The American Ophthalmological Society

Office of the Executive Vice President
Atlanta, GA
May 2016

THE ONE HUNDRED AND FIFTY-SECOND ANNUAL MEETING
of the Society will be held at
The Broadmoor
Colorado Springs, Colorado
Thursday through Sunday
May 19–22, 2016

COMMITTEE ON PROGRAMS
J. Sebag
David T. Tse
Eduardo C. Alfonso
Preston H. Blomquist
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TARGET AUDIENCE
Ophthalmologists in academic practice, private practice, training programs, research, or administrative health care.

MEETING OBJECTIVES
The objectives of the 2016 Annual Meeting are to:

1. Discuss important new advances in the etiology, diagnosis, prevention, and treatment of eye diseases.
2. Identify basic and clinical eye and 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. Demonstrate new educational approaches to training ophthalmologists.
7. Describe the economic impact of governmental initiatives on the delivery of ophthalmic 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 financial disclosures of all presenters, authors, Council members, and members of the Committee on Programs are listed on pages 9-11 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
Parts of the 2016 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 19: 1:30 PM – 5:00 PM
- Friday, May 20: 6:30 AM – 12:00 PM
- Saturday, May 21: 6:00 AM – 12:00 PM
- Sunday, May 22: 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 the American Academy of Ophthalmology and the American Ophthalmological Society. The American Academy of Ophthalmology is accredited by the ACCME to provide continuing medical education for physicians.

CREDIT DESIGNATION STATEMENT
The American Academy of Ophthalmology designates this live activity for a maximum of 12.00 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 2015 MEETING

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>Esen Akpek</td>
<td>Baltimore, MD</td>
</tr>
<tr>
<td>R.V. Paul Chan</td>
<td>Chicago, IL</td>
</tr>
<tr>
<td>John Danias</td>
<td>Staten Island, NY</td>
</tr>
<tr>
<td>James Handa</td>
<td>Baltimore, MD</td>
</tr>
<tr>
<td>Arif Khan</td>
<td>Abu Dhabi, UAE</td>
</tr>
<tr>
<td>Timothy Lai</td>
<td>Kowloon, Hong Kong</td>
</tr>
<tr>
<td>Shahzad Mian</td>
<td>Ann Arbor, MI</td>
</tr>
<tr>
<td>Rona Silkiss*</td>
<td>Oakland, CA</td>
</tr>
<tr>
<td>Jason Slakter</td>
<td>New York, NY</td>
</tr>
<tr>
<td>Nicholas Volpe</td>
<td>Chicago, IL</td>
</tr>
</tbody>
</table>

*Provisional Members

MEMBERS ATTENDING THEIR FIRST MEETING

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
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<tbody>
<tr>
<td>Tamara R. Fountain, MD (2014)</td>
<td>Deerfield, IL</td>
</tr>
<tr>
<td>Massimo Busin, MD (2015)</td>
<td>Forli, Italy</td>
</tr>
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IN MEMORIAM

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Joined</th>
</tr>
</thead>
<tbody>
<tr>
<td>James H. Elliott</td>
<td>Nashville, TN</td>
<td>1980</td>
</tr>
<tr>
<td>Roderick Macdonald, Jr.</td>
<td>West Columbia, NC</td>
<td>1971</td>
</tr>
</tbody>
</table>
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.

<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 non-CME services received directly from a commercial interest or its agent</td>
</tr>
<tr>
<td>Employee</td>
<td>E</td>
<td>Employed by a commercial entity producing, marketing, re-selling, or distributing health care goods or services consumed by, or used on, patients</td>
</tr>
<tr>
<td>Lecture Fees</td>
<td>L</td>
<td>Speakers Bureau lecture fees or honoraria, travel fees or reimbursements when speaking at the invitation on a commercial entity</td>
</tr>
<tr>
<td>Equity Owner</td>
<td>O</td>
<td>Ownership interest, including stocks or stock options (excluding mutual funds), of publicly or privately traded firms producing, marketing, re-selling, or distributing health care goods or services consumed by, or used on, patients</td>
</tr>
<tr>
<td>Patents/Royalty</td>
<td>P</td>
<td>Patent holders, royalties, receipt of intellectual property rights</td>
</tr>
<tr>
<td>Grant Support</td>
<td>S</td>
<td>Grant support or contracted research funds received directly from industry, or principal investigator for grant to your institution received during the past 12 months</td>
</tr>
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</table>

ANSARI, Rafat
S – United States Air Force

ATAER-CANSIZOGLU, Esra
E – Mitsubishi Electric Research Laboratories

BUSIN, Massimo
L – Moria SA, Antony France
P – Moria SA, Antony France

CHAN, Clement
C – Allergan
S – Alcucela; Allergan; Genentech; Regeneron;
NEIL; Ophthotec; Pfizer

CHIANG, Michael
C – Clarity Medical Systems
S – NIH; Research to Prevent Blindness

CORRÊA, Zélia
C – Castle Biosciences

CRAVEN, E. Randy
C – Allergan; Pfizer

GOLDBAUM, Michael
O – Calgene Corporation, Gilead Sciences

GROSSNIKLAUS, Hans
P – Clearside BioSciences
S – NIH

HOROWITZ, Jason
S – National Institute of Health

HUANG, David
O – Optovue, Inc
P – Optovue, Inc.; Carl Zeiss Meditec, Inc.

