/15, 93%). Comparing cases to one eye each of 30 randomly selected controls, we found no significant differences (p>0.05 for all) in age, gender, visual acuity, intraocular pressure, presence of posterior vitreous detachment, nor central corneal thickness. However, cases with retinoschisis tended to have a higher cup-to-disc ratio (p=.06), thinner RNFL thickness (p=.02) and worse mean deviation sensitivity on visual fields (p=.06). Over at least 3 years of follow-up, cases were more likely to have a faster rate of global RNFL thickness thinning (p=0.02) and worsening visual field sensitivity (p=.02).

**Conclusion:** Peripapillary retinoschisis is not rare in glaucoma, seems to involve mechanisms beyond vitreous traction, and is associated with a faster rate of RNFL thinning and visual field progression. This is the first report to identify OCT signs of Mueller cell activation related to peripapillary retinoschisis in living human eyes. Future studies should examine whether this gliopathy is the cause or effect of peripapillary retinoschisis.

**Discussant:** Kent Small
A SOPHISTICATED ALGORITHM TO SEARCH ELECTRONIC HEALTH RECORDS TO IDENTIFY PERSONS WITH OCULAR DISEASES

Joshua Stein*, Moshiur Rahman, Shivani Kamat, Manjool Shah, Joshua Ehrlich, Erin Boese, Jeff Cowall, Chris Andrews, David Hanauer

**Purpose:** As clinicians shift documenting patient care activities to electronic health records (EHRs) from written notes, it is increasingly important to develop approaches to tap EHRs to accurately identify patients with a phenotype of interest.

**Methods:** We developed an approach to scan and prioritize data elements from EPIC EHRs to estimate the probability a given patient has a phenotype of interest. We tested the ability of our algorithm to properly identify patients with exfoliation syndrome (PXF). The algorithm reviews data from the patient’s Problem List, billing data (ICD-9 and 10 codes), examination notes, and free text in the EHR for documentation of PXF. Natural language processing was used to extract structured data from unstructured text. Then using LASSO regression, the algorithm assigns each patient a score from 0 to 1 representing his or her probability of having PXF. EHRs of 200 patients were assessed by glaucoma specialists to be used as the gold standard to train the LASSO model. Later, EHRs of additional patients who were identified by the model as likely PXF cases were assessed by the glaucoma specialists to compute the positive predictive value (PPV) and the negative predictive value (NPV) of the algorithm.

**Results:** Applying our algorithm to all 122339 patients seen at the Kellogg Eye Center over the past 5 years, 353 patients (0.3%) had a predicted probability of PXF >90%, 83 patients (0.07%) had a predicted probability >99%, and 121085 patients (99.0%) had a predicted probability of PXF of <10%. The PPV of the algorithm was 95.0% (91.2%-98.9%) and its NPV was 100%.

**Conclusion:** The algorithm we developed does an excellent job of searching and extracting key data elements from the EHR to identify and properly characterize patients’ probability of having PXF. By assigning each patient a probability score for possessing the phenotype of interest, researchers can use this approach to tap EHRs to identify patients to recruit for clinical trials and other clinical/translational studies. Our approach will minimize the need for manual chart review and revolutionize researchers' ability to identify patients with a phenotype of interest for clinical and translational research.

**Discussant:** Louis Pasquale
CRISPR-BASED GENOME SURGERY FOR THE TREATMENT OF AUTOSOMAL DOMINANT RETINITIS PIGMENTOSA

Stephen Tsang*

Purpose: Develop a universal gene therapy to overcome the genetic heterogeneity in retinitis pigmentosa (RP) due to mutations in rhodopsin (RHO).

Methods: This study involves gene therapy using dual adeno-associated viruses (AAVs) that 1) destroy expression of the endogenous Rho gene in a mutation-independent manner via an improved CRISPR-based gene deletion, and 2) enable expression of wild-type protein via exogenous cDNA. The study includes two kinds of human rhodopsin mutation knock-in mouse models, RhoP23H and RhoD190N. In total, 23 RhoP23H/P23H, 43 RhoP23H/+ and 31 RhoD190N/+ mice were used for analysis. Electroretinogram and histology analysis are the main outcome measures.

Results: The thickness of the outer nuclear layer (ONL) after the subretinal injection of combination ablate-and-replace gene therapy was around 20%~30% greater than gene replacement-only therapy at 3 months after AAVs injection. Furthermore, electroretinogram (ERG) demonstrated that the a and b waves of both RhoP23H and RhoD190N disease models were more significantly preserved using ablate-and-replace gene therapy (p<0.001) but not by gene replacement only.

Conclusion: As a proof-of-concept, our results showcased that the "ablate-and-replace" strategy can ameliorate the disease progression of histology and function of photoreceptors for both of the human mutation knock-in models. These results exhibit the potency of the ablate-and-replace strategy to treat RP caused by different RHO mutations. Furthermore, because ablate-and-replace is mutation-independent, this strategy may be used to treat a wide array of dominant diseases in ophthalmology and other fields. Clinical trials with ablate-and-replace would allow researchers to determine if this strategy provides any benefits for patients with diseases of interest.

Discussant: Terri Young
EXPECTED EFFECT OF CONTRALATERAL MEDIAL RECTUS MUSCLE RECESSION FOR ESOTROPIC DUANE SYNDROME

Steven Archer

Purpose: Bilateral medial rectus recessions are often advocated for unilateral esotropic Duane syndrome. The rationale is that contralateral surgery can provide additional correction of the esotropia and head turn by reducing innervation to the medial rectus muscle in the Duane syndrome eye. This strategy has proven useful for 6th nerve palsy; however, in Duane syndrome any reduction of medial rectus muscle innervation also reduces the anomalous innervation to the lateral rectus muscle, so there may be no net benefit. The purpose of this study is to evaluate the potential beneficial effect on abnormal head posture of contralateral medial rectus muscle recession in Duane syndrome.

Methods: This is an institutional retrospective series of Duane syndrome patients examined by the author from 2013 to 2018. Patients with unilateral esotropic Duane syndrome were tested for improvement in their abnormal head posture with base-out prism over the sound eye to simulate the effect of contralateral surgery.

Results: Of the 48 patients with Duane syndrome seen during this period, 16 had unilateral esotropic Duane syndrome with a compensatory head turn. Of these, 10 had results of contralateral eye prism testing recorded. Even with large amounts of prism ranging from 20 to 50 prism diopters, only 3 showed any improvement in their head turn.

Conclusion: Contralateral medial rectus muscle recession is unlikely to provide any additional effect on abnormal head posture in the majority of patients with unilateral esotropic Duane syndrome. Preoperative testing with prism over the sound eye is advised to predict which patients may benefit from this approach.

Discussant: Michael Brodsky
Purpose: To deal with time demands of clinical documentation using electronic health records (EHRs), ophthalmologists frequently adopt strategies such as copy-paste and templates (“import technology”), and relying on authorship by clinical support staff (e.g. technicians, photographers). This paper describes a retrospective study that quantitatively assesses the prevalence of imported and support staff-authored content in ophthalmology office visit progress notes at Casey Eye Institute at Oregon Health & Science University.

Methods: Eight attending ophthalmologists from 4 different ophthalmic subspecialties (cornea, general, neuro-ophthalmology, retina) were selected. Progress note text from 1 new and 1 follow-up office visit was characterized as: (a) manually-entered or imported, and (b) authored by provider, support staff/technician, or photographer. Next, 5 pairs of chart review notes from serial follow-up office visits for the same providers were compared for similarity using software text computation tools (Workshare Compare, San Francisco, CA; Microsoft Word, Redmond, WA). For analysis, a clinician (AH) coded each element of the progress note as Subjective (S), Objective (O), Assessment (A), Plan (P), or Other.

Results: On average, the majority of text words in new and return progress notes was imported using sources such as copy-paste and templates (514/691 [74%] new, 654/766 [85%] return). Support staff authored significant percentages of progress notes (253/691 [37%] new, 398/767 [52%] return). On average, 897/1168 [77%] text words in serial follow-up chart review notes were identical between notes (Subjective 270/345 [79%], Objective 270/351 [77%], Assessment 98/129 [76%], Plan 24/42 [57%], Other 234/301 [78%]).

Conclusion: Current EHR documentation strategies rely heavily on imported text and support staff authorship. The majority of ophthalmology note text remains identical between serial follow-up visits. These findings raise questions regarding the accuracy, efficiency, and overall effectiveness of progress notes within the EHR, and about potential improved documentation strategies in the future.

