

The American Ophthalmological Society

ONE HUNDRED AND FIFTY-THIRD ANNUAL MEETING

George B. Bartley **PRESIDENT**
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MAY 18-21, 2017
THE OMNI HOMESTEAD
HOT SPRINGS, VIRGINIA

The
American
Ophthalmological
Society

Office of the Executive Vice President
Atlanta, GA
May 2017

THE ONE HUNDRED AND FIFTY-THIRD ANNUAL MEETING

of the Society will be held at

The Omni Homestead
Hot Springs, Virginia
Thursday through Sunday
May 18–21, 2017

COMMITTEE ON PROGRAMS

David T. Tse, Chair
Eduardo C. Alfonso
Preston H. Blomquist
Ivan R. Schwab

The American Ophthalmological Society

THE ONE HUNDRED AND FIFTY-THIRD 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 2017 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. Information and tools to help ophthalmologists deliver high and efficient quality of care based on evidence will be explored in multiple facets.

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 2017 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 18: 1:30 PM – 5:00 PM

Friday, May 19: 6:30 AM – 12:00 PM

Saturday, May 20: 6:00 AM – 12:00 PM

Sunday, May 21: 6:30 AM – 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 12.0 *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 2016 MEETING

William Dupps Jr.	Bay Village, OH
John Fingert	Iowa City, IA
Martine Jager	Oegstgeest, Netherlands
Ivana Kim	Boston, MA
Walter Lisch	Mainz, Germany
Quan Dong Nguyen	Palo Alto, CA
Kanwal “Ken” Nischal	Pittsburgh, PA
Roni Shtein	Ann Arbor, MI
Rona Z. Silkiss	San Francisco, CA

IN MEMORIAM

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

George Beauchamp, MD	Grapevine, TX	Joined 1995
Eliot L. Berson, MD	Boston, MA	Joined 1990
Brian J. Curtin, MD	Rye, NY	Joined 1969
Donald Doughman, MD	Minneapolis, MN	Joined 1980
Barrett G. Haik, MD, FACS	Memphis, TN	Joined 1991
James E. McDonald, MD	Oak Park, IL	Joined 1968
Irvin P. Pollack, MD	Baltimore, MD	Joined 1979
Abbot G. Spaulding, MD	Cincinnati, OH	Joined 1978
William S. Tasman, MD	Wyndmoor, PA	Joined 1970
Richard C. Troutman, MD	Bal Harbour, FL	Joined 1962
Gunter K. von Noorden, MD	Houston, TX	Joined 1969

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

CHAN, R.V. Paul

C – Visunex Medical Systems

QUIGLEY, Harry

O – Graybug Vision

CHIANG, Michael

C – Clarity Medical Systems, Novartis

REYNOLDS, James

C – Novartis

JONAS, Jost

C – Mundipharma, Alimera, Boehringer
Ingelheim, Sanofi, Allergan

SANES, Joshua

C – Biogen

P – Biocompatibles UK Ltd.

SARRAF, David

C – Optovue

KIM, Ivana

C – Genentech

S – Genentech

L – Optovue

O – Optovue

S – Heidelberg, Optovue

NO FINANCIAL RELATIONSHIPS TO DISCLOSE RELEVANT TO MEETING PARTICIPATION:

ALFONSO, Eduardo
ARNOLD, Anthony
AUGSBURGER, James J.
BAKRI, Sophie
BLOMQUIST, Preston
BROWN, Gary
BROWNING, David
BUCKLEY, Edward
BULLOCK, John D.
BUSIN, Massimo
CAPRIOLI, Joseph
CHAN, Clement
CHEW, Emily
CHIANG, Michael
CLARKSON, John
DAVIS, Janet
EDWARD, Deepak
GROSSNIKLAUS, Hans
HAN, Dennis
HARTNETT, Mary Elizabeth
HE, Zhigang
JAGER, Martine
LAIBSON, Peter
LEE, Paul
LISCH, Walter

MCCULLEY, Timothy
MIELER, William F.
MENDEZ, Amber
PARK, Kevin
PARKE, David
PARRISH, Richard
PASQUALE, Louis
PELAEZ, Daniel
PINELES, Stacy
PULIDO, Jose
RAAB, Edward
ROBIN, Alan
ROSALES, Erik
SCHWAB, Ivan
SHIELDS, Carol L.
SHIELDS, Jerry A.
SHULMAN, Julia
SIATKOWSKI, R. Michael
SPENCER, Rand
STEIN, Joshua
STONE, Edwin
TSE, David
WALLACE, David
WILSON, David
WRIGHT, Kenneth

American Ophthalmological Society
Spouse/Personal Guest Schedule

THURSDAY, MAY 18

1:30–5:00 PM	Registration	<i>Jefferson Parlor</i>
2:00–3:30 PM	New Member Spotlight Presentation	<i>Theatre</i>
6:00–7:30 PM	Reception Welcoming New Members (black tie optional)	<i>Crystal</i>

FRIDAY, MAY 19

6:30 AM–12:00 PM	Registration	<i>Jefferson Parlor</i>
8:00–10:30 AM	Spouse/Personal Guest Hospitality Lounge	<i>Dominion</i>
9:00–10:00 AM	Spouse/Guest Lecture Barbara Hauser	<i>Dominion</i>
1:00–4:30 PM	Golf Tournament (men and women)	<i>Cascades Course</i>
1:00–4:30 PM	Tennis Tournament (mixed doubles)	<i>Casino Pro Shop</i>
5:45–6:15 PM	3rd Annual Artistic Soiree by Members and Guests	<i>Empire/Crystal</i>
5:45–7:30 PM	Reception (business casual)	<i>Empire/Crystal</i>

SATURDAY, MAY 20

6:00 AM–12:00 PM	Registration	<i>Jefferson Parlor</i>
8:00–10:30 AM	Spouse/Personal Guest Hospitality Lounge	<i>Dominion</i>
9:00 & 11:00 AM	Spouse/Personal Guest Guided History Tour	<i>Hotel Concierge</i>
12:15–1:45 PM	Emeritus Luncheon (by invitation)	<i>Dominion</i>
1:00–3:30 PM	Skeet Shooting (men and women)	<i>Hotel Lobby</i>
1:00–4:30 PM	Tennis Tournament (men's tennis/women's tennis)	<i>Casino Pro Shop</i>
7:00–8:00 PM	Reception (black tie optional)	<i>Grand Ballroom Foyer</i>
8:00–11:00 PM	Banquet (black tie optional)	<i>Grand Ballroom</i>

SUNDAY, MAY 21

6:30–10:00 AM	Registration	<i>Jefferson Parlor</i>
6:30–8:00 AM	Breakfast (with members)	<i>Georgian</i>

American Ophthalmological Society
Meeting Schedule

THURSDAY, MAY 18

12:00–1:30 PM	New Member Luncheon (by invitation)	<i>Dominion</i>
1:30–5:00 PM	Registration	<i>Jefferson Parlor</i>
2:00–3:30 PM	New Member Spotlight Presentations	<i>Theatre</i>
6:00–7:30 PM	Reception Welcoming New Members (black tie optional)	<i>Crystal</i>

FRIDAY, MAY 19

6:30 AM–12:00 PM	Registration	<i>Jefferson Parlor</i>
6:30–8:00 AM	Breakfast	<i>Georgian</i>
7:30–9:30 AM	Knapp Symposium	<i>Commonwealth</i>
9:30–10:15 AM	Coffee Break and Guided Poster Session	<i>Georgian/ Commonwealth</i>
10:20 AM–12:00 PM	Scientific Program Moderator: David Tse	<i>Commonwealth</i>
1:00–4:30 PM	Golf Tournament (men and women)	<i>Cascades Course</i>
1:00–4:30 PM	Tennis Tournament (mixed doubles)	<i>Casino Pro Shop</i>
5:45–6:15 PM	3rd Annual Artistic Soiree by Members and Guests	<i>Empire/Crystal</i>
5:45–7:30 PM	Reception (business casual)	<i>Empire/Crystal</i>

American Ophthalmological Society
Meeting Schedule

SATURDAY, MAY 20

6:00 AM–12:00 PM	Registration	<i>Jefferson Parlor</i>
6:00–8:00 AM	Breakfast	<i>Georgian</i>
6:30–7:15 AM	Executive Session (members only)	<i>Commonwealth</i>
7:30–8:15 AM	Frederick C. Blodi Lecture Joseph Caprioli	<i>Commonwealth</i>
8:15–9:30 AM	Saturday Symposium	<i>Commonwealth</i>
9:30–10:15 AM	Coffee Break and Guided Poster Session	<i>Georgian/ Commonwealth</i>
10:20 AM–12:00 PM	Scientific Program Moderator: Preston Blomquist	<i>Commonwealth</i>
12:15–1:45 PM	Emeritus Luncheon (by invitation)	<i>Dominion</i>
1:00–3:30 PM	Skeet Shooting (men and women)	<i>Hotel Lobby</i>
1:00–4:30 PM	Tennis Tournament (men's tennis/women's tennis)	<i>Casino Pro Shop</i>
7:00–8:00 PM	Reception (black tie optional)	<i>Grand Ballroom Foyer</i>
8:00–11:00 PM	Banquet (black tie optional)	<i>Grand Ballroom</i>

SUNDAY, MAY 21

6:30–10:00 AM	Registration	<i>Jefferson Parlor</i>
6:30–8:00 AM	Breakfast	<i>Georgian</i>
7:30–10:30 AM	Scientific Program Moderator: Ivan Schwab	<i>Commonwealth</i>