JIA, Yali
P – Optovue, Inc

JONAS, Jost
C – Mundipharma Co.
P – University of Heidelberg
KALPATHY-CRAMER, Jayashree  
S – NIH/NEI

KOKAME, Gregg  
C – Zeiss

LAI, Timothy Y. Y.  
C – Novartis Pharmaceuticals
L – Novartis Pharmaceuticals
S – Novartis Pharmaceuticals

LAUER, Andreas  
S – Oxford BioMedica

OLSEN, Timothy  
S – Genentech/Roche (Study PI)

PANDA-JONES, Songhomitra  
P – University of Heidelberg

PAREL, Jean Marie  
E – University of Miami
P – University of Miami

PIERCE, Eric  
C – AGTC; Editas; GenSight; Vision Medicines
L – Illumina

REYNOLDS, James  
C – Novartis
S – Novartis

SADD, SriniVas  
C – Alcon; Allergan; Bayer; Genentech; Iconic; Novartis; Optos; Zeiss
S – Carl Zeiss Meditec; Optos; Genentech; Regeneron

SADUN, Alfredo  
P – Doheny Eye Institute/UCLA
S – Stealth Peptides; GenSight

SARAF, David  
S – Optovue, Inc.; Genentech; Regeneron

SCHUMAN, Joel  
P – Zeiss

SEBAG, J.  
C – ThromboGenics, LLC; Alcon; Riverside Research, New York
L – ThromboGenics, LLC; Alcon
P – Riverside Research, New York

SKUTA, Gregory  
C – OMIC

ZARBIN, Marco  
C – Genentech; Healios KK; Makindus; Novartis; Ophtotech
L – Novartis
O – Makindus
P – Rutgers University
NO FINANCIAL RELATIONSHIPS TO DISCLOSE RELEVANT TO MEETING PARTICIPATION

<table>
<thead>
<tr>
<th>Name</th>
<th>Name</th>
<th>Name</th>
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<tr>
<td>AIELLO, Lloyd</td>
<td>HUTCHESON, Kelly</td>
<td>SCHEHLEIN, Emily</td>
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<td>AL ZOBIDI, Mohammed</td>
<td>HYSI, Pirro</td>
<td>SHANThA, Jessica</td>
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<tr>
<td>ALFONSO, Eduardo</td>
<td>JONAS, Karyn</td>
<td>SHAPlRO, Michael</td>
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<tr>
<td>ALLINGHAM, R. Rand</td>
<td>KANG, Jae</td>
<td>SHAYA, Fadi</td>
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<tr>
<td>ANDREWS, Chris</td>
<td>KHANDEKAR, Rajiv</td>
<td>SHEKHAWAT, Nakul</td>
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<td>ASCHARD, Hugues</td>
<td>KHOO, Chloe</td>
<td>SHIELDS, Carol L.</td>
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<td>AUGSBURGER, James J.</td>
<td>KUEHLEWEIN, Laura</td>
<td>SHIELDS, Jerry A.</td>
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<td>BAKALL, Benjamin</td>
<td>LEIDERMANN, Yannek</td>
<td>SHTEIN, Roni</td>
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<td>BARTLEY, George</td>
<td>LEVIN, Alex</td>
<td>SIDDIQUE, Teepu</td>
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<td>BEAUCHAMP, Cynthia</td>
<td>LEWIS, Richard Alan</td>
<td>SILVA-GARCIA, Rosemary</td>
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<td>BEAUCHAMP, George</td>
<td>LEYS, Monique</td>
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<td>LIU, Liang</td>
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<td>LOMBARDI, Lorinna</td>
<td>SMALL, Kent</td>
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<td>CAMERON, J. Douglas</td>
<td>MANSBERGER, Steven</td>
<td>STAGER, David</td>
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<td>CAMPBELL, J. Peter</td>
<td>MASHAYEKHI, Arman</td>
<td>STEIN, Joshua</td>
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<td>CAO, Dingcai</td>
<td>MAUMENEE, Irene</td>
<td>STONE, Edwin</td>
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<td>CHAN, R. V. Paul</td>
<td>MCLEOD, Stephen</td>
<td>SUMMERS, C. Gail</td>
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<td>CHAN, Wai-Man</td>
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<td>CHEW, Emily</td>
<td>MENDEZ, Amber</td>
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<td>COLEMAN, Anne</td>
<td>METS, Marilyn</td>
<td>TAPIA, Ket</td>
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<td>CONROY, Joanne</td>
<td>MIELER, William</td>
<td>THIEL, Cassandra</td>
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<td>COOKE BILEY, Jessica</td>
<td>MORRISON, John</td>
<td>THULASIRAJ, Ravilla</td>
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<td>CREMERS, Frans</td>
<td>NEWMAN, Steven</td>
<td>TRABOULSI, Elias</td>
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<td>CRUZ, Antonio</td>
<td>NGUYEN, Justin</td>
<td>TRIVEDI, Rupal</td>
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<td>DAWOOD, Sherif</td>
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<td>DELUCA, Adam</td>
<td>PARRISH, Richard</td>
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<td>DEMIREL, Shaban</td>
<td>PASQUALE, Louis</td>
<td>VAN METER, Woodford</td>
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<td>DRENser, Kimberly</td>
<td>PATEL, Samir</td>
<td>VENKATESH, Rengaraj</td>
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<td>EDMUNDS, Beth</td>
<td>PHASUKKIJWATANA,</td>
<td>VOLPE, Nicholas</td>
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<td>WALLACE, David</td>
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<td>ERDOgMUS, Deniz</td>
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<td>FERRone, Philip</td>
<td>RAVINDRAN, R. D.</td>
<td>WEI, WeiBin</td>
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<td>REPKA, Michael</td>
<td>WEISS, Jayne</td>
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<td>GARDINER, Stuart</td>
<td>ROBIN, Alan</td>
<td>WIGGS, Janey</td>
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<td>GONNERING, Russell</td>
<td>ROHRSCHNEIDER, Klaus</td>
<td>WILSON, David J.</td>
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<td>HARTNETT, Mary Elizabeth</td>
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<td>WILSON, M. Edward</td>
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<td>HILLIER, Sian</td>
<td>SAEEDI, Osamah</td>
<td>WONG, Raymond L. M.</td>
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<td>HOLBACH, Leonard</td>
<td>SAMARA, Wasim</td>
<td>XU, Liang</td>
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<td>HOYNG, Carl</td>
<td>SAY, Emil Anthony T.</td>
<td>YEE, Kenneth</td>
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</table>
## American Ophthalmological Society
### Annual Meeting

#### Event Schedule

**THURSDAY, MAY 19**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>12:00 PM – 1:30 PM</td>
<td>New Member Luncheon (by invitation)</td>
<td>West Terrace</td>
</tr>
<tr>
<td>1:30 PM – 5:00 PM</td>
<td>Registration</td>
<td>West Ballroom Foyer</td>
</tr>
<tr>
<td>2:00 PM – 3:30 PM</td>
<td>New Member Spotlight Presentations</td>
<td>Rocky Mountain Ballroom C</td>
</tr>
<tr>
<td>3:30 PM – 4:30 PM</td>
<td>Poster Session with Authors</td>
<td>Rocky Mountain Ballroom C/ McGrew Room</td>
</tr>
<tr>
<td>6:00 PM – 7:30 PM</td>
<td>Reception Welcoming New Members</td>
<td>Mountain View Terrace</td>
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**FRIDAY, MAY 20**