Discussant: David Parke
CORNEAL ENDOTHELIAL INJURY TRIGGERS POSTERIOR STROMAL KERATOCYTE APOPTOSIS AND POSTERIOR CORNEAL FIBROSIS (HAZE)

Steven Wilson*, Gustavo Marino, Carla Medeiros, Paramananda Saikia, Luciana Lassance

**Purpose:** To determine whether endothelial injuries trigger keratocyte apoptosis and basement membrane component production, and whether severe endothelial injuries trigger posterior corneal scarring.

**Methods:** An 8mm corneal endothelial wound was produced with an olive tip cannula over the central 8 mm of the posterior cornea in 12 New Zealand White rabbits. The animals were sacrificed after 1 hour (N=6) and 4 hours (N=6). The TUNEL assay to detect apoptosis and immunohistochemistry (IHC) to detect the basement membrane component nidogen-1 were performed. Severe keratitis was produced in eight rabbits with pseudomonas aeruginosa and sterilized with tobramycin. Myofibroblasts were detected with immunocytochemistry for alpha-smooth muscle actin at 1, 2, 3, and 4 months after infection. The corneal ultrastructure was examined in wounded and unwounded corneas using a transmission electron microscopy (TEM).

**Results:** TUNEL-positive apoptotic keratocytes were present in the posterior stroma overlying the site of endothelial cell injury at 1 and 4 hours after endothelial trauma. Apoptosis of the keratocytes was confirmed by TEM. Nidogen-1 IHC showed posterior keratocytes, including those undergoing apoptosis, produced basement membrane components. In corneas with severe pseudomonas infection, damage to the epithelial basement membrane (EBM), the endothelium and Descemet's membrane resulted in full-thickness stromal myofibroblast and scar development at 1 month after infection. The EBM regenerated by 2 months and resulted in disappearance of the anterior to mid-stromal myofibroblasts. Posterior myofibroblasts and scarring, however, persisted overlying the endothelial and Descemet's membrane injury even at 4 months after infection.

**Conclusion:** Endothelial scrape injury triggers apoptosis of overlying keratocytes, analogous to keratocyte apoptosis after epithelial scrape injury. Posterior keratocytes produce basement membrane proteins such as nidogen-1 to repair Descemet's membrane. Severe endothelial and Descemet's injury triggers the development of persistent stromal myofibroblasts and scarring at the site of injury that is relevant to posterior corneal scarring after corneal infection, disease or surgery.

**Discussant:** Stephen McLeod
THE RELATIONSHIP BETWEEN OCULAR ITCH, OCULAR PAIN, AND DRY EYE SYMPTOMS

Anat Galor*, Leslie Small, William Feuer, Roy Levitt, Constantine Sarantopoulos, Gil Yosipovitch

Purpose: To evaluate associations between sensations of ocular itch and dry eye (DE) symptoms, including ocular pain, and DE signs.

Methods: A cross-sectional study of 324 patients seen in the Miami Veterans Affairs eye clinic was performed. The evaluation consisted of questionnaires regarding ocular itch, DE symptoms, descriptors of neuropathic-like ocular pain (NOP), and evoked pain sensitivity testing on the forehead and forearm, followed by a comprehensive ocular surface examination including corneal mechanical sensitivity testing. Analyses were performed to examine for differences between those with and without subjective complaints of ocular itch.

Results: The mean age was 62 years with 92% being male. Symptoms of DE and NOP were more frequent in patients with moderate-severe ocular itch compared to those with no or mild ocular itch symptoms. With the exception of ocular surface inflammation (abnormal matrix metalloproteinase 9 testing) which was less common in those with moderate-severe ocular itch symptoms, DE signs were not related to ocular itch. Individuals with moderate-severe ocular itch also demonstrated greater sensitivity to evoked pain on the forearm and had higher non-ocular pain, depression, and post-traumatic stress disorders scores, compared to those with no or mild itch symptoms.

Conclusion: Subjects with moderate-severe ocular itch symptoms also have more severe symptoms of DE, NOP, non-ocular pain and demonstrate abnormal somatosensory testing in the form of increased sensitivity to evoked pain at a site remote from the eye, consistent with generalized hypersensitivity.

Discussant: Shigeru Kinoshita
THE EFFECTS OF YAG LASER ON VITREOUS AND VISION

J. Sebag*, Justin Nguyen, Kenneth Yee, Jeannie Nguyen-Cuu

**Purpose:** Vitreous floaters that significantly degrade contrast sensitivity function (CSF; Retina 34:1062-8, 2014) qualify for the diagnosis of Vision Degrading Vitreopathy. A recent study found that YAG laser of Weiss Rings resulted in only a 54% subjective improvement in only 53% of patients. Persistent degradation in CSF following YAG vitreolysis is hypothesized to play a role.

**Methods:** To test this hypothesis, 32 eyes with vitreous floaters and prior YAG laser vitreolysis were compared to 32 untreated floater cases. Further, of the 32 YAG-treated cases, 22 subsequently chose to undergo vitrectomy and were compared to 10 cases electing observation. Patient (dis)satisfaction was evaluated with the NEI VFQ-25 questionnaire, vision with logMAR visual acuity (VA) and contrast sensitivity function (CSF; Freiburg Acuity Contrast Testing; %W), and vitreous structure with quantitative ultrasound (QUS; IOVS 56:1611-17, 2015).

**Results:** Vitreous echodensity trended lower in YAG-treated vs. untreated eyes (2.2±1.1 vs. 3.5±2.9) but not significantly (p=0.13). There were no differences in VFQ (73±15 vs. 76±15; p=0.22), VA (0.10±0.09 vs. 0.14±0.14; p=0.09), and CSF (3.90±1.53%W vs. 3.92±1.52%W; p=0.48) in YAG-treated vs. untreated floater eyes. Predictably, VFQ was worse in cases that subsequently chose vitrectomy (66.78±9.82) vs. observation (85.90±13.36; p=0.0001). VA trended worse in vitrectomy cases (0.12 ± 0.09) vs. observation (0.07±0.08; p=0.07). In cases that chose vitrectomy, vitreous echodensity was greater (2.5±1.0 vs. 1.7±1.2; p=0.04) and CSF was worse (4.35±1.64%W) compared to the observation group (2.93±0.59%W; p=0.001).

**Conclusion:** Total vitreous echodensity was slightly reduced in YAG-treated eyes, but VFQ, VA, and CSF were the same as untreated eyes, suggesting no benefit from YAG. Dissatisfied patients who chose surgery had 22% worse VFQ-25 scores than satisfied patients, probably because of 32% greater vitreous echodensity and 48% worse CSF. Thus, YAG laser treatments may have minimal structural effects but can leave dissatisfied patients with diminished CSF, resulting in a desire to undergo vitrectomy.

**Discussant:** Timothy Olsen
Purpose: Eye banks are now more intimately involved in corneal transplantation procedures than ever before. Technicians perform complex preparations of donor tissue in the eye bank before surgery, eliminating steps that were once done by the surgeon in the operating room. This presentation describes the technique, advantages and early complication rates of utilizing Descemet membrane endothelial keratoplasty (DMEK) donor tissue that is pre-stripped, prestained, pre-trephinated and pre-loaded into an injector and then delivered in storage medium to the surgeon one to two days later for transplantation.

Methods: 111 eyes with endothelial failure underwent DMEK using donors that were pre-stripped, pre-stained, pre-trephinated and pre-loaded into a Straiko modified Jones tube and delivered in a standard Optisol-filled container one to two days later. Tightness of the scroll (scale of 1-very loose to 4-very tight), time to un-scroll and center the tissue, postoperative rebubble rate and graft failure rate were recorded. Endothelial cell density was measured at three and six months following surgery.

Results: All tissues remained well stained with easy visualization at the time of surgery. The mean scroll tightness was 2.2 (range: 1 to 4). The mean time to center and unscrol the tissue was 3.5 minutes (range: 0.5 to 11.25 minutes). All corneas cleared with no graft failures. Endothelial cell loss six months post operatively was 33% (n=37 eyes). There were 15 cases with placement of another bubble postop (13.5% rebubble rate). Of those 15 cases, two required a second re-bubble.

Conclusion: This report shows the advantages of using pre-stripped, pre-stained, pre-trephinated and pre-loaded tissue for DMEK. The characteristics and handling of the tissue were not different from surgeon-loaded tissue. Because trephinating, staining, and loading the graft intra-operatively is no longer necessary, surgery time and risk of damaging donor tissue are reduced when using pre-loaded tissue.