Knapp Symposium

FRIDAY, MAY 19, 2017

OPTIC NERVE REGENERATION AND RECONNECTION: CURRENT STATUS, CHALLENGES AND AUDACIOUS FUTURE GOALS

INTRODUCTION

David T. Tse, MD
Bascom Palmer Eye Institute
Miami, FL

RGC TYPES DIFFER IN FUNCTION AND IN VULNERABILITY TO DISEASE

Joshua R. Sanes, PhD
Center for Brain Science, Harvard Medical School
Cambridge, MA

PROGRESS AND CHALLENGES IN RGC PROTECTION

Harry Quigley, MD
Johns Hopkins Wilmer Eye Institute
Baltimore, MD

CHALLENGES IN AXON PATHFINDING AND TARGET RECOGNITION

Kevin K. Park, PhD
Miami Project to Cure Paralysis, University of Miami
Miami, FL

PROGRESS AND CHALLENGES IN AXON REGENERATION

Zhigang He, PhD
Boston Children's Hospital
F.M. Kirby Neurobiology Center
Boston, MA

AUDIENCE Q & A

Saturday Symposium

SATURDAY, MAY 20, 2017

FREDERICK C. BLODI LECTURE

INTRODUCTION

George L. Spaeth, MD
Wills Eye Hospital
Philadelphia, PA

RETINAL GANGLION CELL RESCUE IN GLAUCOMA

Joseph Caprioli, MD
Jules Stein Eye Institute
Los Angeles, CA

AUDIENCE Q & A

QUALITY OF CARE: IMPROVEMENT BASED ON EVIDENCE

INTRODUCTION

Anne L. Coleman, MD
Jules Stein Eye Institute
Los Angeles, CA

QUALITY OF CARE AND EVIDENCE-BASED CARE

Paul P. Lee, MD, JD
Kellogg Eye Institute
Ann Arbor, MI

QUALITY OF CARE AND REGISTRIES

David W. Parke, II, MD
American Academy of Ophthalmology
San Francisco, CA

QUALITY OF CARE IN CURRENT PRACTICE AND THE FUTURE

Michael F. Chiang, MD
Oregon Health & Science University
Portland, OR

AUDIENCE Q & A

AOS 2017

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 the Commonwealth.

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.)

1

10:20–10:40 AM

IMPACT OF RESIDENT AND FELLOW TRAINEES ON PATIENT ENCOUNTER LENGTH IN AN ACADEMIC OPHTHALMOLOGY CENTER 

Michael Chiang*, Isaac Goldstein, Sarah Read-Brown, Michelle Hribar

Purpose: Although presence of resident and fellow trainees is a characteristic feature of academic medical centers, little research has examined their impact on workflow. Meanwhile, physician reimbursement models are increasingly based on metrics such as quality and efficiency of care. The purpose of this study is to examine the impact of trainees on patient encounter length at an academic ophthalmology center.

Methods: The EHR enterprise reporting system (Epic; Verona, WI) was used to collect data on all outpatient encounters in 2014 (n=49,644) by 33 faculty providers with stable practices at an academic center (OHSU Casey Eye Institute). Patient check-in time, check-out time, and trainee presence during encounters were derived from the EHR using previously-published methods. We used t-tests and developed a linear mixed model to analyze the relationship between encounter length and presence of trainees.

Results: Encounters where trainees were involved were significantly longer (102.0 ± 56.5 minutes, n=15,628) than those without trainees (81.9 ± 45.7 minutes, n=34,016) ($p < 2.2E-16$). During clinic sessions where trainees were present, the specific encounters without trainees involved were significantly longer (85.2 ± 47.3 minutes, n=15,792) than encounters from clinic sessions where no trainees were present (79.1 ± 44.2 minutes, n=18,224) ($P < 2.2E-16$). Linear mixed model analysis showed that encounter length was increased 11.8 minutes by presence of a fellow, 14.9 minutes by presence of a resident, and 25.5 minutes by presence of both ($p < .0001$ vs. sessions and encounters without trainees), and that presence of a trainee in the clinic session increased encounter length by 1.8 minutes in specific encounters where the trainee was not involved ($p = .003$).

Conclusion: Presence of resident and fellow trainees in a clinic session is associated with increased length of outpatient ophthalmology encounters, both in encounters where the trainee is involved and even in encounters where the trainee is not involved. This has important implications for clinical efficiency, teaching models, and reimbursement models.

Discussant: **John Clarkson**

2

10:40–11:00 AM

GENETIC ANALYSIS OF 1000 CONSECUTIVELY ASCERTAINED FAMILIES WITH INHERITED RETINAL DISEASE 

Edwin Stone*, Jeaneen Andorf, Adam DeLuca, Scott Whitmore, Joseph Giacalone, Luan Streb, Terry Braun, Robert Mullins, Todd Scheetz, Val Sheffield, Budd Tucker

Purpose: To devise and evaluate a strategy for genetic testing of patients with inherited retinal diseases that maximizes sensitivity and statistical significance while minimizing cost. A secondary purpose was to identify the fraction of disease caused by each gene to aid in the design of a comprehensive strategy for treating every individual affected with one of these disorders.

Methods: 1000 consecutive families diagnosed with an inherited retinal disease by a single physician (EMS) were studied. Patients were divided into 62 different clinical categories based on their medical history and examination findings. A focused genetic test consisting of conventional DNA sequencing and/or allele-specific testing was devised for each of the 62 clinical categories. When the focused test was negative, whole exome and/or whole genome sequencing was performed.

Results: 65% of the families were diagnosed with a photoreceptor disorder and 28% with a macular dystrophy. The remaining 7% were distributed among heritable tumors, vitreoretinopathies, foveal hypoplasia, retinoschisis and choroidopathies. Disease-causing genotypes were identified in 762 families (76.2%) and were distributed across 104 different genes. The most common disease-causing gene was ABCA4 (176 families) while 31 of the genes caused disease in only a single family. Clinically focused conventional testing can detect mutations in 57.9% of the families for an average research cost of \$450 per family while exome and genome sequencing can detect mutations in an additional 18.1% and 0.2% of families for \$1200 and \$2500 respectively.

Conclusion: A clinically focused, sequential testing strategy is more sensitive and less expensive than a strategy based entirely on next generation sequencing. The narrower pretest hypothesis associated with the sequential strategy also results in a much lower false discovery rate than strategies that evaluate dozens or hundreds of genes in every patient. Very low false discovery rates will be essential for clinical trials of gene replacement therapy.

Discussant: **Emily Chew**

3

11:00–11:20 AM

CONJUNCTIVAL TUMORS IN CHILDREN IN 806 CASES. FEATURES
DIFFERENTIATING BENIGN FROM MALIGNANT TUMORS 

Carol L. Shields*, Kareem Sioufi, Adel E. Alset, Emil Anthony T. Say, **Jerry A. Shields**

Purpose: To evaluate the clinical features of conjunctival tumors in children with comparison of benign versus (vs) malignant counterparts.

Methods: Retrospective case series.

Results: Of 806 eyes with a conjunctival tumor, the lesion was melanocytic (n=553, 69%) or non-melanocytic (n=253, 31%). Of 553 melanocytic lesions, the most common tumor diagnosis was nevus (89%), primary acquired melanosis (5%), and melanoma (3%). Of 253 non-melanocytic lesions, the leading diagnosis was benign reactive lymphoid hyperplasia (BRLH) (15%), dermoid, (12%), dermolipoma (10%), lymphangioma (5%), capillary hemangioma (5%), and conjunctivitis with nodule simulating tumor (12%). Overall, the tumor was benign in 97% and malignant in 3%, with malignancy including melanoma (2.2%) and lymphoma (1.1%). The mean age at detection of benign vs malignant tumor was 11 vs 14 years (p=0.0052). The relative frequency of any malignancy (per all conjunctival tumors) by age bracket (0-5, 5-10, 10-15, and 15-21 years) was 1%, 2%, 3%, and 7%. Regarding tumor per race (Caucasian vs African American vs Asian vs Hispanic), the findings included conjunctival nevus (83% vs 6% vs 8% vs 3%), melanoma (89% vs 11% vs 0% vs 0%), BRLH (74% vs 18% vs 0% vs 8%), and lymphoma (56% vs 44% vs 0% vs 0%). A comparison (nevus vs melanoma) found significant (p<0.05) differences with melanoma in older age bracket (RR=4.80), with greater tumor thickness (RR=1.14), greater base, (RR=4.92), tumor hemorrhage (RR=25.30) and lacking intrinsic cysts (RR=5.06). These features predictive of conjunctival melanoma in children can be remembered by the mnemonic CATCH Melanoma representing Children Age older, Thickness/Base greater, Cyst lacking, Hemorrhage for Melanoma. A comparison (BRLH vs lymphoma) revealed lymphoma with significantly larger basal dimension (RR=5.16) and location as diffuse, inferior, or superior vs nasal (RR=16.5, 12.38, 8.25, respectively).

Conclusion: Conjunctival tumors in children are generally benign (97%) and the top five tumors included conjunctival nevus, BRLH, primary acquired melanosis, dermoid, and dermolipoma. Clinical features can assist in differentiating benign from malignant counterparts.

Discussant: **Edward Buckley**

4

11:20–11:40 AM

LIMBAL AND CONJUNCTIVAL TRANSPLANTATION FROM THE SAME LIVING-RELATED BONE MARROW DONOR TO PATIENTS WITH OCULAR GRAFT VERSUS HOST DISEASE 

Massimo Busin*, Giuseppe Giannaccare, Laura Sapigni, Emilio Campos

Purpose: To investigate the outcomes of conjunctival and limbal transplantation from the same living-related bone marrow donor to eyes with severe ocular graft versus host disease (GVHD).