<table>
<thead>
<tr>
<th>Time</th>
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<th>Location</th>
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<tbody>
<tr>
<td>6:30 AM – 12:00 PM</td>
<td>Registration</td>
<td>West Ballroom Foyer</td>
</tr>
<tr>
<td>6:30 AM – 8:00 AM</td>
<td>Continental Breakfast</td>
<td>Mountain View Terrace</td>
</tr>
<tr>
<td>7:30 AM – 9:30 AM</td>
<td>Spouse/Personal Guest Hospitality Lounge</td>
<td>West Tower Lobby</td>
</tr>
<tr>
<td>9:30 AM &amp; 10:45 AM</td>
<td>Spouse/Personal Guest Guided Art Tours</td>
<td>West Tower Lobby</td>
</tr>
<tr>
<td>7:30 AM – 9:50 AM</td>
<td>Knapp Symposium</td>
<td>West Ballroom</td>
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<tr>
<td>9:50 AM – 10:20 AM</td>
<td>Coffee Break and Poster Viewing</td>
<td>McGrew Room</td>
</tr>
<tr>
<td>10:20 AM – 12:00 PM</td>
<td>Scientific Program</td>
<td>West Ballroom</td>
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<tr>
<td>1:00 PM – 4:30 PM</td>
<td>Tennis Tournament</td>
<td>The Broadmoor Tennis Courts</td>
</tr>
<tr>
<td>5:45 PM – 6:15 PM</td>
<td>Artistic Performances by AOS Members &amp; Guests</td>
<td>Rocky Mountain Ballroom</td>
</tr>
<tr>
<td>6:15 PM – 7:30 PM</td>
<td>Reception (business casual)</td>
<td>Rocky Mountain Ballroom</td>
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# Event Schedule

## SATURDAY, MAY 21

<table>
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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>6:00 AM – 12:00 PM</td>
<td>Registration</td>
<td>West Ballroom Foyer</td>
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<tr>
<td>6:00 AM – 8:00 AM</td>
<td>Continental Breakfast</td>
<td>Mountain View Terrace</td>
</tr>
<tr>
<td>6:30 AM – 7:15 AM</td>
<td>Executive Session (members only)</td>
<td>West Ballroom</td>
</tr>
<tr>
<td>7:30 AM – 10:00 AM</td>
<td>Spouse/Personal Guest Hospitality Lounge</td>
<td>West Tower Lobby</td>
</tr>
<tr>
<td>7:30 AM – 10:00 AM</td>
<td>Inaugural Lecture</td>
<td>West Tower Lobby</td>
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<tr>
<td>7:30 AM – 8:25 AM</td>
<td>Frederick C. Blodi Lecture</td>
<td>West Ballroom</td>
</tr>
<tr>
<td>8:25 AM – 9:30 AM</td>
<td>Second Symposium</td>
<td>West Ballroom</td>
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<tr>
<td>9:30 AM – 10:00 AM</td>
<td>Coffee Break and Poster Viewing</td>
<td>McGrew Room</td>
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<tr>
<td>10:00 AM – 12:00 PM</td>
<td>Scientific Program</td>
<td>West Ballroom</td>
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<tr>
<td>12:00 PM – 1:30 PM</td>
<td>Emeritus Luncheon (by invitation)</td>
<td>West Terrace</td>
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<tr>
<td>12:30 PM – 6:00 PM</td>
<td>Guided Fly Fishing</td>
<td>West Lobby</td>
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<tr>
<td>1:00 PM – 4:30 PM</td>
<td>Golf Tournament</td>
<td>The Broadmoor East Course</td>
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<tr>
<td>6:30 PM – 7:30 PM</td>
<td>Reception</td>
<td>Lakeside Terrace</td>
</tr>
<tr>
<td>7:30 PM – 10:30 PM</td>
<td>Banquet (black tie optional)</td>
<td>Lake Terrace Dining Room</td>
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## SUNDAY, MAY 22

<table>
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<tr>
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<td>Registration</td>
<td>West Ballroom Foyer</td>
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<tr>
<td>6:30 AM – 8:00 AM</td>
<td>Continental Breakfast</td>
<td>Mountain View Terrace</td>
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<tr>
<td>7:30 AM – 10:30 AM</td>
<td>Scientific Program</td>
<td>West Ballroom</td>
</tr>
<tr>
<td></td>
<td>Moderator: Preston Blomquist</td>
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Knapp Symposium
FRIDAY, MAY 20, 2016

INNOVATIVE PARADIGM SHIFTS IN OPHTHALMOLOGY

INTRODUCTION

J. Sebag, MD
VMR Institute for Vitreous Macula Retina
Huntington Beach, CA

PHENOTYPE VS. GENOTYPE: WHAT INHERITED DISEASES FORETELL ABOUT TOMORROW’S DEFINITION OF DISEASE

Eric Pierce, MD, PhD
Harvard Medical School
Boston, MA

BEYOND VISUAL ACUITY: NEW PARADIGMS OF MEASURING VISION

Alfredo A. Sadun, MD, PhD
Doheny Eye Institute/UCLA
Los Angeles, CA

FROM SPACE TO EARTH: NANOIMAGING FOR EARLIER DETECTION OF EYE DISEASE

Rafat R. Ansari, PhD
NASA Glenn Research Center
Cleveland, OH

THE EVOLUTION OF THERAPEUTICS IN OPHTHALMOLOGY

Jean-Marie A. Parel, Ing ETS-D, PhD
Bascom Palmer Eye Institute
Miami, FL

AUDIENCE Q & A
Saturday Symposium
SATURDAY, MAY 21, 2016

FREDERICK C. BLODI LECTURE

INTRODUCTION

Irene H. Maumenee, MD
University of Illinois Eye and Ear Infirmary
Chicago, IL

ZONULES AND MOLECULES: THE UNDERLYING PATHOPHYSIOLOGY OF ECTOPIA LENTIS

Elias I. Traboulsi, MD
Cole Eye Institute
Cleveland, OH
Audience Q & A

HEALTH CARE DELIVERY

INTRODUCTION

M. Edward Wilson, Jr., MD
Storm Eye Institute
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TELEOPHTHALMOLOGY: CHANGING THE PARADIGM OF EYE CARE IN THE COMMUNITY AND THE HOME

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PARAMEDICAL SCOPE OF PRACTICE: NON-MD PROVIDERS WILL DELIVER MORE CARE

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AUDIENCE Q & A
Scientific Program

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 West Ballroom.