Discussant: Henry Gelender
**DesceMET ENDothelial Thickness COMParison TRIAL:**
A randomized controlled double masked trial comparing DMEK to ultrathin DSAEK.

Winston Chamberlain*, David Wilson, Jennifer Rose-Nussbaumer, Charles Lin, Ariana Austin, Matthew Duggan

**Purpose:** To compare clinical outcomes of Ultrathin Descemet stripping automated endothelial Keratoplasty (UT-DSAEK) and Descemet membrane endothelial Keratoplasty (DMEK) in the treatment of corneal endothelial dysfunction.

**Methods:** Design: Multicenter, double-masked, randomized controlled clinical trial. Study Participants: Patients with damaged or diseased endothelium from Fuchs endothelial dystrophy or Pseudophakic bullous keratopathy who were considered good candidates for either DMEK or UT-DSAEK.

Intervention: Study participants were randomized to UT-DSAEK or DMEK 1-2 days prior to surgery.

Main Outcome Measures: The primary outcome was best corrected visual acuity at 6 months. Secondary outcomes include 3-month visual acuity, 3 and 6-month endothelial cell density, complications, and corneal HOA’s.

**Results:** 216 patients with endothelial dysfunction were screened and 50 eyes of 38 patients were enrolled. Overall, we found a 1.5 line 3-month visual acuity improvement among DMEK compared with UT-DSEK (95% CI 2.5 to 0.6 lines better; P =0.002) and 1.8 line 6-month visual acuity improvement among DMEK compared with UT-DSAEK after correcting for baseline visual acuity (95% CI 2.5 to 1.0 lines better; P <0.001). On average DMEK had 77 fewer cells/mm2 at 3 months (95% CI -326 to 172; P=0.54) and 150 fewer cells/mm2 at 6 months (95% CI -365 to 66; P=0.17) compared with UT-DSAEK but this was not statistically significant. At 3 months. At 6 months, DMEK had significantly less coma (P≤0.003), trefoil (P≤0.007), oblique astigmatism (P≤0.006), and total HOA (P<0.001) of the posterior corneal surface at 4.0- and 6.0-mm-diameter optical zones. At 3 and 6 months post-operatively, no significant differences in spherical aberration, HOAs of the anterior surface, or entire cornea existed between groups. Intraoperative and post-operative complication rates were similar between groups.

**Conclusion:** DMEK had superior visual acuity results compared with UT-DSAEK at 6 months in patients with isolated endothelial dysfunction with similar endothelial cell loss and complications rates.

**Discussant:** Woodford Van Meter
DETERMINING THE PREVALENCE OF PCV IN ANTI-VEGF RESISTANT EYES AND THE SENSITIVITY AND SPECIFICITY OF DETECTING PCV WITH EN-FACE OCT AND OCTA

Gregg Kokame*, Talisa de Carlo, Kyle Kaneko, Rebecca Lian, James Lai, Raymond Wee

Purpose: Determine the prevalence of polypoidal choroidal vasculopathy (PCV) in eyes with exudative age-related macular degeneration (AMD) in two different groups based on responsiveness to anti-vascular endothelial growth factor (VEGF). 2) Determine sensitivity and specificity of PCV diagnosis of en face optical coherence tomography (OCT) and OCT angiography (OCTA).

Methods: Retrospective, chart review of 256 consecutive eyes diagnosed with exudative AMD. Part 1: exudative AMD eyes were separated into two groups - group 1 with eyes resistant to anti-VEGF injections defined as persistent disease activity after four injections and group 2 with eyes without residual disease activity. The proportion of eyes with diagnosis of PCV was determined in each group. Part 2: en face OCT and OCTA in its entirety were reviewed in a blinded fashion to determine if they could detect the PCV complex. Sensitivity and specificity of PCV diagnosis was determined for each imaging technique using indocyanine green (ICG) angiography as the ground truth.

Results: Part 1: PCV was noted to have a prevalence of 44.5% (114/256 eyes) overall. PCV was diagnosed in 50.8% (61/120 eyes) of eyes in group 1 and 28.6% (28/98 eyes) of group 2 (p=0.00044). Part 2: Sensitivity and specificity of en face OCT were 30.0% and 85.7%, of OCT angiograms were 26.8% and 96.8%, and of OCTA were 43.9% and 87.1% respectively.

Conclusion: PCV is more commonly seen in eyes with exudative AMD resistant to anti-VEGF suggesting that diagnosis is crucial to guiding treatment. Sensitivity of detecting PCV was low using en face OCT and OCTA but specificity was high. ICG angiography remains the gold standard for PCV detection.

Discussant: David Sarraf
OPTICAL COHERENCE TOMOGRAPHY ANGIOGRAPHY OF COLLATERAL VESSEL FORMATION IN EYES WITH RETINAL VEIN OCCLUSION SUPPORTS VENOUS OUTFLOW ORIGIN IN THE DEEP VASCULAR COMPLEX

David Sarraf*, K. Bailey Freund, Belinda Long, Sean Garrity, Kiran Vupparaboina, Kunal Dansingani

Purpose: To determine the level of collateral vessel formation in eyes with branch or hemispheric retinal vein occlusion (RVO) using optical coherence tomography angiography (OCTA).

Methods: Eyes with branch or hemispheric RVO displaying collateral vessels in the macula, as identified with color fundus photography and fluorescein angiography, were retrospectively studied with OCT angiography. Meticulous segmentation at the level of the superficial and deep retinal vascular complex (DVC) was performed in each case and the course of collateral formation was carefully analyzed using two dimensional OCT angiographic analysis and color-coded three dimensional or 3D volume renderings prepared from raw OCTA voxel data.

Results: A total of 23 eyes (21 branch, 1 hemispheric RVO) of 23 patients (mean age 73 ± 11 years) were studied and 101 collateral vessels were identified and analyzed (mean of 4.4 ± 2.0, range: 2-9 collaterals per eye). With en face OCTA, the collaterals appeared as curvilinear dilated flow signals that connected veins across the horizontal raphe or veins on opposite sides of an occluded venous segment within the same retinal hemisphere. Of the 101 collaterals analyzed, nearly all illustrated substantially greater flow signal in the DVC, and all collaterals ultimately coursed through the DVC. Three dimensional volume rendering of the OCT angiograms, to simultaneously visualize the superficial and deep retinal vascular complex, demonstrated that the predominant level of collateral formation was in the DVC.

Conclusion: Collateral vessels associated with branch or hemispheric retinal vein occlusion were all found to ultimately course through the deep vascular complex. The absence of collaterals confined exclusively to the superficial capillary plexus (SCP) suggests that retinal venous drainage may not originate in the SCP and indicates that the deep vascular complex may be specialized for venous outflow. These results support an “in series” arrangement of the retinal capillary plexus.

Discussant: David Huang
Purpose: This study was designed to assess the efficacy, reliability and repeatability of SPARCS (Spaeth Richman Contrast Sensitivity test) in patients with glaucoma, particularly in comparison to the Pelli-Robson Chart test for contrast sensitivity.

Methods: One hundred thirty-five eyes of 135 patients were evaluated. Three age- and sex-matched groups were studied: normal controls, glaucoma suspects (suspicious optic discs) and glaucoma patients; the glaucoma subgroup was further subdivided into three subgroups, mild, moderate and or severe, based on the amount of visual field damage.

Results: The correlation between Pelli-Robson scores and SPARCS scores was strong (S=0.807; p<0.001). The Intraclass Correlation Coefficient (ICC) for Pelli-Robson was 0.952, and for SPARCS 0.0988. The coefficient of repeatability (COR) was better for SPARCS (5.65%) than for Pelli-Robson (12.44%). SPARCS had higher sensitivity (84.4%) and specificity (70%) for detecting glaucoma than Pelli-Robson (80.0% and 65.6%).

Conclusion: The present study indicates that SPARCS is a better method of testing contrast sensitivity than the Pelli-Robson chart test. In addition to being as or more reliable and repeatable it offers a universal way to measure contrast sensitivity because it is independent of the effects of literacy and educational status, and does not require access to a special chart or payment. It can be reliably used in patients with different stages of glaucoma.

Discussant: Robert Stamper
TOCILIZUMAB FOR THE TREATMENT OF GIANT CELL ARTERITIS: OPTHALMIC SUBSET ANALYSIS OF A PHASE 3 RANDOMIZED CONTROLLED TRIAL

Timothy McCulley*, Katie Tuckwell, Sophie Dimonaco, Micki Klearman, Neil Collinson, John Stone

Purpose: Report visual manifestations during a clinical trial (GiACTA) of tocilizumab, an interleukin-6 receptor-α inhibitor, in GCA patients.