Methods: A 10 x 5 mm graft, including bulbar conjunctiva and limbus, was transplanted from the same living-related bone marrow donor into eyes with severe GVHD. Postoperative treatment included only topical steroids and tetracycline ointment for 3 months. No systemic immunosuppressive therapy was given. Ocular surface disease index (OSDI), visual acuity and Schirmer test type I were evaluated preoperatively as well as 1, 3, 6 and 12 months postoperatively. In addition, 1 year after surgery conjunctival and corneal cells from the eye of a female patient with donor/recipient sex-mismatch were submitted to fluorescence in situ hybridization (FISH) analysis with X and Y chromosome probes.

Results: The donor tissue was grafted successfully and remained vital for the whole follow-up time in all 4 eyes of 2 patients who had undergone CLT. Also the eyes of the living-related donors healed without complications. OSDI score was above 60 in both patients before CLT and improved to 16 and 50 respectively, 6 months after CLT. Preoperative vision was 20/400 or less in all eyes and improved to 20/200 or better in all but one eye, which had advanced corneal keratinization. In one eye vision improved from 20/400 before CLT to 20/25 six months after CLT. In all eyes Schirmer test type I was below 1 mm preoperatively and improved to 5 mm or more 6 months postoperatively. In the eye tested, FISH analysis demonstrated the presence of cells with donor chromosomes as late as 1 year after CLT.

Conclusion: Conjunctival and limbal tissue transplanted from the same living-related bone marrow donor into eyes with severe GVHD survives in the recipient environment for at least 1 year in the absence of immunologic rejection. Vision in eyes without advanced corneal keratinization is substantially increased after CLT. Restoring normal tear secretion, CLT improves ocular surface conditions and may possibly allow successful corneal surgery, when required.

Discussant: **Ivan Schwab**

5

11:40–12:00 PM

RANIBIZUMAB FOR THE PREVENTION OF RADIATION COMPLICATIONS IN PATIENTS TREATED WITH PROTON BEAM IRRADIATION FOR CHOROIDDAL MELANOMA CME

Ivana Kim**, Anne Marie Lane, Purva Jain, Caroline Awh, Evangelos Gragoudas

Purpose: To investigate the safety and potential efficacy of ranibizumab for prevention of radiation complications in patients treated with proton irradiation for choroidal melanoma

Methods: Forty patients with tumors located within 2 disc diameters of the optic nerve and/or macula were enrolled in this open-label study. Participants received ranibizumab 0.5 mg or 1.0 mg at tumor localization and every 2 months thereafter for the study duration of 24 months. The incidence of adverse events, visual acuity, and other measures of ocular morbidity related to radiation complications were assessed. Historical controls with similar follow-up meeting the eligibility criteria for tumor size, location, and baseline visual acuity were assembled for comparison.

Results: Fifteen patients with large tumors and 25 patients with small/medium tumors were enrolled. Thirty patients completed the month 24 visit. No serious ocular or systemic adverse events related to ranibizumab were observed. At 24 months, the proportion of patients with visual acuity $\geq 20/200$ was 30/31 (97%) in the study group versus 92/205 (45%) in historical controls ($P < .001$). 24/31 (77%) versus 46/205 (22%) of controls had visual acuity $\geq 20/40$ at 24 months ($P < .001$). Clinical evidence of radiation maculopathy at month 24 was seen in 8/24 (33%) patients with small/medium tumors versus 42/62 (68%) of controls ($P = .004$). Three patients with large tumors developed metastases.

Conclusion: In this small pilot study, prophylactic ranibizumab appears generally safe in patients treated with proton irradiation for choroidal melanoma. High rates of visual acuity retention were observed through 2 years.

Discussant: **David Wilson**

6

10:20–10:40 AM

MISSED DIAGNOSIS OF PARAPROTEINEMIC KERATOPATHY IN PATIENTS WITH MONOCLONAL GAMMOPATHY OF UNDETERMINED SIGNIFICANCE

CME

Walter Lisch*, Joanna Wasielica-Poslednik, Tero Kivelä, Uwe Pleyer, Christina Lisch, **Jayne S. Weiss**

Purpose: To distinguish distinct bilateral corneal opacities of monoclonal gammopathies in cases initially misdiagnosed as hereditary or inflammatory diseases.

Methods: Slit-lamp examination of thirteen patients with completely distinct bilateral opacity patterns of the cornea. After weeks, months, and years of the first ophthalmological diagnosis a serum protein electrophoresis (SPE) was performed in twelve patients in order to rule out a monoclonal gammopathy of undetermined significance (MGUS). In one patient a penetrating keratoplasty and a DNA analysis had been performed prior to making the diagnosis of MGUS. In another patient with known biclonal gammopathy of undetermined significance a blood copper analysis was performed because of brownish discoloration at the level of Descemet's membrane.

Results: Initial ophthalmological diagnosis of all twelve patients had to be revised as distinct forms of paraproteinemic keratopathy (PPK) after SPE was performed: patient 1 cystinosis, SPE one year later: punctiform crystalline-like PPK; patient 2 Schnyder Corneal Dystrophy (CD), SPE few weeks later: comma-shaped crystalline PPK; patient 3 Lattice CD 1, SPE two years later: lattice-like PPK; patient 4 Granular CD, SPE one year later: peripheral granular-like PPK; patient 5 Peripheral keratitis, SPE one year later: peripheral inflammatory band-like PPK; patient 6 Reis-Bücklers CD, SPE three months later: geographic-like PPK; patient 7 Cornea farinata, SPE one month later: posterior flake-like PPK; patient 8 Stromal CD, SPE six years later: stromal flake-like PPK; light microscopy showed irregular extracellular deposits staining red with Masson trichrome. TGFB1- and decorin-genes were negative; patient 9 Peripheral keratitis/scleritis, SPE five years later: peripheral inflammatory PPK; patient 10 Lattice CD 1, SPE seven months later: lattice-like PPK; patient 11 Peripheral keratitis/scleritis, SPE two years later: peripheral inflammatory band-like PPK; patient 12 Stromal keratitis, SPE three years later: stromal punctiform-like PPK; patient 13 showed a syndrome that we propose to call Lewis syndrome which includes biclonal GUS and hypercupremia (1326 μ g/dL; normal range 76-152)+ discoid brownish discoloration at the level of Descemet's membrane.

Conclusion: The ophthalmologist has the important responsibility to distinguish PPK vs distinct heritable and inflammatory corneal entities. Patients with distinct forms of bilateral corneal opacity and without any hint of inheritance should be analyzed by serum protein electrophoresis in order to rule out the chameleon-like PPK. The Lewis syndrome is to be differentiated vs Wilson's disease.

Discussant: **Peter Laibson**

7

10:40–11:00 AM

ASSOCIATION OF PSEUDOEXFOLIATION WITH SYSTEMIC VASCULAR DISEASES IN A SOUTH INDIAN POPULATION- THE ARAVIND PSEUDOEXFOLIATION (APEX) STUDY 

Aravind HariPriya, Ashok Vardhan, Banushree Ratukondla, Pradeep Ramulu, **Alan Robin***

Purpose: To determine whether specific vascular risk factors and cardiac abnormalities are more common among PEX patients than non-PEX controls.

Methods: Design: Cross-sectional analysis of patients recruited into the APEX (Aravind Pseudoexfoliation) study (begun in 2011).

Setting: Multi-centered study done at four tertiary Aravind Eye Hospitals in Tamil Nadu, India.

Participants: Patients > 40 years with or without PEX, requiring cataract surgery were eligible. We enrolled 930 PEX and 476 non-PEX subjects and performed detailed ocular examinations of each subject including grading of specific ocular features reflecting PEX. We also evaluated for multiple systemic potential cardiovascular diseases and their risk factors.

Main Outcome(s) and Measures: Blood pressure and prevalence of hypertension and diabetes. We also evaluated ECG findings, cholesterol levels, and homocysteine levels in subjects with and without PEX.

Results: The mean ages of PEX and non PEX patients were 64.8 ± 6.8 and 59.9 ± 7.3 years ($p < 0.001$), respectively. PEX patients were more often male than non-PEX patients (54.7% vs 45.3%; $p < 0.001$). In multivariable analyses adjusting for both age and sex, higher systolic blood pressure values were noted for PEX patients as compared to non-PEX patients, ($\Delta = +3.97$ mmHg; $p = 0.001$, [95% CI 1.7 - 6.2]). Also, PEX patients were more likely to demonstrate an ECG abnormality than non-PEX patients (OR 1.64; [95% CI 1.04 - 2.60]). PEX material at pupil margin and pupillary ruff hypotrophy were the two physical findings specifically found to be associated with higher systolic BP and a greater likelihood of ECG abnormality ($p < 0.05$ for both). PEX was not observed to be associated with a higher risk of diabetes, hypercholesterolemia or hyperhomocysteinemia ($p > 0.1$ for all).

Conclusion: In South Indian patients requiring cataract surgery, PEX is associated with higher systolic BP and more frequent ECG abnormalities. Association of specific ocular PEX findings as markers for systemic comorbidities should be further investigated in the future studies. PEX patients may benefit from greater attention to BP and prevention of cardiovascular disease.

Discussant: **Louis Pasquale**

TEMPORAL PROFILE OF RETINOPATHY OF PREMATURITY IN EXTREMELY PREMATURE INFANTS 

R. Michael Siatkowski*, Vincent Venincasa, Victoria Bugg, Dvorak Justin, Kai Ding, Faizah Bhatti

Purpose: Although benchmark studies on retinopathy of prematurity (ROP) (CRYO-ROP, ET-ROP, eROP, STOP-ROP) included extremely premature infants, none produced a detailed analysis of differences in the clinical course of ROP between extremely premature (gestational age \leq 28 weeks) vs premature (gestational age $>$ 28-37 weeks) infants. The purpose of this study was to compare the temporal profile of ROP in premature vs extremely premature infants to determine whether a change in diagnostic examination criteria is required for this population.