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

Papers are limited to eight (8) minutes and the first discussant to three (3) minutes. General discussion will be limited to eight (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.)
ACTIVE RAPI1 INHIBITS INFLAMMATORY MECHANISMS OF RPE-INDUCED VEGF EXPRESSION AND CHOROIDAL NEOVASCULARIZATION

Mary Elizabeth Hartnett*, Haibo Wang

Purpose: Besides its role in angiogenesis, vascular endothelial growth factor (VEGF) attracts activated, migrating choroidal endothelial cells. We explored inflammatory and oxidative mechanisms causing VEGF expression in human retinal pigment epithelial cells (RPE) and in experimental CNV. We tested the hypothesis that inflammatory mediated generation of reactive oxygen species (ROS) increased VEGF expression in RPE and was inhibited by Rap1.

Methods: RPE stimulated with tumor necrosis factor-alpha (TNFalpha) or phosphate-buffered-saline (PBS) control were analyzed for ROS, beta-catenin or nuclear factor-kappa B (NF-kappaB) activation, and VEGF expression. RPE were 1) pharmacologically treated with antioxidant, apocynin; Rap1 activator, 2’-O-Me-cAMP (8CPT); NF-kappaB inhibitor, Bay11-7082; beta-catenin/Wnt inhibitor, XAV939; or respective controls; 2) transfected with small interfering RNA (siRNA) to nicotinamide adenine dinucleotide phosphate-(NADPH) oxidase subunit, p22phox, or control siRNA; or transduced with adenoviral expressed active Rap1a (adRap1a) or adenoviral-green fluorescent protein (adGFP) control. Six-week old C57Bl/6 mice underwent laser (MicronIV, Phoenix) and were treated with TNF-alpha antibodies, 8CPT, or controls. Outcomes were CNV volume in lectin-stained choroidal flat mounts, VEGF and beta-catenin expression in choroid/RPE lysates and ROS in eye sections. Statistics were analyzed by ANOVA.

Results: TNFalpha induced ROS and VEGF in RPE; both were inhibited by apocynin or p22phox siRNA compared to respective controls (all P<0.01). p22phox siRNA inhibited transcriptional activity of beta-catenin in TNFalpha-treated RPE. Beta-catenin inhibitor, XAV939, but not NF-kappaB inhibitors, reduced VEGF expression in TNFalpha-treated RPE. Activated Rap1a with adRap1aCA, compared to AdGFP, reduced ROS, beta-catenin transcriptional activity and VEGF expression in TNFalpha-stimulated RPE (P<0.01). In lasered eyes, TNFalpha inhibition or 8CPT reduced laser-induced CNV, VEGF and beta-catenin compared to controls (P<0.05).

Conclusion: TNFalpha induced VEGF expression through ROS-mediated Wnt/beta-catenin signaling. Rap1 activation reduced ROS that triggered beta-catenin mediated VEGF expression in RPE. Crosstalk among inflammatory, oxidative and angiogenic pathways related to neovascular AMD was reduced by Rap1 activation.

Discussant: Marco A. Zarbin
OCT ANGIOGRAPHY OF MACULAR GANGLION CELL CIRCULATION IN GLAUCOMA

David Huang*, Yali Jia*, Liang Liu, Hana Takusagawa, Beth Edmunds, Lorinna Lombardi, John C. Morrison

Purpose: To detect macular circulation defects in glaucoma.

Methods: One eye of each participant was imaged using 70 kHz 840 nm optical coherence tomography (OCT) (RTVue-XR, Optovue). The macular region was scanned using a 6x6 mm volumetric angiography scan. The split-spectrum amplitude-decorrelation angiography algorithm was used. A novel algorithm was used to remove flow projection artifact. The retina was segmented into two slabs: ganglion cell complex (GCC = nerve fiber layer to inner plexiform layer) and inner nuclear layer+outer plexiform layer (INL+OPL). The total retinal circulation was also analyzed using a thick slab that includes both GCC and INL+OPL. An en face angiogram of each slab was obtained by maximum flow (decorrelation value) projection. The vessel density, defined as the percentage area occupied by vessels, was calculated from the 6x6 mm angiograms, excluding the foveal avascular zone.

Results: Thirty glaucoma and thirty age-matched normal participants were enrolled. The macular GCC circulation was visibly attenuated in glaucomatous eyes and focal capillary dropout could be detected. In glaucoma group, the GCC and total retinal vessel density (mean±SD, 62.5%±8.7% and 82.5%±8.7%) were lower than the normal (79.4%±3.8% and 91.0%±2.7%, both P<0.001, Mann-Whitney test). The INL+OPL vessel density in the glaucoma (61.7%±0.5%) was not significantly lower (P=0.098) than the normal (67.0%±9.2%). When the specificity was fixed at 95%, the glaucoma diagnostic sensitivity of GCC vessel density, total retinal vessel density and GCC thickness were 90%, 80% and 77%, respectively. The GCC vessel density had a higher correlation with average retinal sensitivity over the corresponding VF points (r=0.453, P=0.012) than the GCC thickness (r=0.399, P=0.029).

Conclusion: Glaucoma preferentially affects vessel density in the GCC more than deeper layers. The GCC vessel density has high diagnostic accuracy in glaucoma. OCT angiography of macular ganglion cell circulation could be useful in the clinical evaluation of glaucoma.