Methods: Patients with confirmed active GCA were randomly assigned 2:1:1:1 to double-masked subcutaneous tocilizumab 162 mg weekly (TCZ-QW) or every-other-week (TCZ-Q2W) plus 26-week prednisone taper or to placebo plus 26-week (PBO+26) or 52-week (PBO+52) prednisone taper for 52 weeks; prednisone doses <20 mg/day were masked. Sustained remission was defined as flare absence, CRP normalization, and prednisone taper adherence for weeks 12-52. Primary and key secondary endpoints were proportions of patients in sustained remission, comparing TCZ and PBO groups (significance level, 0.005). In this subanalysis, we compare ophthalmic/visual findings between groups.

Results: Among 251 patients randomly assigned (mean±SD age, 69±8.2 years), 56% and 53.1% in the TCZ-QW and TCZ-Q2W groups, respectively, achieved sustained remission versus 14.0% in the PBO+26 group (p<0.0001) and 17.6% in the PBO+52 group (p<0.0002). Median cumulative steroid exposure was 1862.0 mg in both TCZ groups versus 3296.0 mg for PBO+26 and 3817.5 mg for PBO+52 (p<0.001). Serious AEs were reported in 15.0%, 14.3%, 22.0%, and 25.5% of TCZ-QW, TCZ-Q2W, PBO+26, and PBO+52 patients. Flares involving visual complications occurred in 2 patients (4.1%) in the TCZ-Q2W group (blurred vision, ischemic optic neuropathy), 3 patients (6%) in the PBO+26 group (amaurosis fugax, blurred vision, blurred vision and diplopia), 4 patients (7.8%) in the PBO+52 group (3 blurred vision, 1 diplopia), and no patients in the TCZ-QW group. Proportions of patients were lower in TCZ than placebo groups.

Conclusion: TCZ plus 26-week prednisone taper was superior to PBO+26 and PBO+52 tapers in achieving sustained remission at 52 weeks. Proportions of patients with ophthalmic/visual symptoms or complications were lower in TCZ than placebo groups.

Discussant: Anthony Arnold
COMPLETE LENSECTOMY FOR ECTOPIA LENTIS IN CHILDREN: OUTCOMES AND COMPLICATIONS USING AN ANTERIOR SEGMENT APPROACH

M. Edward Wilson*, Sarah Logan, Rupal Trivedi

Purpose: The management of ectopia lentis in children is complex. We report the outcomes of a consecutive case series of children after total lensectomy using an anterior segment approach.

Methods: An IRB approved retrospective study was conducted of consecutive patients operated by one surgeon for ectopia lentis in childhood. Patient characteristics, visual and refractive outcomes, surgical and post-surgical complications and associated eye conditions that developed during the post-operative period were collected and de-identified.

Results: 124 eyes of 64 patients (21 female, 39 male) were included. 60 patients were operated bilaterally. 69 eyes belonged to patients with a diagnosis of Marfan syndrome, 6 eyes from children with other systemic diagnoses, and 49 eyes from children with an unknown diagnosis. The mean age at surgery was 6.88 years. After lensectomy, 41.9% were aphakic, 30.6% underwent primary IOL implantation, and 27.4% underwent secondary IOL placement. The mean follow-up was 5.16 years. The median visual acuity was 20/30. Late complications included visual axis opacification requiring surgery in 6 eyes, glaucoma in 15 eyes, and retinal detachment in 4 eyes. In 6 eyes, an angle-supported ACIOL rotated after years of stability and was exchanged for an iris-claw IOL. Two of these eyes, from 1 patient, developed cystoid macular edema that resolved after IOL exchange.

Conclusion: Visual outcomes after lensectomy for ectopia lentis in children are characteristically good. Complete lensectomy from an anterior chamber approach is safe. Late post-operative complications are serious but rare. In children, anterior chamber angle-supported IOLs may rotate because of eye growth and are not recommended. Iris claw implantation is recommendable for children.

Discussant: Edward Buckley
PROPHYLACTIC RANIBIZUMAB FOR EXUDATIVE AGE-RELATED MACULAR DEGENERATION (AMD) IN VULNERABLE EYES WITH NON-EXUDATIVE AMD TRIAL (PREVENT): A PROSPECTIVE CONTROLLED CLINICAL TRIAL

Clement Chan**, Maziar Lalezary, Prema Abraham, Michael Elman, Steven Lin, Rahul Khurana, Alok Bansal, Mark Wieland, James Palmer, Louis Chang, Glenn Yiu, Brandon Lujan

**Purpose**: To present demographics and interim results of PREVENT for preventing neovascular AMD in fellow eyes with nonexudative AMD in patients diagnosed with neovascular AMD in one eye.

**Methods**: PREVENT is a multicenter, prospectively randomized, single-masked, controlled, interventional investigator-sponsored phase I/II study. Fellow eyes with nonexudative AMD (study eyes) at high risk for nAMD (≥ one large druse and pigmentary changes) of 100 patients with nAMD in one eye diagnosed within 5 years are randomized (1:1) to 0.5 mg ranibizumab (IVR) versus observation (SHAM) for every 3 months (M) for 2 years. Fundus Reading Center (same day confirmation of diagnosis) before enrollment (Glenn Yiu, UC Davis) and SD-OCT Reading Center (Brandon Lujan) on assessing macular attributes (macular thickness and volume, drusen volume and area, area of atrophy, etc) are performed. ETDRS best-corrected visual acuity (BCVA), intraocular pressure, ophthalmic examination, and spectral-domain optical coherence tomography (Zeiss, Cirrus) Fundus photography, autofluorescence, and fluorescein angiography are obtained at baseline and every 3M for 2 years. Adverse events are monitored. The primary outcome measure is conversion to nAMD.

**Results**: For this interim report, 90 eyes (Patients) (PT) have been enrolled in study (52 [57.8%] IVR, 38 [42.2%] SHAM). All are Caucasians (51 females, 39 males). Mean age was 78.0. Mean BCVA was (20/28, 78 letters) at baseline, and (20/31, 76 letters) at last follow-up (p=0.26). Regarding follow-up, 27 PT completed 21-24M, 19:12-18M, 8: 6-9M: 10: 3M, and 26: <3M of follow-up. Thus far, 7 eyes have converted to nAMD (4 of 38 [10.5%] in SHAM [at 6M, 1M, 18M, 12M] and 3 of 52 [5.8%] in IVR [at 9M, 9M, 3M]). No adverse events have been noted.

**Conclusion**: Interim analysis shows more nonexudative eyes in SHAM than treatment group converting to nAMD, suggesting benefit of prophylactic anti-VEGF therapy with ranibizumab, pending further study.

**Discussant**: William Mieler
Posters will be displayed from Friday, May 18 through Sunday, May 20.

Poster authors will be available to discuss their work during guided poster sessions scheduled on Friday, May 18 from 9:40–10:20 AM and on Saturday, May 19 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

SIR WILLIAM OSLER - A WANNABE OPHTHALMOLOGIST

John Bullock*

During his lifetime, Osler was a world-famous physician. However, he had hoped to become an ophthalmologist but was unable to secure a position at the Moorfields Eye Hospital in London. Instead, he became one of the four founding professors of the Johns Hopkins Hospital and, later, Regius Professor of Medicine at Oxford.
TRAINING OF RESIDENTS AND FELLOWS IN RETINOPATHY OF PREMATURITY (ROP) AROUND THE WORLD: AN INTERNATIONAL WEB-BASED SURVEY

Tala Al-Khaled, Mikel Mikhail, Karyn Jonas, Wei-Chi Wu, Rachelle Anzures, Atchara Amphonphruet, Tsengelmaa Chuluunbat, Lihteh Wu, J. Peter Campbell, Michael Chiang, R.V. Paul Chan*

*Purpose: As the rate of neonatal survival continues to rise in lower and middle income countries, the number of newborns who are susceptible to developing retinopathy of prematurity (ROP) is increasing. Therefore, there is a greater need for ophthalmologists skilled in ROP diagnosis and management. The purpose of this study is to characterize ROP training practices in international training programs.