Methods: This was a retrospective review of 301 patients/586 eyes (62/122 premature, 236/464 extremely premature) born from 2010-2015. ROP and various systemic data were collected from birth until spontaneous regression, treatment, or death.

Results: Extremely premature infants were diagnosed with ROP earlier than premature infants after adjusting for gestational age (33.6 vs 36.0 weeks, $p < 0.0001$), took 3.7 weeks (53%) longer to achieve regression ($p < 0.0001$), and were 3 times more likely to require treatment (29.7% vs 9.9%, $p < 0.0001$). Birthweight was not independent of gestation age as a risk factor in this population. Rate of weight gain was greater in extremely premature infants compared to premature infants after adjustment for birth weight, and independent of whether treatment was necessary.

Conclusion: Although extremely premature infants develop ROP earlier, have a longer temporal profile of disease, and are more likely to require treatment than premature infant, current AAP/AAO/AAPOS/AACO guidelines are sufficient to detect referral-warranted ROP in this population.

Discussant: **James Reynolds**

THERAPEUTIC BIOMARKERS IN LACRIMAL GLAND ADENOID CYSTIC CARCINOMA: INSIGHTS FROM THE TUMOR'S RESPONSE TO INTRA-ARTERIAL CYTOREDUCTIVE CHEMOTHERAPY 

Daniel Pelaez*, Neda Nikpoor, Wensi Tao, Ravi Doddapaneni, **David Tse**

Purpose: To characterize the molecular response of lacrimal gland adenoid cystic carcinoma tissue to intra-arterial cytoreductive chemotherapy (IACC) in order to identify potential therapeutic biomarkers.

Methods: Patient pre-chemotherapy tumor biopsy samples and corresponding (paired) post-IACC resection specimen were identified and paraffin sectioned for microdissection (n=6). Full-length proteins were extracted and quantified. Lysates were assayed through unbiased proteomic screening. Concurrently, cell cultures from patient samples collected pre-, and post-chemotherapy were used to validate molecular targets and drug screening of these targets for cellular viability or cellular proliferation.

Results: Proteomic assay revealed several markers with statistically significant tendencies in all specimens. Apoptotic markers are upregulated and correlate well with TUNEL, Parp, and Caspase-3 immunohistochemistry. Similarly, markers indicative of a stem cell phenotype were also upregulated following chemotherapy. Bioinformatic analysis revealed the FGF signaling pathway as upregulated following chemotherapy. The FGF receptor 1 (FGFR1) was the most significantly upregulated protein across all samples following IACC. Immunohistochemistry confirmed this upregulation in post-chemo samples and in the cell cultures from patients collected after chemotherapy. Drug screening in LGACC cell lines showed that, while supplementation with an FGFR1&2 selective inhibitor reduced cellular proliferation in all cultures, post-chemo cultures were exquisitely sensitive to this inhibition. The use of other inhibitors did not affect cell growth or viability. Combinatorial drug studies has confirmed a synergistic effect between with the use of cisplatin and AZD4547.

Conclusion: This study validates the use of tissue response in the elucidation of novel therapeutic targets to augment the effects of current management of this lethal orbital tumor. Identification of mechanisms used to subvert chemotherapeutic toxicity, or the phenotype of chemoresistant cells, can help elaborate more effective treatment regimens. We advance the inhibition of FGFR as a novel adjuvant therapy to intra-arterial chemotherapy for LGACC. We are exploring this strategy in a pre-clinical xenograft model for this disease.

Discussant: **Carol Shields**

10

11:40–12:00 PM

MUSHROOM SHAPED INTRAOCULAR LESIONS OTHER THAN MELANOMAS **Jerry A. Shields***, **Carol L. Shields**

Purpose: It is generally believed that a mushroom shaped intraocular lesion is highly suggestive, if not pathognomonic, of choroidal melanoma. The purpose of this presentation is to demonstrate conditions that can also assume a mushroom shape, suggesting a choroidal melanoma.

Methods: The files of an ocular oncology service were reviewed and a literature search done for lesions that can also assume a mushroom shape with ultrasonography.

Results: We identified 13 conditions other than melanoma that occasionally assumed a mushroom configuration. This included adenocarcinoma of pigment epithelium, choroidal metastasis, schwannoma, melanocytoma, choroidal hemangioma, recurrent retinoblastoma, macular degeneration, mycotic abscess, retinal vasoproliferative tumor, solitary fibrous tumor, fibrovascular proliferation, and dislocated lens.

Conclusion: Severe conditions other than melanoma can have a mushroom shape and should not be confused with melanoma.

Discussant: **Jose Pulido**

11

7:30–7:50 AM

QUALITY METRICS AND RETINAL DETACHMENT SURGERY: TIME TO UNPLANNED RETURN TO THE OPERATING ROOM 

Sophie Bakri*, Alexander Grosinger, Benjamin Nicholson, Andrew Barkmeier, Raymond Iezzi

Purpose: To assess 45-day return to the operating room (ROR) as a quality metric in retinal detachment (RD) surgery.

Methods: Eyes with a new clinical diagnosis of untreated rhegmatogenous RD between January 2012 and June 2014 were identified using the institutional electronic medical record. Charts were reviewed to identify all subjects who returned to the operating room and the reason for their return. The primary outcome variable was 45-day ROR, and data was also collected on any ROR that occurred outside this 45-day period. Numerous clinical characteristics were analyzed for associations with ROR. For all ROR events, the charts were reviewed to identify possible causes for ROR.

Results: There were 307 previously untreated RDs identified; 220 were uncomplicated RDs (i.e. excluded eyes with proliferative vitreoretinopathy [PVR] and trauma-related detachment). The uncomplicated RD group had a 45-day ROR of 12/220 (5.5%). The ROR rate over the entire follow-up period was 23/220 (10.5%). The mean final visual acuity in 45 day-ROR eyes was 1.19 ± 1.13 (~20/310) versus 0.34 ± 0.38 (~20/43) in those with no ROR ($P=0.026$). The mean time to ROR in the uncomplicated group was 71.8 days (SD 71.3, range 5-312 days). The "all RD" group (including PVR and trauma) had a 45-day ROR rate of 21/307 (6.8%). The ROR rate over the entire follow-up period was 41/307 (13.3%). The multivariate analysis to assess for risk factors for 45 day return showed associations with a history of an open globe injury ($P=0.0050$) and more clock hours of RD ($P=0.043$). Among these 45 day RORs, 11/21 (52%) had pre-existing extenuating circumstances such as trauma.

Conclusion: The 45-day ROR metric captured about half of all ROR events. Even after excluding trauma and PVR-related RDs, one third of all 45 day RORs were related to pre-existing extenuating circumstances including acute retinal necrosis and macular hole. ROR was associated with significantly worse visual outcomes, both in the 45 day ROR groups and the all-time ROR groups. A risk-adjusted quality metric with longer followup should be sought for the assessment of retinal detachment outcomes.

Discussant: **Rand Spencer**

12

7:50–8:10 AM

IS DISCRIMINANT SCORE ASSOCIATED WITH GEP CLASS IN DECISIONDX-UM TEST IMPORTANT PROGNOSTICALLY? **James J. Augsburger***, Zelia M. Correa

Purpose: When the result of prognostic gene expression profile testing of a uveal melanoma using the DecisionDx-UM test is reported, the GEP class assigned to the tumor is associated with a discriminant score. The higher the absolute value of this discriminant score, the greater the alleged strength of the assignment of the tumor to the reported GEP class. We designed a study to determine whether this discriminant score holds any prognostic significance above that conveyed by the GEP class assignment.

Methods: The authors identified cases of posterior uveal melanoma evaluated by fine needle aspiration biopsy prior to or at the time of initial treatment of the intraocular tumor (9/2007 through 8/2015) and divided them initially into GEP Class 1 and GEP Class 2 subgroups. Within each subgroup, they subdivided the cases into four quartiles determined by the discriminant scores associated with the GEP Class assignment. They computed and compared actuarial event rate curves for death from metastatic melanoma for the patients in those four subdivisions of the two GEP Class subgroups.

Results: The total study group consisted of 560 cases. Of these, 391 (69.8%) were GEP Class 1 and 169 (30.2%) were GEP Class 2. The mean largest basal diameter and thickness of the tumors in the GEP Class 2 subgroup (13.5 mm, 6.6 mm) were substantially larger than these dimensions of the tumors in the GEP Class 1 subgroup (11.1 mm, 5.1 mm). The GEP Class 2 group included a substantially greater proportion of posterior tumors involving the ciliary body (42.6%) than did the GEP Class 1 subgroup (19.2%). The cumulative actuarial probability of death from metastatic melanoma at 6 years was substantially higher in the Class 2 subgroup (0.51) than in the Class 1 subgroup (0.12). The cumulative actuarial survival curves of the discriminant score subdivisions of cases in the Class 2 subgroup were not significantly different from one another; however, the lowest quartile discriminant score subdivision of the GEP Class 1 subgroup exhibited a substantially higher cumulative 6-yr probability of melanoma-related death (0.25) than any of the other three quartile subdivisions.

Conclusion: GEP Class 1 uveal melanomas associated with a low discriminant score may have a higher probability of metastasis and metastatic death than GEP Class 1 tumors associated with a higher discriminant score.