Discussant: Joel S. Schuman*
OCT ANGIOGRAPHY OF THE MACULA AFTER PLAQUE RADIOTHERAPY OF CHOROIDAL MELANOMA. COMPARISON OF IRRADIATED VERSUS NON-IRRADIATED EYES IN 65 PATIENTS

Carol L. Shields*, Emil Anthony T. Say, Wasim A. Samara, Chloë T. L. Khoo, Arman Mashayekhi, Jerry A. Shields

Purpose: To study macular capillary density and foveal avascular zone (FAZ) in the superficial and deep capillary plexuses following plaque radiotherapy of choroidal melanoma using optical coherence tomography angiography (OCTA).

Methods: Retrospective analysis of 65 consecutive patients with choroidal melanoma. All patients were treated with standard dose $^{125}\text{I}$ plaque radiotherapy and imaged with OCTA. A comparison of irradiated versus nonirradiated (control) eyes was performed.

Results: The mean patient age was 55 years (median 56, range 12-81 years). Underlying medical diseases included diabetes mellitus (4/65, 4%) or hypertension (25/65, 38%), but no patient demonstrated disease-related retinopathy. The mean pre-treatment melanoma diameter was 11 mm (median 11, range 4-20 mm) and mean thickness was 5 mm (median 5, range 2-13 mm). At mean follow-up of 46 months after plaque radiotherapy, the most frequent finding on OCTA (irradiated eye) was non-perfusion in the superficial capillary plexus (19/65, 29%) and deep capillary plexus (20/65, 31%), followed by loss of choriocapillaris within tumor margins (11/65, 17%). The FAZ showed significantly larger mean area (irradiated vs nonirradiated eye) in the superficial plexus ($0.961 \text{ mm}^2$ vs $0.280 \text{ mm}^2$, $P<0.0001$) and deep plexus ($1.396 \text{ mm}^2$ vs $0.458 \text{ mm}^2$, $P<0.0001$), even in eyes without any clinical evidence of radiation maculopathy (superficial $0.278 \text{ mm}^2$, $P=0.03$; deep $0.454 \text{ mm}^2$, $P=0.02$). Parafoveal capillary density (superficial and deep) was decreased in all irradiated eyes ($P<0.001$). This difference was preserved after subgroup analysis of eyes with ($P<0.001$) or without ($P<0.001$) clinical or OCT evidence of radiation maculopathy. These findings could be more significant as some eyes were excluded from measured analysis due to uninformative OCTA image distortion from advanced cystoid macular edema (5/65, 8%), profound macular non-perfusion (5/65, 8%), and tumor-related image distortion (3/65, 5%).

Conclusion: OCTA demonstrated significant enlargement of the FAZ and decreased parafoveal capillary density of both superficial and deep capillary plexuses in eyes following plaque radiotherapy of choroidal melanoma, even in eyes with no clinical evidence of radiation maculopathy.

Discussant: J. Douglas Cameron
MULTIMODALITY IMAGING IN POLYPOIDAL CHOROIDAL VASCULOPATHY

Gregg Kokame*, Jessica Shantha

Purpose: To evaluate multimodality diagnostic imaging in Polypoidal Choroidal Vasculopathy (PCV) using en-face optical coherence tomography (OCT) and OCT angiography (OCTA) in patients diagnosed with PCV by indocyanine green angiography (ICGA).

Methods: Two subset of patients were identified to evaluate both imaging techniques. A retrospective consecutive case series of 100 eyes diagnosed with PCV by ICGA were examined with en-face OCT spectral domain imaging. Prospectively, 39 eyes diagnosed with PCV were identified for imaging with ICGA and OCTA. ICG angiography was the gold standard for the comparison in size of the PCV complex and the characteristic configuration of the branching vascular network (BVN) and polyp lesions.

Results: The PCV complex was seen better on ICGA in 45 eyes (45%), on en-face OCT in 44 eyes (44%), and equally well visualized in 11 eyes (11%). The size of the PCV complex was larger on en-face OCT in 65 eyes, larger on ICGA in 23 eyes, and equal in size in 12 eyes. For OCTA, the PCV complex was better seen on ICGA in 31 eyes (79%), comparable to ICGA in 5 eyes (13%), better on OCTA in 2 eyes (5%), and equivocal in 1 eye (3%). Thirty-two polyps were identified on ICGA with 10 polyps partially visualized on OCTA. A BVN was visualized in 37 eyes on ICGA. On OCTA, the BVN was better visualized in 3 eyes, comparable in 6 eyes, partially visualized in 26 eyes, and not visualized in 2 eyes. Morphological findings on OCTA include dark low flow areas corresponding to retinal pigment epithelial detachments.

Conclusion: En-face OCT imaging provides characteristic images of PCV. OCT angiography, in its current early development, images vascular flow, but incompletely visualizes the PCV lesions. Both modalities confirm the location of the PCV complex between the RPE and Bruch’s membrane.

Discussant: Jason S. Slakter
OCT ANGIOGRAPHY OF TYPE 1 VERSUS TYPE 3 NEOVASCULARIZATION BEFORE AND AFTER ANTI-VEGF THERAPY IN PATIENTS WITH AMD

David Sarraf*, Nopasak Phasukkijwatana, Laura Kuehlewein, SriniVas Sadda*

Purpose: To assess the morphological structure and quantitative response of type 1 and type 3 neovascular lesions before and after anti-VEGF therapy using OCT angiography (OCTA) analysis.

Methods: Consecutive AMD eyes with type 1 and type 3 neovascularization, diagnosed by spectral domain OCT, were recruited and analyzed with OCT angiography (OCTA) before and after anti-VEGF therapy. Morphological and quantitative OCTA analysis was performed in each eye. Quantitative analysis included OCTA measurements of the area of the neovascular lesion before and after anti-VEGF therapy. Type 1 and type 3 lesions were structurally compared at baseline and the morphological and quantitative response to anti-VEGF therapy was also compared using OCTA analysis.

Results: A total of 11 eyes with type 1 neovascularization and 11 eyes with type 3 neovascularization were recruited and analyzed with OCT angiography (OCTA) before and after anti-VEGF therapy. The mean area of type 1 lesions was 6.36 mm² before anti-VEGF therapy and 6.35 mm² after therapy and the average reduction in area was 2.56%. The mean area of type 3 lesions was 0.097 mm² before anti-VEGF therapy and 0.025 mm² after therapy and the average reduction in area was 78.2%. Type 1 lesions were larger neovascular complexes with large mature vessels that were resistant to anti-VEGF therapy. Type 3 lesions were much smaller neovascular complexes with small caliber, tiny vessels that were much more responsive to anti-VEGF therapy.