Methods: A publicly available web-based platform (SurveyMonkey) was used to develop a 28 question, multiple-choice survey that focused on evaluation of training for ROP screening and treatment. We solicited training programs in the Philippines, Thailand, Mongolia, Costa Rica and Taiwan. Survey responses were collected from July 2016-February 2017 and analyzed using descriptive statistics.

Results: 101 responses were collected from residents, fellows, and attending ophthalmologists from three countries were analyzed. Three countries had adequate participation to be included in the analysis, and two countries were excluded due to either no response or incomplete responses. 46 of 96 participants (48%) reported 1-33% of screenings were performed under direct attending supervision, and 35 of 95 participants (37%) reported the use of formal assessments for ROP competency during their training. The majority of respondents (Country A, 88%; Country B, 72%; Country C, 75%) estimated 1-33% of their clinical practice involved ROP screening. Notably, 44 of 96 participants (46%) reported performing zero ROP laser photocoagulation treatments during training (Country A, 63%; Country B, 38%, Country C, 32%).

Conclusion: International ophthalmology residents and fellows perform a limited number of ROP examinations and laser interventions during their training. ROP examinations by trainees are often unsupervised and lead to no formal evaluation by an attending ophthalmologist. Limited ROP training among ophthalmologists may lead to patient mismanagement. Our findings may serve as a foundation to improve ROP curricula and training in international ophthalmology training programs.
PATIENT-REPORTED OUTCOMES AND QUALITY OF LIFE AFTER TREATMENT OF CHOROIDAL MELANOMA: A COMPARISON OF ENUCLEATION VS RADIOTHERAPY IN 1596 PATIENTS

Bertil Damato*, Laura Hope-Stone, Bruce Cooper, Steve Brown, Peter Salmon, Heinrich Heimann, Laura Dunn

Purpose: To test the hypothesis that patients treated with radiotherapy for choroidal melanoma enjoy better quality of life (QoL) than patients who have undergone enucleation.

Methods: In this non-randomized study, patients with choroidal melanoma treated at the Royal Liverpool University Hospital, UK, were invited to complete QoL questionnaires approximately six months post-operatively and then on each anniversary of their primary treatment. These instruments consisted of the European Organization for Research and Treatment of Cancer (EORTC)-QLQ_OPT30 questionnaire, Hospital Anxiety & Depression Scale (HADS), and the Functional Assessment of Cancer Treatment (FACT-G) questionnaire. Patient-reported outcomes were correlated with: demographics; ocular treatment, social factors; presenting tumor and ocular status; self-reported general health; marital status and employment status. Change in anxiety, depression, self-reported QoL and FACT-G scores over time were analyzed by multilevel regression.

Results: The 1596 patients were treated with radiotherapy (72.3%) or enucleation (27.7%). Enucleation was associated with male gender ($\chi^2$, P=.004), older age (t-test, P<.001), larger tumor diameter (t-test, P<.001), monosomy 3 ($\chi^2$, P=.001), depression (Linear regression, 95% Confidence Interval [CI], 1.17 to 1.01) and reduced physical and functional wellbeing (Linear regression, 95% CI, -1.14 to -1.12 & -1.96 to -.47 respectively. Poor QoL was attributed to the ocular disease by 21% and 20% of enucleated and irradiated patients respectively ($\chi^2$, P=.938). Over time, FACT-G scores diminished more among patients who underwent enucleation than those who received radiotherapy (Multilevel regression, P=.039).

Conclusion: Patient-reported outcomes and QoL were worse in patients who had undergone primary enucleation for choroidal melanoma. These outcomes may have been caused by factors predisposing to enucleation rather than enucleation itself, because enucleated patients tended to be older, with more advanced disease at presentation, and a worse prognosis for survival.
IMPACT OF TEPROTUMUMAB ON PROPTOSIS IN MODERATE TO SEVERE THYROID EYE DISEASE

Raymond Douglas*, Robert Holt, Renee Perdok

Purpose: To assess mean and individual proptosis response (Hertel values) from a 24 week, phase 2 study of teprotumumab (tepro), an Insulin-like Growth Factor 1 Receptor antibody in patients with active Thyroid Eye Disease (TED).

Methods: A multicenter, double-masked, randomized, placebo trial of 88 patients with moderate-severe TED has previously demonstrated a significant and rapid response to tepro as compared with placebo when measured by a composite endpoint of % of patients with ≥ 2 points reduction in clinical activity score (CAS) and a reduction ≥ 2mm in proptosis (NEJM 376:18:2017). The CAS was also independently significantly reduced. To better elucidate proptosis response, we analyzed with post hoc mean, percent and individual responses over 24 weeks in placebo and tepro intent-to-treat (ITT) patients.

Results: 30/42 (71.4%) treated tepro and 9/45 (20%) placebo treated patients reached the proptosis outcome at 24 weeks (chi-square, p < 0.001). The least square (LS) mean reduction from baseline was also significantly reduced from placebo at weeks 6, 12, 18, and 24 (all, p < 0.001), reaching a difference in the LS mean of -2.65 mm reduction from placebo at 24 weeks with repeated-measures mixed-modeling. Individual proptosis plots (Figure 1) indicated that most patients showed some benefit to tepro, with only one patient worsening then improving, as compared to placebo.

Conclusion: Teprotumumab reduced proptosis significantly beginning at 6 weeks of treatment and over the course of 24 weeks as compared with placebo. This analysis indicates that proptosis alone can serve as a sensitive outcome for future clinical trials examining benefits of treating thyroid eye disease. A phase 3 trial with teprotumumab is currently ongoing using proptosis as the primary outcome (NCT03298867).
TARGETED BIOLOGIC AND IMMUNOTHERAPY FOR LOCALLY ADVANCED CANCERS OF THE ORBIT, EYELID, AND CONJUNCTIVA: A PARADIGM SHIFT?

Bita Esmaeli*, Oded Sagive, Wen-Jen Hwu, Renata Ferrarotto, Michael Tetzlaff

**Purpose:** "Targeted therapy" for cancer refers to treatments that target specific molecules involved in tumor growth and carcinogenesis, in contrast to traditional chemotherapy that affect all rapidly-dividing cells. Immunotherapy refers to interventions that modify the host’s immune response and bring about cancer cell death. The purpose of this report is to evaluate the specific use of these new classes of drugs in patients with locally advanced and metastatic periocular basal cell carcinoma (BCC), squamous carcinoma (SCC), conjunctival and orbital melanoma.

**Methods:** A retrospective review of patients with locally advanced BCC, SCC, or melanoma of conjunctiva, orbit, or eyelid treated with targeted biologic therapy using sonic hedgehog inhibitors, EGFR inhibitors, or immune check point inhibitors between the years 2013-2017. Response to therapy, side effects, and outcomes in terms of both survival and ocular function were evaluated.

**Results:** Seven patients with locally advanced BCC were treated with vismodegib in the neoadjuvant setting followed by surgery. Six patients with locally advanced SCC were treated with EGFR inhibitors (erlotinib or ceutximab) (n=3); or immune check point inhibitors (n=3). Eight patients with locally advanced conjunctival melanoma (n=5) or orbital melanoma (n=2) and periocular aggressive cutaneous melanoma (n=1) were treated with immune checkpoint inhibitors. In all patients, partial or complete response to treatment was achieved. In all patients, orbital exenteration was avoided and ocular function was preserved. Side effects for each class of drugs will be discussed and were mostly grade II (per CTCAE criteria) and managed medically.

**Conclusion:** The recent availability of targeted biologic drugs and immune check point inhibitors for metastatic and locally advanced periorbital and orbital cutaneous cancers (specifically BCC, SCC, and melanoma) have revolutionized the outcomes in such patients both in terms of survival and eye preservation.
ORAL PROTON PUMP INHIBITORS ENHANCE VISUAL HALLUCINATIONS IN MACULAR DEGENERATION PATIENTS BY DISRUPTING HORIZONTAL CELL-CONE PHOTORECEPTOR FEEDBACK

Anne Hanneken*, Wallace Thoreson

Purpose: The purpose of this study was to document the clinical observation that proton pump inhibitors can enhance patterned visual illusions in patients with exudative macular degeneration, validate the retinal origin of the illusions and study the electrophysiologic basis for the defects in outer retinal processing.

Methods: We detail clinical observations on visual hallucinations in five macular degeneration patients treated with proton pump inhibitors having the core structure, 2-pyridyl-methylsulfinyl-benzimidazole. We tested possible retinal mechanisms using paired whole cell recordings to examine effects of these compounds on feedback interactions between horizontal cells and cones in amphibian retina.