Discussant: **Martine Jager**

13

8:10–8:30 AM

COMPARATIVE EFFECTIVENESS AND COST-EFFECTIVENESS ANALYSES OF THE PROSTAMIDES AND TIMOLOL FOR OPEN ANGLE GLAUCOMA 

Gary Brown*, Melissa Brown, Heidi Lieske

Purpose: To perform patient, preference-based, comparative effectiveness and cost-utility (cost-effectiveness) analyses evaluating topical bimatoprost 0.01%, latanoprost 0.005%, travoprost 0.004%, tafluprost 0.0015% and timolol 0.5% for open-angle glaucoma (OAG) therapy.

Methods: Comparative effectiveness and incremental and average cost-utility analyses were performed assuming a twenty-year (mean life expectancy) model, bilateral therapy, 2015 U.S. real dollars, and societal and third party insurer cost perspectives. A Value-Based Medicine (standardized) approach was utilized, including: 1) patient-derived, time tradeoff utilities, 2) average national ophthalmic and non-ophthalmic Medicare Fee Schedule costs, and 3) other societal (caregiver, transportation, activities-of-daily-living, employment, etc.) costs. Drug data were obtained from FDA submission applications, published meta-analyses and other clinical trials. Murdoch and Jay data provided the natural history of untreated OAG. Comparative effectiveness drug outcomes of QALY gain and quality-of-life gain integrated: 1) intraocular pressure reduction, 2) visual field loss lessening, 3) vision acuity maintenance and 4) adverse event incidences and disutilities.

Results: Bimatoprost conferred a mean 22.8% patient quality-of-life gain for the average OAG patient, while travoprost conferred a 21.8 quality-of-life gain, tafluprost a 21.1% gain, latanoprost a 19.0% gain, and timolol a 15.7% gain. The incremental cost-utility ratio of bimatoprost referent to travoprost was \$2,767/QALY. Bimatoprost dominated latanoprost, tafluprost and timolol, delivering greater patient value for lesser cost. The annual, financial return-on-investment to society---predominantly patients---for the direct ophthalmic costs expended ranged from 12.2% for tafluprost to 19.7% for latanoprost. All drugs were very cost-effective.

Conclusion: Topical bimatoprost delivers greater patient value and is more cost-effective than other prostamides and timolol for OAG therapy. Nonetheless, each drug studied is very cost-effective referent to interventions across medicine, and all increase the wealth of the nation. The model herein can also evaluate other glaucoma therapies, a relevant issue as healthcare interventions compete for scarce financial resources.

Discussant: **Joshua Stein**

14

8:30–8:50 AM

EN FACE OCT AND OCT ANGIOGRAPHY OF PERIVENULAR ISCHEMIA ASSOCIATED WITH CENTRAL RETINAL VEIN OCCLUSION 

David Sarraf*, Khalil Falavarjani, Nopasak Phasukkijwatana, Emmett Cunningham Jr., Ananda Kalevar, Rosa Dolz Marco, Irena Tsui, Richard Rosen, K. Bailey Freund, **Lee Jampol**, Srinivas Satta

Purpose: OCT angiography and en face OCT to assess the spectrum of perivenular ischemia at the level of the deep retinal capillary plexus in eyes with retinal vein occlusion.

Methods: Eyes with recent retinal vascular occlusion illustrating deep retinal capillary ischemia and paracentral acute middle maculopathy (PAMM) in a perivenular fern-like pattern with en face OCT were evaluated in this study. Multimodal retinal imaging including en face OCT and OCT angiography with segmentation of the inner nuclear layer was performed in all patients. Color fundus photography and fluorescein angiography (FA) images were used to create a vascular overlay of the retinal veins versus the retinal arteries to map the distribution of PAMM with en face OCT analysis.

Results: Multimodal retinal imaging was performed in 10 eyes with acute retinal vascular obstruction. While 7 eyes demonstrated obvious fundusoscopic findings of retinal vein obstruction (5 with central and 2 with hemicentral retinal vein occlusion), 3 eyes were unremarkable. OCT angiography and en face OCT analysis demonstrated a spectrum of ischemia at the level of the inner nuclear layer (i.e. PAMM) in a remarkable perivenular fern-like pattern with sparing of the periarteriolar area in all cases.

Conclusion: OCT angiography and en face OCT may illustrate a remarkable perivenular pattern of ischemia involving the inner nuclear layer in eyes with retinal vascular obstruction even in the absence of significant fundusoscopic findings. Perivenular ischemia of the deep retinal capillary plexus demonstrates a wide spectrum of presentation, identified best with en face OCT, and developing as a result of high outflow pressure reducing flow through the deep capillary plexus with ischemia greatest at the venular end of the capillary unit.

Discussant: **William Mieler**

15

8:50–9:10 AM

THE PROGNOSTIC VALUE OF CHROMOSOME STATUS IN UVEAL MELANOMA IS ENHANCED BY ADDING AJCC STAGE 

Martine Jager*, Mehmet Dogrusoz, Mette Bagger, Gregorius Luyten, Jens Kiilgaard

Purpose: The chance to develop metastases in a patient with a uveal melanoma can be determined using mRNA expression or chromosome status, with chromosome 3 loss/a class 2 RNA pattern giving a high chance of metastases. We studied whether adding information on tumor size (AJCC staging) enhances this prognostic information.

Methods: We retrospectively studied a cohort of 522 patients, who had been treated for UM in two different centers, between 1999 and 2015. 156 patients underwent brachytherapy. The mean follow-up time was 47.7 months. Death due to UM metastases was chosen as the primary endpoint.

Results: When we considered only patients with a uveal melanoma with a normal chromosome 3 and 8q status, no patient with a small tumor (stage I) died due to metastases, while those with a stage II and stage III showed an increased but comparable incidence of UM deaths ($p=0.13$). Among tumors with either monosomy 3 or chromosome 8q gain, patients with a stage II or a stage III tumor showed a higher incidence of UM death than stage I cases ($p=0.03$). In tumors with monosomy 3 plus chromosome 8q gain, the 5-year incidence of death was 30% in stage I (95% CI 0-54%), 45% in stage II (95% CI 32-55%) and 77% in stage III (95% CI 64-85%), ($p<0.001$).

Conclusion: We conclude that molecular information and the tumor size should be used together to provide good prognostic information to patients with uveal melanoma.

Discussant: **Hans Grossniklaus**

16

9:10–9:30 AM

GLAUCOMA IN HIGH MYOPIA AND PARAPAPILLARY DELTA ZONE **Jost Jonas****, Kyoko Ohno-Matsui

Purpose: To examine the prevalence of glaucomatous optic neuropathy (GON) in a medium myopic to highly myopic group of patients and to assess associated factors.

Methods: The retrospective observational hospital-based study included patients who had attended the Tokyo High Myopia Clinics within January 2012 and December 2012 and for whom fundus photographs were available. GON was defined based on the appearance of the optic nerve head on the fundus photographs.

Results: The study included 519 eyes (262 individuals) with a mean age of 62.0 ± 14.3 years (range:13-89 years) and mean axial length of 29.5 ± 2.2 mm (range:23.2-35.3mm). GON was present in 164 (28.1%; 95% confidence intervals (CI):24.4,31.7%) eyes. GON prevalence increased from 12.2% (95%CI:1.7,22.7) in eyes with an axial length of <26.5 mm to 28.5% (24.4,32.5), 32.6% (27.9,37.2), 35.6% (30.5,41.1), and 42.1% (35.5,48.8) in eyes with an axial length of ≥ 26.5 mm, ≥ 28 mm, ≥ 29 mm and ≥ 29 mm, respectively. In multivariate analysis, higher GON prevalence was associated (Nagelkerke r^2 : 0.28) with larger parapapillary delta zone diameter ($P < 0.001$; odds ratio (OR):1.86;95%CI:1.33,2.61), longer axial length ($P < 0.001$;OR:1.45;95%CI:1.26,1.67) and older age ($P = 0.01$;OR:1.03;95 %CI:1.01,1.05). If parapapillary delta zone width was replaced by vertical disc diameter, higher GON prevalence was associated (r^2 :0.24) with larger vertical optic disc diameter ($P = 0.04$;OR:1.70;95%CI:1.03,2.81), after adjusting for longer axial length ($P < 0.001$;OR:1.44;95%CI:1.26,1.64) and older age ($P < 0.001$;OR:1.04;95%CI:1.02,1.06).

Conclusion: Axial elongation associated increase in GON prevalence (mean: 28.1% in a medium to highly myopic study population) was associated with parapapillary delta zone as surrogate for an elongated peripapillary scleral flange and with larger optic disc size.

Discussant: **Richard Parrish**

17

9:30–9:50 AM

SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY ANGIOGRAPHY IN CHILDREN WITH AMBLYOPIA 

Stacy Pineles*, Marcela Lonngi, Irina Tsui, Federico Velez, **David Sarraf***

Purpose: Amblyopic patients have thicker choroid and increased retinal outer segment layer thickness on optical coherency tomography (OCT). The purpose of this study was to compare blood flow in the retinal capillary layers in amblyopic children versus controls using non-invasive OCT-angiography (OCT-A).

Methods: Prospective study of children with amblyopia and normal controls. Parameters studied included macular vessel density (MVD), foveal avascular zone (FAZ) area in the superficial retinal capillary plexus (SCP) and deep retinal capillary plexus (DCP), and foveal thickness. T-tests and a linear regression (LR) to accounting for age and refractive error were utilized.

Results: 11 amblyopes and 46 controls were included. Mean age was 10.1 years (range 5-17). Mean MVD of the SCP was 49.5% for the amblyopes and 51.1% for controls (LR, $p=0.049$). MVD of the DCP was 54.43% and 59.06%, respectively (LR, $p=0.013$). FAZ at the SCP and DCP was 0.26 mm² and 0.35 mm² vs 0.27 mm² and 0.34 mm² in amblyopes and controls, respectively ($p=0.565$ and 0.848). Foveal thickness was similar in the groups ($p=0.787$).