Conclusion: OCT angiography can be used to assess the response of type 1 and type 3 neovascular lesions to anti-VEGF therapy. Type 1 neovascular lesions are larger and more resistant to anti-VEGF therapy. Type 3 lesions are smaller and much more responsive to anti-VEGF therapy. These obvious morphological differences may be attributable to the different vascular origin of the neovascular complexes and may have therapeutic implications.

Discussant: David J. Wilson
A COMPARISON OF OUTCOMES OF LASER TRABECULOPLASTY SURGERY PERFORMED BY OPTOMETRISTS VERSUS OPHTHALMOLOGISTS IN THE STATE OF OKLAHOMA

Joshua Stein*, Chris Andrews, Gregory Skuta*

Purpose: Oklahoma is one of the few states where optometrists have surgical privileges to perform laser procedures on the eye. Optometrists in other states are lobbying to obtain permission to obtain such privileges. We compared outcomes of laser trabeculoplasty (LTP) surgeries performed by ophthalmologists to those performed by optometrists to determine whether differences exist among procedures performed by the two provider types.

Methods: Using health care claims data from a 20% sample of Medicare enrollees in 2008-2013 we identified all enrollees with glaucoma residing in Oklahoma who underwent LTP (CPT: 65855). For each procedure, the data specifies whether the procedure was performed by an ophthalmologist or optometrist. We compared the proportion of LTPs performed by ophthalmologists who required >1 additional LTP sessions in the same eye to the proportion of LTPs performed by optometrists. Logistic regression determined factors affecting the odds of undergoing >1 LTP in the same eye.

Results: 1532 eyes underwent LTP in Oklahoma. Among these, 1258 (82.1%) were performed by ophthalmologists and 274 (17.9%) by optometrists. Among the 1532 eyes receiving LTP, 283 eyes (18.5%) underwent >1 LTP in the same eye. The proportion of eyes undergoing LTP by an optometrist requiring >1 subsequent LTP sessions (35.0%) was more than double the proportion of eyes who received this procedure by an ophthalmologist that required >1 additional sessions (14.9%) (P<0.0001). Medicare beneficiaries undergoing LTP by optometrists had a 178% increased odds of requiring additional LTP in the same eye compared to those receiving LTP by ophthalmologists (OR=2.78, CI=1.93-4.00, P<0.0001).

Conclusion: Considerable differences exist among the need for additional LTP sessions among patients initially receiving LTP by ophthalmologists and those initially undergoing LTP by optometrists. Health policymakers should be cautious about approving laser privileges for optometrists practicing in other states until the reasons underlying these differences are better understood.

Discussant: James C. Tsai
SUBSTANTIAL OVER-PRESCRIPTION OF ANTIBIOTICS FOR ACUTE CONJUNCTIVITIS IN THE UNITED STATES

Nakul Shekhawat*, Roni Shtein, Taylor Blachley, Joshua Stein

Purpose: Acute conjunctivitis is often caused by viruses, thus antibiotics are often unnecessary. We examined the extent that patients diagnosed with acute conjunctivitis are treated with topical antibiotics and factors associated with antibiotic use.

Methods: We analyzed health claims data from a U.S managed care plan from 2001-2014. Eligible patients were diagnosed with acute conjunctivitis and continuously enrolled for >90 days after initial diagnosis. We excluded patients hospitalized, undergoing intraocular surgery, or diagnosed with chronic conjunctivitis. Topical antibiotic use was defined as >1 prescription fill within 14 days of initial conjunctivitis diagnosis. Multivariable logistic regression determined factors associated with antibiotic use.

Results: Of 340,630 patients diagnosed with acute conjunctivitis, 198,511 (58%) filled topical antibiotic prescriptions. 20% of patients (N=38,774) received combined antibiotic-steroids, which are contraindicated in acute infectious conjunctivitis. Prescription fills differed by patient age, race, income and diagnosing provider (all P<0.001) but not contact lens wear (P=0.58) or HIV diagnosis (P=0.36). Whites, those with higher incomes, and more educated patients had higher odds of receiving antibiotics (all P<0.0001). Compared to patients diagnosed with acute conjunctivitis by ophthalmologists (37% fill), patients had higher percentages and odds of antibiotic fill if diagnosed by urgent care physicians (68% fill; OR:3.02, CI:2.91-3.13), internists (58%; OR:2.64, CI:2.55-2.74), family practitioners (55%; OR:2.31, CI:2.23-2.40), pediatricians (59%; OR:2.17, CI:2.03-2.32), and optometrists (45%; OR:1.19, CI:1.15-1.24). HIV patients with conjunctivitis were no more likely to receive antibiotics (P=0.81) and patients with severe diabetes with conjunctivitis were 18% less likely to receive antibiotics (P<0.0001) compared to patients without these conditions diagnosed with conjunctivitis.

Conclusion: We identify rampant over-prescription of antibiotics for conjunctivitis among insured US patients, including potentially harmful practices that may prolong infection duration, promote antibiotic resistance, and increase healthcare costs. Antibiotic use appears to be driven more by sociodemographic factors and provider diagnosing the condition than medical indication.

Discussant: Stephen D. McLeod
VALUE CREATION WHERE CONTROL MEETS COMPLEXITY: PROTOCOLS IN MEDICINE

George Beauchamp*, Russell Gonnering, Cynthia Beauchamp

Purpose: The current social construct of healthcare is dominated by the lexicon and metaphors of the financial, industrial and political (FIP) arenas. This has produced a complicated mechanistic system dominated by focus on cost, control, technology and reductionist methodology. The system seeks certainty and universality through consensus or control. Meanwhile, medicine (and disease) is “complex” and patients are cared for in a Complex Adaptive World. The applicability of a merely complicated system and its methodologies seem to fall short for the purposes of the practice of medicine. We examine the concept of protocol driven care as an illustrative example.

Methods: Using available outcomes data and applied to a statistical model, we evaluated the likelihood that an individual with a medically complex disease will benefit from strict adherence to medical protocols.

Results: Given a serious medical condition, the likelihood that a protocol will add value (quality at a cost) to an individual’s care is 2%.