Results: Five patients with advanced wet macular degeneration described patterned visual hallucinations that were induced or enhanced by oral proton pump inhibitors. The abnormal images increased with light, disappeared in the dark, and originated in the retina, based on ophthalmodynamometry. Simultaneous paired whole cell recordings from amphibian cones and horizontal cells showed that 2-pyridyl-methylsulfinyl-benzimidazoles blocked the negative shift in voltage dependence and increase in amplitude of the calcium current (ICa) in cones that is induced by changes in horizontal cell membrane potential. These effects disrupt the negative feedback from horizontal cells to cones that is important for the formation of center-surround receptive fields in bipolar and ganglion cells, and thus for normal spatial and chromatic perception.

Conclusion: Our study suggests that changes in the output of retinal neurons caused by disturbances in outer retinal feedback mechanisms can enhance patterned visual hallucinations.
ADVANCED ANALYSIS OF TOPOGRAPHY-GUIDED LASIK TREATMENT PLANNING STRATEGIES

Ronald Krueger*, Vinicius De Stefano

Purpose: Since the U.S. approval of topography-guided customized treatments (TCAT), much debate has ensued regarding the appropriate planning strategies when manifest and topographically measured cylinder values differ in axis and magnitude. We wish to analyze our pattern of success among the eyes that gained one or more lines of best corrected visual acuity (BCVA).

Methods: 256 eyes undergoing TCAT by a single surgeon from Feb 2016 to May 2017 were enrolled in this retrospective study at the Cleveland Clinic. All eyes were healthy, and had at least 4 good quality topographic maps. The corneal shape was captured with the Topolyzer, and coupled with the eye’s refraction to generate an ablation profile with the Allegretto Wave Eye-Q laser. The cylinder magnitude and axis of laser entry were decided by the surgeon, based on both the manifest and measured values, assisted by additional data from a tomographer (Pentacam) and ocular wavefront (LADARWave). All patients were followed at 1 day, 1 week and 3 months.

Results: At three months, 95.7% achieved UDVA of 20/20 or better, while 81.4% were 20/15 or better. 25.6% gained one or more lines of BCVA. Among these eyes, measured and manifest axis differed by less than 15° in 59%, between 15° and 30° in 18% and more than 30° in 23%. When it differed by at least 5°, the measured axis was treated in 79%, 67% and 73% of eyes, respectively. In the 68% of eyes with greater measured cylinder magnitude, 75% were treated between manifest and measured with only 7% at full measured value (TMR). By contrast, when manifest was greater, 60% were treated at total measured value and 40% in between. Despite the improvement in vision, whole-eye aberrometry showed a significant increase in coma, spherical aberration and total RMS (all p < 0.001).

Conclusion: TCAT can achieve better than glasses vision in more than a quarter of eyes. In eyes gaining a line of vision, the measured axis is treated in ~75%. When the measured magnitude is higher, a value between the measured and manifest is chosen in 75% to avoid overcorrection. Tomography and ocular wavefront values assist in the selection process.
ANALYSIS OF RETINAL THINNING USING SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY OF SICKLE CELL RETINOPATHY EYES COMPARED TO AGE AND RACE-MATCHED CONTROL EYES

Jennifer Lim*, Dingcai Cao

Purpose: To determine the prevalence and systemic associations of retinal thinning as seen on spectral domain optical coherence tomography (SDOCT) imaging of sickle cell eyes.

Methods: We performed a prospective study to evaluate the clinical and SDOCT findings of sickle cell patients as compared to age and race-matched controls. All subjects underwent visual acuity testing, slit lamp biomicroscopy, dilated phthalamcoscopy and SDOCT imaging at baseline. The stage of sickle cell retinopathy was staged according to the Goldberg classification system. Early Treatment of Diabetic Retinopathy (ETDRS) SDOCT subfield measurements were compared between sickle cell and control subjects and also amongst sickle cell hemoglobin subtypes. Associations between ETDRS subfield measurements and hemoglobin subtype, retinopathy stage and systemic diseases were assessed.

Results: 513 sickle cell eyes (260 patients) and 75 control eyes (39 patients) were enrolled. Median visual acuities were 20/20. ETDRS central (P=.002), inner (nasal P=.009, superior P=.021, temporal P<.001, inferior P=.017) and temporal outer (P=.012) subfield measurements were thinner in sickle cell compared with control eyes. Hemoglobin SS eyes had significantly thinner inner ETDRS subfield measurements compared with SC and SThal eyes. SDOCT thinning in all subfields was associated with age (P=.017). SDOCT ETDRS subfield thinning was associated with the presence of seizure disorder, avascular necrosis of any joint, hypertension and history of pulmonary embolism or deep vein thrombosis.

Conclusion: The macula is thinner in sickle cell compared with control eyes; retinal thinning correlates with age, sickle cell stage and is most severe in hemoglobin SS subtypes. SDOCT imaging adds information to the clinical staging of the disease and potentially can serve as a biomarker of more severe retinopathy.
IDENTIFICATION OF FIVE DISTINCT MECHANISMS UNDERLYING RECURRENT EROSION IN CORNEAL DYSTROPHIES

Walter Lisch*, Tero Kivelä, Shazad I. Mian, Daniel Schorderet, Francis L. Munier, Christina Lisch, Jayne S. Weiss

Purpose: To describe the distinct mechanisms underlying corneal erosive episodes in nine corneal dystrophies (CD).

Methods: 221 patients with distinct forms of CD were analyzed: 1 family with ERED; 7 sporadic patients with EBMD; 1 family with MECD; 5 families with GCD1; 3 families with GCD2; 2 families with LCD1, 1 family with RBCD, 1 family with TBCD, and 21 sporadic cases with FECD. Key biomicroscopic features and histological alterations of each form of CD are presented. DNA analysis was performed in all presented families.

Results: 117 patients suffered from painful attacks of recurrent erosion: all 10 patients with ERED and the new COL17A1 mutation; 3 of 7 patients with EBMD showed aberrant basement membranes; 3 patients with MECD suffered from punctiform epithelial defects; 50 of 112 patients with GCD1, 2 of 18 with GCD2; 5 of 7 with LCD1, all 25 with RBCD, and all 18 with TBCD showed hyaline and/or amyloid deposits at the anterior part of the cornea; in 1 patient of 21 with FECD the erosion was due to rupturing of the epithelial bulla.

Conclusion: The five causes of painful recurrent attacks due to epithelial alterations of the cornea in CD are: (1) genetic disturbance of COL17A1 in the hemidesmosomes (ERED); (2) aberrant epithelial basement membranes (“maps” and “fingerprints” of EBMD); (3) opening of microcysts to the corneal surface (MECD); (4) distinct pathological keratoepithelin deposits at the anterior part of the cornea (GCD1, GCD2, LCD1, RBCD, TBCD); (5) secondary epithelial edema and breaking of the epithelial bulla (FECD).
FACTORS ASSOCIATED WITH IMPROVED BCVA IN OCA1A

Laura May, Kimberly Merrill, John Connett, C. Gail Summers*

Purpose: OCA1A, with lifelong absent melanin in skin, hair, and eyes, is the most severe type of albinism with greatest ametropic refraction and poorest visual outcomes. We sought to evaluate the relationship between refraction and age at spectacle initiation on BCVA in OCA1A.

Methods: After IRB approval, retrospective chart review of 70 consecutive patients with OCA1A seen at this institution identified 21 fitting inclusion criteria of BCVA recorded at age 12. Exclusion included other vision-threatening diagnoses. We recorded age at beginning glasses, refraction, most recent and age 12 BCVAs, and gender.

Results: Regression analysis showed astigmatism was significantly associated with age 12 logMAR BCVA (p=0.029); spherical equivalent and gender were not. There was a positive relationship between most recent logMAR BCVA and age at glasses initiation (p=0.061). Best BCVA (20/50) occurred in patient beginning glasses at age 3 months. Poorest BCVA (20/250) was in patient beginning glasses at age 4 years. When glasses were begun by age 12 months (n=9), mean BCVA was 20/85; when begun later (n=12), mean BCVA was 20/106 (p=.287). All in the first group and only half in the second group had improved visual acuity from age 12 to last follow up.