Conclusion: OCT-A shows a statistically significant lower retinal vessel density in patients with amblyopia. The clinical significance of this finding should be explored in future studies. In our population of amblyopes, there was no difference in the FAZ nor foveal thickness compared to controls.

Discussant: **David Wallace**

18

9:50–10:10 AM

EVALUATION OF THE RUNGE NEAR CARD FOR STANDARDIZED VISUAL ACUITY ASSESSMENT 

Matthew Cooke, Patricia Winter, McKenney Kaitlin, Krissa Packard, Vesper Williams, Dorsey Eleanor, Aniko Szabo, Alexis Visotcky, William Wirostko, David Weinberg, **Judy Kim**, Edward Barnett, Dennis Han*

Purpose: To evaluate the Runge visual acuity near card for clinical use by comparing it with standard protocol visual acuity testing using the ETDRS visual acuity chart.

Methods: Volunteer subjects prospectively underwent protocol-refracted VA testing with three different acuity charts: the back-illuminated ETDRS chart at 4 meters, a projected Snellen chart at 20 feet, and the Runge Near Card at 16 inches. Analysis was stratified by good ($\log\text{MAR} < 0.6$; 20/80 equivalent or better) or poor ($\log\text{MAR} \geq 0.6$; 20/100 equivalent or worse) visual acuity on the ETDRS chart.

Results: Of 144 subjects enrolled, ETDRS acuity measurements were obtainable in 138. In these, the mean (+/-S.D.) $\log\text{MAR}$ visual acuities [Snellen equivalent] as measured by the ETDRS chart, Runge card, and Snellen chart, respectively, were $0.69 \pm .51$ [20/98, $n=138$], $0.66 \pm .50$ [20/91, $n=138$], and $0.67 \pm .62$ [20/94, $n=137$], ($p=N.S.$) The Runge card showed similar overall agreement with ETDRS testing as with the Snellen chart. Lin's concordance correlation coefficients (CCCs) for the group overall were: between Runge card and ETDRS, 0.92; between Snellen and ETDRS, 0.91; and between Runge card and Snellen, 0.87. ($p=N.S.$) The Runge card showed slightly better agreement with ETDRS in subjects with poor acuity ($\text{CCC}=.79$, $n=71$) compared to those with good acuity ($\text{CCC}=.70$, $n=67$, $p=0.23$). The Runge card agreed with ETDRS better than did the Snellen in subjects with poor acuity ($\text{CCC}=.79$ vs $.63$, respectively, $p=.001$), but not in those with good visual acuity ($\text{CCC}=.70$ vs $.87$, respectively, $p=.005$).

Conclusion: The Runge near card agreed well with both the ETDRS and Snellen charts. Across all VA levels, its agreement with ETDRS was more uniform than was the Snellen, which best agreed with ETDRS at good VA levels. This study supports the Runge card for clinical use. It may be particularly useful in urgent care or resource-poor settings where ease and portability of administration are important considerations.

Discussant: **Kenneth Wright**

ACCURACY OF IMAGING MODALITIES IN DIFFERENTIATING PSEUDOPAPILLEDEMA FROM TRUE OPTIC DISK EDEMA (ODE) IN CHILDREN



Melinda Chang, Federico Velez, Joseph Demer, Laura Bonelli, Peter Quiros, **Alfredo Sadun**, Stacy Pineles, **Anthony Arnold***

Purpose: Differentiation between pseudopapilledema and true optic disk edema (ODE) in children is challenging because drusen, the most common cause of pseudopapilledema, are often buried and non-calcified at this age. The optimal method for differentiating pseudopapilledema from ODE in children is unknown.

Methods: We prospectively recruited children (5 to 18 years old) diagnosed with pseudopapilledema or ODE. All patients underwent imaging with: b-scan ultrasonography, fundus photography, autofluorescence (AF), fluorescein angiography (FA), optical coherence tomography (OCT) of the retinal nerve fiber layer (RNFL), spectral-domain OCT (SD-OCT) of the optic nerve, and enhanced-depth imaging OCT (EDI-OCT) of the optic nerve. Image interpretations by three masked neuro-ophthalmologists were compared to the clinical diagnosis to compute the sensitivity and specificity of each imaging modality for detecting ODE.

Results: Twenty-one eyes (17 with pseudopapilledema and 4 with ODE) of 11 patients were included. Consistency of image interpretation by intraclass correlation coefficient ranged from -0.21 (ultrasonography) to 0.83 (FA). FA had the highest sensitivity (100%) and specificity (100%) for detection of ODE. Fundus photography had 75% sensitivity and 71% specificity. The other imaging modalities had low sensitivity (0 to 50%) but moderate specificity (75 to 88%).

Conclusion: FA was the best imaging modality for differentiating pseudopapilledema from ODE in children. The other imaging techniques, except fundus photography, had low sensitivity for identifying ODE, due to irregularities in the images suggestive of drusen rather than ODE. While EDI-OCT shows improved identification of buried drusen, the ability of OCT to identify mild ODE remains limited.

Discussant: **Timothy McCulley**

AOS 2017

Poster Abstracts

Posters will be displayed from Friday, May 19 through Sunday, May 21.

Poster authors will be available to discuss their work during guided poster sessions scheduled on Friday, May 19 and Saturday, May 20 from 9:30–10:15 AM.

Friday Session Moderators: **Preston Blomquist** and **David Tse**

Saturday Session Moderators: **Ivan Schwab** and **David Tse**

Please note the following program key:

Bold = AOS Member

* = Presenter

♦ = Financial Disclosure

(Posters will indicate relevant financial relationships.)

1

THE ROLE OF OXYGEN-INDUCED VASO-OBLITERATION IN THE DEVELOPMENT OF PARAVENTRICULAR LEUKOMALACIA AND RETINOPATHY OF PREMATURITY 

Kenneth Wright*, Lingkun Kong

Purpose: Two major complications that affect the outcomes of prematurity during perinatal period are retinopathy of prematurity (ROP), and periventricular leukomalacia (PVL). The goal of this study is to test our hypothesis that PVL and ROP share a common pathogenesis of hyperoxia down regulating VEGF, thus inducing vascular involution of immature vessels that leads to tissue ischemia.

Methods: Animal model of oxygen induced retinopathy in mice were generated by exposing 7 days old (P7) FVB mice to 95% O₂ for 5 days then returning to room air (RA). Animals were examined at P12, P19 and P30; 2) In vivo 3D-micro MRI images and angiography of mice of high quality and detail were obtained using lysosomal sc-Gd (19m MGD) as a nanoparticle MRI contrast agent with a Bruker Biospec 9.4T 20 cm bore MRI system; 3) Histopathology study was done on both ocular and brain tissues; and 4) VEGF levels in the serum and CSF were measured.

Results: After exposure to hyperoxia for 5 days, 3D in vivo MRI angiography showed a 50% to 60% global reduction of both cerebral and ocular vessels as compared to controls raised in room air (RA). Changes occurred to the cerebral small vessels and Circle of Willis. One week after the animals were returned to room air, there were significant neovascularization in both brain and eyes with the majority of these new vessels showing discontinuation (leakage) of contrast agent into surrounding tissues. The density of both cerebral and ocular blood vessels were still about 30% less than that in RA treated animals. MRI T2 imaging showed edema of the cortex especially surrounding the ventricles, hippocampus and corpus callosum. Histology showed new blood vessels and hemorrhage in the ventricle. Post oxygen exposure both serum and CSF showed a significant decrease in VEGF levels, then 7 days after being returned to room air VEGF levels increased.

Conclusion: Hyperoxia resulted in down regulation of VEGF causing global oxygen induced vascular involution in both eyes and brain leading to tissue ischemia. PVL has a similar root cause as ROP that is oxygen induced vascular involution of immature vessels. PVL can be considered "ROP of the brain".

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INTRACRANIAL PRESSURE, INTRAOCULAR PRESSURE, TRANSLAMINAR PRESSURE GRADIENT, AND PAPILLEDEMA SEVERITY **Timothy McCulley***, Jessica Chang

Purpose: This study is designed to assess the correlation between intracranial pressure (ICP) and papilledema severity in patients with idiopathic intracranial hypertension (IIH). We also assess the influence of intraocular pressure (IOP) as a component of TPG on papilledema severity.

Methods: In this university-based retrospective study, the electronic medical record database was used to identify 261 consecutive patients assigned the diagnosis of IIH within the neuro-ophthalmology clinic of the Wilmer Eye Institute between 2011 and 2015. Twenty-nine patients (4 males, 25 females, mean age 34 years, range 16-73) met inclusion criteria. These were having undergone lumbar puncture (LP), optical coherence tomography (OCT) of the peripapillary retinal nerve fiber layer (RNFL), and measurement of IOP, all within a three month period. Translaminar pressure gradient (TPG, the difference between ICP and IOP) and ICP were plotted against average RNFL thickness, and the Pearson correlation coefficient was calculated. Linear regression was then performed to assess whether IOP contributes to RNFL thickness. Further analysis evaluated whether asymmetric IOP correlates with asymmetric RNFL thickness.

Results: Using single variable linear regression, there was a correlation between LP opening pressure (ICP) and OCT RNFL average thickness ($R=0.4$, $p=0.03$). TPG (ICP minus IOP) correlated less closely ($R=0.30$, $p=0.11$). On multivariate regression analysis, neither ICP nor TLG were found to significantly correlate with average OCT RNFL thickness. Among patients with asymmetry in IOP between right and left eyes, there was no trend to suggest a corresponding asymmetry in OCT RNFL thickness.