Conclusion: Medical care is akin to a Common Pool Resource (CPR) described by Elinor Ostrom, and her eight principles should be used to guide its delivery. The first two are: 1) clearly defined boundaries (clear definition of the contents of the common pool resource and effective exclusion of external un-entitled parties); and 2) rules regarding the appropriation and provision of common resources that are adapted to local conditions. Those local conditions include the empirical realities of complexity in medicine (see the Stacey Matrix) that provide context for the care of individuals with medically complex disease. All medical value is local. Protocols may be helpful in value creation, but only when both certainty and agreement are high; these conditions are relatively uncommon.

Discussant: George B. Bartley
LONG-TERM OUTCOME OF HALF-DOSE VERTEPORFIN PHOTODYNAMIC THERAPY FOR THE TREATMENT OF CENTRAL SEROUS CHORIORETINOPATHY (AN AOS THESIS)

Timothy Y. Y. Lai*, Raymond L. M. Wong, Wai-Man Chan

Purpose: To evaluate whether half-dose verteporfin photodynamic therapy (PDT) is better than natural history for the treatment of central serous chorioretinopathy (CSC).

Methods: Retrospective review of consecutive CSC patients treated with half-dose verteporfin PDT or untreated with observation and a minimum follow-up of 36 months. The main outcome measures included mean change in visual acuity and CSC recurrence. Survival analysis was performed to compare the CSC recurrence rates between the two groups.

Results: A total of 192 eyes of 192 patients were included; 75 eyes were treated with half-dose verteporfin PDT and 117 were untreated. The mean follow-up duration was 74.1 months. At the last follow-up, the mean logMAR visual acuity was significantly better in the half-dose verteporfin PDT group compared with the untreated control group ($P=0.005$). The mean visual improvement of the half-dose verteporfin PDT group at the last follow-up was 1.8 lines, compared with 0.0 line in the untreated control group ($P<0.001$). Recurrence of CSC developed in 15 eyes (20%) in the half-dose verteporfin PDT group compared with 63 eyes (53.8%) in the untreated control group ($P<0.001$). Survival analysis demonstrated that eyes treated with half-dose verteporfin PDT were significantly less likely to develop CSC recurrence compared with untreated controls ($P<0.001$). Regression analysis showed that half-dose verteporfin PDT was the only significant factor in reducing the risk of CSC recurrence.

Conclusion: Half-dose verteporfin PDT for the treatment of CSC resulted in significantly better visual acuity outcomes and lower recurrence rate in the long term compared with untreated controls.

Discussant: SriniVas R. Sadda*
Purpose: To measure the effects of macular pucker (MP) on retinal structure and quantify the impact on vision by measuring visual acuity (VA), contrast sensitivity (CS), and distortions. The response to MP surgery was evaluated using these measures.

Methods: 37 patients with unilateral MP and normal fellow eyes were evaluated by ultrasound to diagnose posterior vitreous detachment (PVD) and by OCT to measure central macular thickness. Visual function was assessed by measuring VA (logMAR), and CS with Freiburg Acuity Contrast Testing (FrACT; Weber index (%W) = luminance_max - luminance_min / luminance_max). A visual distortion index (DI) was calculated by 3-dimensional Threshold Amsler Grid (3D-TAG) testing [1-5]. Comparisons to the control fellow eyes were performed pre-operatively and at 1, 3, 6, and 12 months following vitrectomy with membrane peeling.

Results: PVD was present in 93% of phakic and 92% of pseudophakic MP eyes, but in only 41% of phakic and 46% of pseudophakic controls ($P<0.01$ for each). Central macular thickness averaged 511 ± 84 microns in MP vs. 259 ± 56 in controls ($P<0.01$). VA was 0.50 (20/63; controls = 0.21 (20/32); $P<0.01$), CS was 8.45±4.9%W (controls=3.39±1.4%W; $P<0.01$), and the DI was 12.6±18.5% (controls=0.15±0.58%; $P<0.01$). Each index progressively improved at 1, 3, 6 and 12 months post-op, ultimately attaining 46% reduction in macular thickness ($P<0.01$), 30% improvement in VA ($P<0.01$), 58% improvement in CS ($P<0.01$), and 96% reduction in distortions ($P<0.01$). Only distortions (DI) normalized compared to controls.

Conclusion: These clinical measures characterize the impact of MP on macular structure and function. All measures improved after surgery, although only distortions normalized. The results further suggest direct effects by MP on the inner retina that lower CS. These clinical indices provide objective quantitative assessments of the severity of MP and can serve as useful outcome measures of therapy.

Discussant: Timothy W. Olsen*
OPHTHALMIC MANIFESTATIONS OF AMYOTROPHIC LATERAL SCLEROSIS

Nicholas Volpe*, Joseph Simonett, Amani Fawzi, Teepu Siddique

Purpose: To determine if clinical and histopathologic findings were present in the eyes of patients with amyotrophic lateral sclerosis (ALS) and explore correlations to an animal model of ALS.

Methods: Two patients with ALS were studied histopathologically as well as the retinas of ALS/dementia transgenic mice with dysfunctional ubiquilin2, UBQLN2P497H. Clinical study 1, an observational, cross-sectional study, was performed using optical coherence tomography (OCT) to obtain and compare mean total macular thickness and average and quadrant specific peripapillary retinal nerve fiber layer (pRNFL) scans from 16 patients with ALS to controls. Correlation analysis was performed to evaluate the association with disease duration. Clinical study 2 consisted of measuring visual acuity, color vision, contrast sensitivity, and quality of life in 12 patients.

Results: Histopathologic studies demonstrated intraretinal inclusions in one patient and loss of ganglion cell axons in another. Mouse eyes had intraretinal inclusions in the inner plexiform layers. Total macular volume was thinner in patients compared to controls ($P<0.05$), and 37.5% of patients with ALS had an average pRNFL below the 1st percentile. Total macular and pRNFL thickness correlated inversely with disease duration.

Conclusion: Histopathologic analysis of ALS eyes and mice with the UBQLN2P497H mutation, as well as OCT measurements, supports involvement of the anterior visual pathway. We identified pathologies, including intraretinal deposits and axonal loss. pRNFL and total macular thinning found on OCT correlated with disease duration. A pattern of vision loss specific for ALS was not identified. This study confirms ocular involvement in patients and transgenic animals with ALS/dementia.