Conclusion: Several factors influence visual outcome in albinism. BCVA in OCA1A is occasionally reported to be 20/50-60 but is more often reported at 20/100-20/200. Earlier glasses wear may be related to the severity of refractive error. Results in this small cohort suggests that BCVA may be better than usually reported in OCA1A when refractive error is great and glasses wear begins by age 1.
COMPARING CENTRAL CORNEAL EPITHELIAL, STROMAL AND TOTAL THICKNESS IN MALES WITH AND WITHOUT PRIMARY OPEN ANGLE GLAUCOMA

Hatim Batawi, Ivonne Lollett*, Cima Maliakal, Sarah Wellik, Michael Anderson, William Fauer, Carol Karp, Anat Galor

Purpose: Glaucoma is the leading cause of irreversible blindness worldwide. Ocular hypertension, age, black race, and family history are risk factors for primary open-angle glaucoma (POAG). Studies suggest central corneal thickness (CTT) as a POAG predictor; however, individual layer thicknesses aren't well studied. We compared central corneal epithelial (ET), stromal (ST), and total (CCT) thickness in males with and without POAG.

Methods: Case-control study of 116 men at the Miami Veterans Affair Hospital. Patients with anterior segment optical coherence tomography images were classified into POAG and non-POAG groups. POAG was defined as ≥2: IOP≥21 mmHg, optic nerve abnormalities and/or imaging abnormalities. ET, ST and CCT were compared.

Results: Both groups were similar in race and ethnicity. The POAG group had a higher mean age (70.3 ± 8.9 vs 66.0 ± 11.7), p<0.03. Black patients had lower ST (447.8 ± 29.0 μm) and CCT (503.0 ± 30.5 μm) than white patients (ST: 470.0 ± 31.7 μm; CCT: 525.1 ± 32.4 μm), p=0.0001 and p=0.0002, respectively. Mean ST and CCT were lower in the POAG group (ST: 453.4 ± 32.5μm; CCT: 507.3 ± 33.8 μm) vs. the non-POAG group (ST: 465.2 ± 31.2 μm; CCT: 521.5 ± 31.5 μm), p=0.05 and p=0.02, respectively. ET, ST, and CCT were negatively correlated with use of anti-glaucoma medications.

Conclusion: The association between CCT and POAG is driven by ST. Black patients had lower ST and CCT. Black race was more significantly associated with ST than glaucoma. Glaucoma medications were associated with lower thickness measurements. Limitations include retrospective design, male population, and lack of automated software for measurements.
THE PRESENT STATUS OF MUTATION ANALYSIS IN HEREDITARY OCULAR DISEASES

Irene H. Maumenee*

Purpose: To compare methods and costs of mutation analysis performed for patients with hereditary eye diseases between five commercial and University based laboratories.

Methods: Five physicians practicing medical or ophthalmic genetics were contacted about their preferred laboratories. Five laboratories were identified, which in turn were then assessed for methodology and cost; quality of analysis was not assessed.

Results: Three of five physicians chose two or more laboratories for analysis, based on relevance of genes available for sequencing, cost and willingness of companies to obtain insurance clearance. Laboratories analyzed either selected retinal genes, all known retinal genes, all known eye genes, or all known disease causing human genes (WES). Analyses could be requested for 1-3 genes, small defined panels, selected eye gene panels, WES or WGS. Primary WES or WGS was not the test of choice for most clinicians. The cost of analysis by company varied significantly from free for a group of selected genes to $7,000 for whole exome sequencing (WES) per trio or three related family members. The cost of mutation analysis per patient cohort rose with the need for consecutive testing.

Conclusion: Decision making in mutation analysis in hereditary ocular diseases remains ill-defined and varies with the acumen of the requesting physician. Some investigators will select specific genetic mutations for analysis based on pattern recognition, and if negative, will move to the next more complex test, whereas others will choose WES primarily. The cost of mutation analysis of a cohort will rise if repeat testing is required for patients and break-even points will need to be considered. WES will become the primary method of testing, when sequencing will be reliably accurate; this approach will permit diagnoses of genetic diseases with delayed onset.
MANUAL SMALL INCISION CATARACT SURGERY IN A US EDUCATIONAL SETTING

Joseph Miller*, Mingwu Wang, Balamurali Ambati, Christopher Robertson, Keith Joiner

Purpose: To determine if Manual Small Incision Cataract Surgery (MSICS) offers comparable outcomes to phacoemulsification (PHACO); and to determine patient acceptance and the actual institutional cost of providing this service in the setting of an academic medical center.

Methods: MSICS marginal cost estimate was $406/eye (5 cases/day, 30 minutes each). We received IRB and institutional permission to proceed at $500/eye. Ophthalmology and anesthesia professional fees were not loaded into the cost. Recruitment was via local optometrists, Lions Clubs, and social organizations. Bilingual Lions discussed the program with potential patients. The recruitment goal was n=100.

Results: In planning the study, we anticipated that patients would decline participation following a counseling session. We expected that when informed that they would experience a longer period of recovery with increased discomfort for up to a week, and need to wear glasses for both distance and near, due to likely post-operative astigmatism, that they would not elect to proceed. Instead, we learned that despite extensive recruitment efforts, few patients in our community who were legally in the country were uninsured or could not afford their copay. No insured patients chose MSICS. All patients who participated were uninsured. Over an enrollment period of one year, a total of 8 subjects enrolled in the study, with 2 patients electing to have both eyes done. Enrollment was discontinued because of failure to meet recruitment goals.

Conclusion: This study demonstrates that an institution can elect to provide a service at lower than Medicare prices, and some patients will choose to have a surgery performed that is offered at a significantly lower price, despite expectation of longer recover and need for spectacle correction, provided the ultimate outcome is safe and equivalent. We discovered however that the number of patients in our community was far less than anticipated.
**AFFERENT SYSTEM DISCORDANCE. WHEN THE OCT DOES NOT MATCH THE PSYCHOPHYSICS**

**Steven Newman**

*Purpose:* Assessment of the afferent system can be seen to consist of three paths: psychophysics (vision and visual fields), physiology (afferent pupillary defect, ERG, and VEP), and anatomy (disc appearance, and more currently, OCT). While these usually parallel each other, there are several reasons why there may be discordance.

*Methods:* This was a retrospective study of 100 patients coded as having disparity between tests, studied in more detail for possible explanations and implications.

*Results:* In spite of improvement on 4th generation OCT, artifacts still occur, which sometimes may be eliminated by lubrication, repeat study or use of another machine. Another artifact (OCT thickening) may occur with epiretinal pathology. The normal delay in anatomic changes (due to apoptosis) can lead to acute changes in psychophysics preceding changes in OCT. Persistent normal OCT may be due to masking of nerve axonal loss associated with compression at the orbital apex ("green disease"). Ganglion cell segmentation may reveal abnormalities earlier, or in spite of, normal RNFL. Redundancy in the visual system normally leads to late improvement in psychophysics, despite continued anatomic abnormalities (optic neuritis, optic nerve decompression). Transynaptic degeneration may produce variable OCT changes that do not always parallel the visual fields.

*Conclusion:* OCT has been of dramatic benefit in caring for patients, not only with retinal disease, but afferent system dysfunction. Discordance, however, may occur between psychophysics (visual fields) and the OCT findings. A better understanding of how this pathology may occur will improve our ability to deal with clinical problems that arise in practice.
RELATIONSHIP BETWEEN CLAIMS DATA AND THE PREFERENCES AND TRENDS SURVEY: AN ANALYSIS OF ANTI-VASCULAR ENDOTHELIAL GROWTH FACTOR MEDICATION CHOICE FOR AGE RELATED MACULAR DEGENERATION

Ravi Parikh*, Paula Feng, Lucian Del Priore, Ron Adelman, Nauman Chaudhry

Purpose: To assess published self-reported practice patterns among retina specialists with published claims data representing actual practice patterns for the use of anti-vascular endothelial growth factor (anti-VEGF) medications in the treatment of age-related macular degeneration (AMD) in the United States.

Methods: We compared physician self-reported preference for anti-VEGF medications to treat age-related macular degeneration in the American Society of Retina Specialists’ Practice and Trends (PAT) Survey with the largest published study using claims data from 2006-2015 from OptumLabs Data Warehouse as a data source. A Pearson’s Chi-Squared test compared the relative proportions of drug use between the two groups, with <0.05 indicating statistical significance.

Results: From 2006-2015, the PAT surveys had approximately 3,548 respondents to questions on which anti-VEGF medication was used for the treatment of AMD. Over the study period, 62.3% (2,211/3,548) of respondents preferred bevacizumab, 30.4% (1,078/3,548) ranibizumab, and 7.3% (259/3,548) aflibercept in the treatment of AMD. Claims data on anti-VEGF use for AMD noted 59.7% (359,267/601,917) of injections were for bevacizumab, 23.8% (143,200/601,917) were for ranibizumab, and 16.5% (99,450/601,917) were for aflibercept. The difference in the relative use of bevacizumab, ranibizumab and aflibercept use was not significant between the data sets (P=0.1991).