Conclusion: Our data confirms a correlation between ICP and papilledema severity. This correlation was less than perfect ($R=0.4$), suggesting that disc edema is not a function of ICP alone, and that other factors contribute. Our data suggests that IOP in the clinical setting has no significant influence on papilledema severity: TPG correlated less well than ICP alone.

CHAOS THEORY, THE ARRHENIUS EQUATION, AND THE FDA **John D. Bullock***

Purpose: Chaos theory is the branch of mathematics that deals with complex systems whose behavior is highly sensitive to slight changes in conditions. The Arrhenius Equation (TAE) relates the rate of a chemical reaction to temperature. Based on TAE, the FDA suggested that shelf-lives of contact lens solutions (104 weeks) are halved with every 10°C rise in storage temperature. The purpose of this study was to determine the validity of the FDA formula.

Methods: Prior experimental data from studies involving the worldwide ReNu with MoistureLoc (RML)-related Fusarium keratitis event of 2004-2006 were compared with the shelf-lives (SL [in weeks]), determined by the FDA's simple halving principle: $SL=104x(\frac{1}{2})^{[(T-23)/10]}$, where T=actual storage temperature and 23°C=room temperature (RT).

Results: 42°C is near the "tipping point" of RML's thermal stability. For 56°C, the FDA formula predicted a RML shelf-life of 10.6 weeks. A simulated RML solution (alexidine [0.00045%], in phosphate buffered saline) stored at 56°C/1-7 days in a plastic ReNu bottle failed to inhibit Fusarium (P=0.003), with ~96% alexidine absorption by the ReNu bottle. However, challenged Fusarium cultures were inhibited by RML heated (56°C/4 weeks) in a glass container; those alexidine concentrations were similar to levels in a RT-stored ReNu bottle (P=0.7272). After boiling (~100°C/10 minutes) in a glass tube, RML did not lose fungistatic efficacy (P=1.00). With continuous RT storage, RML retained anti-Fusarium capability for ≥36 months past the stated "expiration date." RML's thermally-induced anti-Fusarium failure follows a nonlinear, chaotic-like mathematical step function [with Boolean values of 1 ("anti-Fusarium") and 0 ("not-anti-Fusarium")] rather than the predictable, deterministic, continuous exponential decay function of Arrhenius.

Conclusion: The FDA's shelf-life formula was inconsistent (both over- and under-estimation) with actual RML storage data. Therefore, formulators of contact lens solutions should perform stability testing at actually encountered storage temperatures rather than those based on a simplistic formula inapplicable to complex, real-world conditions.

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MATERNAL PREECLAMPSIA AND INFANT RISK OF RETINOPATHY OF PREMATURITY Julia P. Shulman*, Cindy Weng, Jacob Wilkes, Tom Greene, **M. Elizabeth Hartnett**

Purpose: Maternal preeclampsia causes morbidity to infants and mothers in 4-18% of births worldwide. Controversy exists as to the effect of preeclampsia on infant retinopathy of prematurity (ROP), a leading cause of childhood blindness. Some studies report preeclampsia associated with increased ROP, but others report a seemingly protective effect. To gain understanding into the association of preeclampsia and ROP, we evaluated unrestricted and restricted birth cohorts from a population of mothers and infants in Utah over a 10-year period.

Methods: The Utah Institutional review board approved retrospective analysis of all live births recorded in Intermountain Healthcare's electronic medical record system, including 21 hospitals and one tertiary children's hospital. Generalized estimating equations for logistic regressions with covariate adjustment were applied to relate ROP to preeclampsia in an unrestricted birth cohort of full and preterm infant births and in a restricted subcohort of preterm, very low-birth weight (P-VLBW) infants born less than 31 weeks gestation and less than 1500 grams.

Results: The unrestricted cohort included 290,992 infants, of whom 2015 were P-VLBW. Preeclampsia was associated with increased ROP (adjusted odds ratio [aOR] 2.46; 95% CI 2.17 - 2.79), severe ROP (aOR 5.21; 95% CI 3.44 - 7.91), infant death (aOR 1.66; 95% CI 1.16 - 2.38), and of having a P-VLBW infant (aOR 7.74; 95% CI 6.92 - 8.67) in the unrestricted cohort, but was inversely associated with all ROP (aOR of 0.79; 95% CI 0.68 - 0.92), severe ROP (aOR of 0.62; 95% CI 0.36 - 1.06) and infant death (aOR = 0.19; 95% CI 0.11-0.32) in the P-VLBW subcohort.

Conclusion: Our results strongly suggest an adverse total effect of preeclampsia with ROP and severe ROP. The association of reduced risk of ROP in the restricted, preterm-VLBW subcohort may reflect a bias, because prematurity is an outcome of preeclampsia.

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ASSESSMENT OF A NOVEL TELE-EDUCATION SYSTEM TO ENHANCE
RETINOPATHY OF PREMATURITY (ROP) TRAINING BY INTERNATIONAL
OPHTHALMOLOGISTS-IN-TRAINING IN MEXICO 

Samir Patel, Maria Ana Martinez-Castellanos, David Berrones-Medina, Ryan Swan,
Michael Ryan, Karyn Jonas, Susan Ostmo, J. Peter Campbell, **Michael Chiang, RV Paul
Chan***

Purpose: To evaluate a tele-education system developed to improve diagnostic competency in retinopathy of prematurity (ROP) by international ophthalmologists-in-training.

Methods: This is a prospective, randomized, cohort study. 58 international residents and fellows participated. 29/58 (50%) trainees were randomized to the educational intervention (pretest, ROP tutorial, ROP educational chapters, and posttest), and 29/58 (50%) trainees were randomized to a control group (pretest and posttest only). A secure web-based educational system was developed using a repository of over 2,500 unique image sets of ROP. For each image set used, a reference standard ROP diagnosis was established. Trainees were presented with image-based clinical cases of ROP during a pretest, posttest, and training chapters. Accuracy of ROP diagnosis was determined using sensitivity and specificity calculations from the pretest and posttest results. The unweighted kappa statistic was used to analyze the intra-grader agreement for ROP diagnosis by the ophthalmologists-in-training during the pretest and posttest for both groups.

Results: Trainees completing the tele-education system had statistically significant improvements ($P < 0.01$) in the accuracy of ROP diagnosis for plus disease, zone, stage, category, and aggressive posterior ROP (AP-ROP). Compared to the control group, trainees who completed the ROP tele-education system performed better on the posttest for accurately diagnosing plus disease (67% vs. 48%, $P = 0.04$) and the presence of ROP (96% vs. 91%, $P < 0.01$). The specificity for diagnosing AP-ROP (94% vs. 78%, $P < 0.01$), type-2 ROP or worse (92% vs. 84%, $P = 0.04$) and treatment-requiring ROP (89% vs. 79%, $P < 0.01$) was better for the trainees completing the tele-education system as compared to the control group. Intra-grader agreement improved for identification of plus disease, zone, stage, and category of ROP after completion of the educational intervention.

Conclusion: A tele-education system for ROP education is effective in improving diagnostic accuracy of ROP by international ophthalmologists-in-training.

SOMATOTYPE AND THE RISK OF HYDROXYCHLOROQUINE RETINOPATHY 

David Browning*, Chong Lee

Purpose: To determine the relative importance of actual body weight (ABW) and ideal body weight (IBW) as risk factors for hydroxychloroquine retinopathy (HR) and whether dosing by ABW, IBW, or the lesser of the two predicts HR best.

Methods: A retrospective chart review was performed of patients screened for HR in whom both height and weight were documented. Retinopathy was diagnosed based on 10-2 visual fields, spectral domain optical coherence tomography, multifocal electroretinograms, or fundus autofluorescence. Daily dose and duration of treatment were extracted.

Results: The charts of 740 patients were reviewed to yield 469 in which both height and weight were recorded. Thirty-six (7.7%) had HR. Median weight was 161 lbs IQR 155-187 and 143 lbs IQR 119-180 for the patients without and with HR, respectively ($P=0.0173$). Body mass index (BMI) was 27.6 IQR 24.1-32.4 and 24.1 IQR 20.9-31.9 for the patients without and with HR, respectively ($P=0.0241$). The percentage of asthenic patients among patients without and with HR was 27% and 53%, respectively ($P=0.0018$). The percentage of short, obese patients was 9.9% and 8.3% in those without and with HR, respectively ($P=1.000$). Three patients with retinopathy (11.1%) were both short and obese. Under 2016 AAO guidelines, in one of the three, dosing would have been described as safe, but under guidelines based on the lesser of ABW and IBW, none would have. In a logistic regression model, the strongest risk factor for HR was adjusted daily dose and the next strongest was duration of treatment. Neither ABW nor IBW were additionally predictive.

Conclusion: Previous AAO guidelines erroneously direct attention to short, obese patients as having unusual risk for HR. In fact, short, asthenic patients are at the highest risk. Daily dosing based on the lesser of actual and ideal body weight is safest.

CLINICAL AND ANATOMIC OUTCOMES OF CONCURRENT PHACOVITRECTOMY SURGERY FOR A VARIETY OF INDICATIONS CME

William F. Mieler*, Ivy Zhu, Elmer Y. Tu

Purpose: To report the clinical and anatomic outcomes of concurrent phacovitrectomy surgery for epiretinal membrane (ERM), vitreomacular adhesion (VMA), macular hole (MH), retinal detachment (RD), proliferative diabetic retinopathy (PDR), or other indications at post-operative months 1, 3, and 6.

Methods: Fifty-two patients (n = 52 eyes) participated in a retrospective cross-sectional analysis of concurrent phacovitrectomy surgeries performed at the University of Illinois at Chicago for ERM, VMA, MH, RD, or other indications (non-clearing vitreous hemorrhage of non-diabetic origin or silicone oil removal) by the same surgeons (Mieler, Tu). Cases of VMA were further subdivided by etiology (i.e. idiopathic versus proliferative diabetic retinopathy). The following data was gathered from clinical documentation: pre-operative indication for surgery and best-corrected visual acuity (BCVA); intraoperative and short-term complications; status of post-operative retinal anatomy and BCVA at months 1, 3, and 6. A paired two-sample, one-tailed t-test was performed to determine statistical significance for improvements in BCVA. A chi-squared test was performed to determine the statistical significance in improvements of retinal anatomy.

Results: Average age was 59.6 + 12.1 years with 53.7% (28/52) males; 38.4% (20/52) of cases were performed for VMA (3 idiopathic, 17 PDR), 23.0% for ERM, 15.3% for other indications, 15.4% for RD, and 9.6% for MH. Pre-operative BCVA as measured by logMAR was 1.46 + 1.09. There were no intraoperative complications which compromised the intended goals of surgery, though 7 repeat operations were performed with one patient requiring two repeat operations for refractory PDR. Post-operative BCVA was 1.28 + 1.14, 0.95 + 0.95, and 1.08 + 1.10 at post-operative months 1, 3, and 6, respectively. At post-operative month 3 and 6, 2 (3.8%) and 9 (17.3%) patients had been lost to follow up. Of the remaining patients, the improvement in BCVA after 6 months was 0.36 in logMAR analogous to a two-line improvement, though this was only of borderline statistical significance (p = 0.05). Further stratification by pre-operative indication grouping ERM, MH, and idiopathic VMA together found a 0.27 improvement in BCVA after 6 months that was statistically significant (p=0.002). In cases of VMA due to PDR an improvement in BCVA of 0.29 as measured by logMAR was found, but was not statistically significant (p = 0.25). Abnormalities in retinal anatomy (cystoid macular edema (CME), failure of hole closure, retinal pigment mottling, chorioretinal scarring, vitreous hemorrhage) were seen in 63.4%, 60.0%, and 72.1% at post-operative months 1, 3, and 6, respectively. Changes in retinal anatomy between months 1 and 6 were not statistically significant (p = 0.95).

Conclusion: In our study of concurrent phacovitrectomy surgery, subgroup analysis of the BCVA after 6 months in cases of ERM, MH, and idiopathic VMA, did improve significantly. However, the cases of PDR did not show a statistically significant improvement in BCVA. These findings highlight the difficult and often intractable nature of PDR surgical cases. No patients suffered any intraoperative or short-term complications, though 7 repeat operations were required with one patient undergoing two repeat pars plana vitrectomies for refractory PDR. Overall, final visual function improved in cases of ERM, MH, or idiopathic VMA, though in a few cases, recovery was limited by mild persistent CME, macular pigment mottling, or recurrent opening of the MH. Visual potential in cases of VMA secondary to PDR was guarded. Limitations of this study include the loss to follow-up in a minority of patients.

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COMPARISON OF SINGLE NUCLEOTIDE POLYMORPHISM PROFILES AMONG DIFFERENT PHENOTYPES OF NEOVASCULAR AGE-RELATED MACULAR DEGENERATION **Clement Chan***, Prema Abraham, Andre Hafner, Lorah Perlee

Purpose: Primary outcome measure was comparison of single nucleotide polymorphism (SNP) profiles among patients with different phenotypes of AMD, including bilateral geographic atrophy (GA), vascularized pigment epithelial detachment (vPED) or type-1 neovascular AMD (nAMD), and type-2 nAMD to determine if certain genetic variants are more associated with specific phenotypes of advanced AMD. Secondary measure was comparison of SNP profiles of Good with Poor Responders to anti-VEGF treatment for Type-1 or Type-2 nAMD.

Methods: Case control study of Caucasian subjects ≥ 50 years were phenotyped based on clinical data and assigned to one of three cohorts: GA, Type-1 nAMD, Type-2 nAMD. Buccal mucosal swabs from each subject were genotyped with a panel of 12 AMD associated SNPs using matrix-assisted laser desorption ionization-time of flight mass spectrometry system, at Sequenom Center for Molecular Medicine. SNP frequencies and allelic odds ratios (ORs) were analyzed for significance using Fisher's exact test. Good responders were defined as ≥ 10 letters improvement or $\geq 50\%$ reduction central subfield thickness.

Results: Genotyping was performed on 37 eyes (E) with GA, 63E with Type-1 nAMD, and 57E with Type-2 nAMD. Higher frequencies of C3 risk variant rs2230199 (Arg102Gly), CFH SNPs rs12144939 and rs2274700 were observed more in GA than Type-1 E ($p=0.007-0.04$). No significant differences in SNP profiles were noted between Good and Poor Responders when assessing entire cohort, or when stratified according to Type-1 or Type-2 AMD, or according to individual anti-VEGF drug (bevacizumab, ranibizumab, or aflibercept).

Conclusion: Genetic variants in complement pathway have been implicated in pathogenesis of inflammatory and immune responses. Higher frequencies of genetic variants linked to inflammation found in GA may contribute to its pathogenesis. Lack of differences in SNP profiles between Good and Poor Responders could be due to multiple reasons including sample size issues. More studies are needed to confirm these findings including multiplicity testing.

INTRAOPERATIVE USE OF MICROSCOPE-INTEGRATED OPTICAL COHERENCE TOMOGRAPHY FOR SUBRETINAL GENE THERAPY 

Ninel Gregori, Byron Lam, **Janet Davis***

Purpose: Report the novel use of microscope integrated optical coherence tomography as an adjunct to delivery of subretinal gene therapy

Methods: A Lumera 700 operating microscope outfitted with Rescan 700 technology (Carl Zeiss-Meditech, Dublin CA) was used to perform subretinal injections of a Rab-escort protein 1 encoded in an adenovirus-associated virus 2 vector (AAV2-Rep1) in 5 of 6 patients with choroideremia enrolled in an investigational trial.

Results: Intraoperative scanning confirmed elevation of the retina during the initial injection of balanced salt solution and then confirmed subretinal injection of the vector by imaging bleb elevation. Inadvertent suprachoroidal injection was averted in 2 of 5 cases. Thin foveal tissue and preexisting macular holes were monitored during injection for hole formation or enlargement. There were no cases of subretinal or suprachoroidal hemorrhage. Coverage of the pre-determined target zone was achieved in all cases.

Conclusion: Intraoperative confirmation of subretinal injection is useful in retinal degenerations with highly altered retina, RPE, and choroid, such as choroideremia. In other degenerations, mapping the surface area and dome height of the bleb after vector injection would help confirm administration of the correct dose. Use of this technique would likely make gene therapy accessible to more surgeons and clinical centers.

CLINICAL AND GENETIC PROFILE AND MANAGEMENT OUTCOMES OF UNILATERAL PRIMARY CONGENITAL GLAUCOMA IN SAUDI ARABIA 

Sultan Alzuhairy, Leen Abu Safieh, Rajiv Khandekar, **Deepak Edward***

Purpose: Unilateral primary congenital glaucoma (UPCG) is a rare variant of congenital glaucoma. We describe the clinical presentation, genotype and outcomes of the management of UPCG

Methods: The study included a retrospective review of non syndromic UPCG. Patient demographics, uncorrected visual acuity (UCVA), intraocular pressure (IOP), axial length (AL) of the eye, and corneal diameter (CD) were noted. Genotyping included screening for CYP1B1 pathogenic mutations. Comparisons of ocular parameters at presentation and at last follow up visits was performed. UCVA improvement by one or more lines was considered as 'good' visual outcome.

Results: Of the 500 children with PCG in a registry, 13 (4.3%) (6 male;7female) had UPCG. At presentation, the median IOP was 30 mmHg, CD in the affected eye was 13 mm and median C/D ratio was 0.8. Four eyes had no corneal haze, 7 eyes had mild haze and 2 eyes had moderate haze. Haab's striae were noted in 5 (38%) eyes. The median AL of the UPCG eye was 23 mm. The p.G61E homozygous CYP1B1 common mutation was found in 12 (92.3%) eyes and there was no correlation with the phenotype. The median duration of follow up was 6.8 years. At last follow up, good UCVA was reported for 10 patients and poor UCVA for 3 patients. The median IOP at last follow up was 15 mmHg (range, 9 mmHg to 26 mmHg). Three eyes had mild corneal haze and 10 eyes had none. The AL at last follow-up in 6 of the 13 eyes showed no change and the CD in all affected eyes showed no change.

Conclusion: The clinical phenotype and genotype of UPCG was similar to that of bilateral PCG in this population. Management outcomes seemed better for UPCG than reported for bilateral congenital glaucoma in the region.

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LACRIMAL GLAND ABSCESS IN A CHILD; A RARE ASSOCIATION WITH IGG4-RELATED DISEASE 

Edward Raab*, Hamideh Moayedpardazi, Steven Naidu, **Alan Friedman**, Murray Meltzer

Purpose: To increase awareness of lacrimal gland inflammation in children as a possible manifestation of IgG4-related disease.

Methods: Single case report, including clinical history, pertinent imaging studies, and biopsy findings. Emphasis on clues from the history and appearance of the lesion at surgery.

Results: High index of suspicion by one of the authors led to appropriate evaluation of surgical specimen.

Conclusion: This case adds to the recent awareness of the continuing evolution of knowledge of IgG4-related diseases and the need that it be considered as a rare manifestation of orbital inflammatory conditions.

FUTURE ANNUAL MEETINGS

2018 AOS Annual Meeting

The St. Regis Monarch Beach

Dana Point, California

May 17-20, 2018

2019 AOS Annual Meeting

The Greenbrier

White Sulphur Springs, West Virginia

May 16-19, 2019

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