Conclusion: The PAT survey responses appear to reflect actual physician practices based upon claims data and demonstrate the prevalence of bevacizumab as the prevailing treatment for AMD.
HOW TO EXPLAIN A “FLAT” ELECTRORETINOGRAM WHEN PATIENTS WITH LEBER’S CONGENITAL AMAUROSIS MAY NOT BE BLIND

Cameron Parsa*, Aurélie Taylor

Purpose: To explain how a “flat” or “extinguished” electroretinogram (ERG) in a patient with Leber’s congenital amaurosis can be diagnostic for this entity and yet not necessarily indicative of severe loss of vision.

Methods: Basic principles of ocular as well as auditory electrophysiology, wave physics, phototransduction metabolic pathways and ophthalmic genetics were reviewed and organized to reveal heretofore overlooked pathways. Retrospective observation and correlations of ocular as well as auditory electrophysiology characteristics in institutional referral-based ophthalmic genetics practice for Leber’s congenital amaurosis were made. The literature was searched using MEDLINE, and articles were obtained from the bibliographies of these publications.

Results: Basic principles of ocular as well as auditory electrophysiology, wave physics, phototransduction metabolic pathways and ophthalmic genetics were reviewed and organized to reveal heretofore overlooked pathways. Retrospective observation and correlations of ocular as well as auditory electrophysiology characteristics in institutional referral-based ophthalmic genetics practice for Leber’s congenital amaurosis were made. The literature was searched using MEDLINE, and articles were obtained from the bibliographies of these publications.

Conclusion: A “flat” or “extinguished” ERG need not indicate absent vision, but overall destructive interference of individual a-waves, then subsequent b-waves, averaged for the recorded ERG. Analogous auditory electrophysiologic findings are noted in corresponding so-called congenital auditory dys-synchrony. Previously investigated, but since neglected, electrooculography may offer benefits in terms of prognostic value. For a subset of patients with Leber’s congenital amaurosis, the response to an interventional genetic or pharmacologic therapeutic regimen may potentially be followed in more sensitive and objective manner at the cellular level via electrooculography, prior to visual acuity, visual evoked potentials, or ERG testing revealing any changes in overall retinal function.
MULTIMODAL IMAGING INCLUDING OCT-A AND FUNCTIONAL TESTING OF NORTH CAROLINA MACULAR DYSTROPHY (NCMD) PROVIDES NEW INSIGHTS INTO THE DEVELOPMENTAL NATURE OF NCMD AND THE DEVELOPMENT OF THE HUMAN MACULA

Kent Small*, Fadi Shaya, Leslie Small, Nitin Udar, Edwin Stone

Purpose: To describe multimodal imaging and corresponding functional studies in a new family with North Carolina Macular Dystrophy (NCMD/MCDR1) incorporating OCT angiography (OCT-A) for the first time to our knowledge.

Methods: A descriptive, retrospective study of a family with NCMD. Diagnostic multimodal imaging and functional testing of the retina included color fundus photographs, fundus auto fluorescence, fluorescein angiography (IVFA), spectral domain OCT (SD-OCT), OCT angiography, multifocal ERG (mf-ERG), full field ERG, and microperimetry. DNA sequencing was performed using Sanger sequencing. IRB approval was obtained.

Results: Three subjects, representing 3 generations of a single family each demonstrating a different grade of NCMD, underwent clinical and genetic testing. Multimodal imaging helped to demonstrate the developmental nature of the retinal and choroidal lesions in each and the extent of visual function that was suggestive of the stage of development that is affected my methylation at the 6q16 locus. Genetic testing demonstrated the V2 point mutation (French / German mutation) in the DNASE 1 hypersensitivity binding site on chromosome 6q16 causing overexpression of the retinal transcription factor PRDM13. The oldest family member has many similarities to foveal hypoplasia / foveal plana.

Conclusion: NCMD has great phenotypic variability, which can only be appreciated by examining multiple family members. This is the first report to our knowledge showing a correlation of functional studies with multimodal imaging including OCT-A. All layers of the retina and choroid demonstrate mal-development and varying degrees of malfunction. Although PRDM13 is over expressed in the amacrine cells, we have yet to demonstrate an abnormality specific to this cellular layer. The retinal vasculature seems surprisingly well preserved / intact by OCT-A when compared to the IVFA. OCT-A suggests foveal hypoplasia to be a phenocopy of grade 1 NCMD. OCT-A does reveal vascular abnormalities not found with standard IVFA. We propose that the grade of severity is determined by the embryonic stage that methylation occurs at the DNASE1 hypersensitivity binding site which regulates the expression / overexpression of the retinal transcription factor PRDM13. We propose that there is a similar control of expression at the MCDR3 / IRX1 site.
INSIGHTS INTO BRAIN IMAGING IN ALBINISM

Kayla Stevens, Anna Schweigert, C. Gail Summers*

Purpose: The diagnosis of albinism can be based on the clinical phenotype, with genetic testing being used more recently to determine the type. When a diagnosis is not recognized, nystagmus can precipitate brain imaging. We sought to determine factors influencing imaging in albinism.

Methods: After IRB approval, this retrospective review of 552 charts of individuals evaluated for albinism identified 52 (9%) who met the inclusion criterion of imaging prior to a diagnosis of albinism in our clinic. We recorded type of albinism, results, and when and why the scan was ordered.

Results: Type of albinism was OCA1B (12), OCA2 (24), OCA4 (1), OA1 (13), and OCA not further characterized (2). Thirty-nine (75%) underwent brain MRI, 9 (17%) had CT, and 4 (8%) had both. Thirty-nine patients (75%) received imaging for nystagmus and 13 (25%) for unrelated reasons. Three scans (6%) were abnormal. Scans tabulated by decade showed: 1970-9 - 1, 1980-9 - 5, 1990-9 - 12, 2000-9 - 25, 2010-17 – 7, decade unknown (2).

Conclusion: Only pigmenting types of albinism were imaged, as absent melanin (OCA1A) has a diagnostic phenotype. Imaging increased over the years, showing a higher rate in 2000-9, diminishing recently; this could represent sampling bias. The majority were imaged for nystagmus and were normal. Continued educational efforts may reduce imaging in albinism. Most with nystagmus don’t have an acute disorder and have normal imaging (1-3). An eye examination prior to imaging should be considered.
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THE ROLE OF VITRECTOMY FOR LAMELLAR MACULAR HOLES AND MACULAR PSEUDOHOLES AND THEIR CLASSIFICATION

John Thompson*

Purpose: To evaluate the limitations in the current classification of lamellar macular holes and pseudoholes and the results of vitrectomy in eyes with decreased acuity.

Methods: Vitrectomy was performed in a retrospective consecutive single-surgeon case series of 64 eyes with lamellar macular holes/macular pseudoholes and decreased visual acuity. Epiretinal membranes were removed in all eyes and internal limiting membrane was removed in 70.3% of eyes.

Results: The existing classification system does not accurately reflect the OCT morphology as virtually all lamellar macular holes and pseudoholes have an epiretinal membrane by OCT with varying central foveal thicknesses. The mean preoperative visual acuity was 20/80 – 2 and improved to 20/63 +2 at 1 year (P=.001), 20/50 +1 at 2 years (P<.001) and 20/50 -2 on the final examination (P<.001) at a mean of 3.3 years following surgery. The visual acuity improved 3 or more lines in 34% or eyes at 1 year, 39% at 2 years and 34% at the final examination. Only 8% of eyes had lost 3 or more lines on the final examination. The OCT is the best predictor of which eyes will benefit from surgery.

Conclusion: Vitrectomy is beneficial in most eyes with decreased visual acuity from epiretinal membranes associated with lamellar macular holes and macular pseudoholes. An international group is developing a revised classification system for lamellar macular holes and pseudoholes to facilitate future studies.
New This Year!

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FUTURE ANNUAL MEETINGS

2019 AOS Annual Meeting
The Greenbrier
White Sulphur Springs, West Virginia
May 16–19, 2019

2020 AOS Annual Meeting
Lodge at Torrey Pines
La Jolla, California
May 14–17, 2020

2021 AOS Annual Meeting
Ritz-Carlton, Naples
Naples, Florida
May 20–23, 2021