Discussant: Steven E. Feldon
Purpose: A lower ocular perfusion pressure, derived as diastolic blood pressure (DBP) minus intraocular pressure (IOP), is regarded as a strong risk factor for primary open-angle glaucoma (POAG). We evaluated whether single nucleotide polymorphisms (SNPs) associated with IOP or DBP show association with POAG.

Methods: We selected from two pivotal meta-analyses, 7 independent SNPs associated with IOP and 27 associated with DBP at the genome-wide significance level. Using genotype data from the NEIGHBORHOOD (NEI Glaucoma Human Genetics Collaboration Heritable Overall Operational Database), which includes 3,853 POAG cases and 33,495 controls, we extracted genotype dosages for these SNPs. We also extracted summary SNP data from the International Consortium of Blood Pressure to assess shared heritability between DBP and POAG. We tested the association between selected SNPs and POAG; furthermore, we generated a weighted genetic risk score (GRS). Finally, we leveraged a method called LD score, which uses summary genetic data from common genetic variants across the genome, to assess within-trait and across-trait heritability for POAG and BP.

Results: Overall, IOP SNPs showed strong association with POAG - five of seven SNPs were significant at the Bonferroni correction level of 0.0015 (strongest association: OR=1.41, 95% CI: 1.28, 1.56; P=5.9x10^-13 for TMCO1 rs7555523). The weighted GRS was highly significant (OR=2.38, 95% CI: 2.02-2.81; P=3.8x10^-26). In contrast, only one DBP SNP demonstrated significant association with POAG (SH2B3 rs3184504; OR=1.17, 95% CI: 1.09-1.25; P=6.2x10^-6). The DBP GRS was insignificantly associated with POAG (P>0.28). The heritability across the genome for POAG and BP was 10% and 11%, respectively. Yet there is negligible shared heritability between BP and POAG (2.2%±2.3%; P=0.42).

Conclusion: In agreement with the existing literature, we confirmed that POAG shares genetic basis with IOP. Conversely, it appears that the most common DBP SNPs have only limited contribution to POAG.

Discussant: Anne L. Coleman
PLUS DISEASE IN RETINOPATHY OF PREMATURITY: INSIGHTS ABOUT EXPERT DIAGNOSIS FROM COMPUTER-BASED IMAGE ANALYSIS


Purpose: Published definitions of "plus disease" in retinopathy of prematurity (ROP) reference arterial tortuosity and venous dilation within the posterior pole of a standard published photograph. One possible explanation for limited inter-expert reliability for plus disease diagnosis is that experts deviate from published written and pictorial definitions. The purpose of this study is to identify vascular features used by experts for diagnosis of plus disease through quantitative image analysis.

Methods: We developed a computer-based image analysis system (Imaging and Informatics in ROP, i-ROP), and trained the system to classify images compared to a reference standard diagnosis (RSD). The relationship of the performance of i-ROP as a function of the field of view (circular crops of 1-6 disc diameters [DD] radius) and vessel subtype (arteries only, veins only, or all vessels) was examined. The RSD was compared to the majority diagnosis of experts. A set of 77 digital fundus images was used to develop the i-ROP system. A subset of 73 images was independently classified by 11 ROP experts for validation. The primary outcome measure was the percentage accuracy of i-ROP system classification of plus disease with the RSD as a function of field-of-view and vessel type. Secondary outcome measures included the accuracy of the 11 experts compared to the RSD.

Results: Accuracy of plus disease diagnosis by the i-ROP system was highest (95%) when it incorporated vascular tortuosity from both arteries and veins, and with the widest field of view (6 disc diameter radius). This was comparable to the diagnostic accuracy of 11 expert clinicians (79-99%). Accuracy was <90% when using only arterial tortuosity \((P=0.057)\), and <85% using a 2-3 disc diameter view similar to the standard published photograph \((P= 0.004)\).

Conclusion: ROP experts appear to consider findings from beyond the 2-3 DD posterior retina when diagnosing plus disease, and consider tortuosity of both arteries and veins, in contrast to published definitions. It is feasible for a computer-based image analysis system to perform comparably to ROP experts, using manually segmented images.

Discussant: David K. Wallace
ROLE OF APHAKIC RATE OF REFRACTIVE GROWTH IN PREDICTING LONG-TERM POSTOPERATIVE REFRACTION AFTER SECONDARY IOL IMPLANTATION IN CHILDHOOD

M. Edward Wilson*, Rupal H. Trivedi

Purpose: The purpose of this study is to evaluate the role of aphakic rate of refractive growth (RRG3) in predicting long-term postoperative refraction after secondary IOL implantation in children.

Methods: We reviewed the charts of children who underwent cataract surgery before 18 months and secondary IOL implantation at our institute. Data were collected for refraction at the spectacle plane at multiple intervals (first aphakic AR1, last aphakic AR2, first pseudophakic PR1 and last pseudophakic PR2). Patients were included if duration between two aphakic refractions and two pseudophakic refractions was at least 2 years. We calculated the predicted error (PE) based on the observed individual RRG3 value and compared that to the PE using the mean RRG3.

Results: Eighty-eight eyes were identified, of those, 31 eyes met inclusion criteria. We anticipate follow-up data for an additional 10 patients to be included in the final report. The mean age at cataract removal, secondary IOL implantation and final refraction was 2.4 months, 4.7 years and 9.6 years respectively. The median PE using observed individual and mean population RRG3 was 0.61D and 2.09D respectively (Wilcoxon signed rank test $P<0.001$). Similar values for absolute PE was 2.45D and 2.28D respectively ($P=0.4$).

Conclusion: Using individually measured values of RRG3 from the early years of aphakia showed promising results in predicting the long-term postoperative refraction after secondary IOL implantation in children

Discussant: David Stager, Jr.
ORBITAL SULCUS CHANGES AS DETERMINED BY PRETARSAL SKIN HEIGHT IN CHILDREN TREATED WITH TOPICAL PROSTAGLANDIN ANALOGUES FOR PRIMARY CONGENITAL GLAUCOMA

Deepak Edward*, Mohammed Al Zobidi, E. Randy Craven*, Antonio Cruz, Rajiv Khandekar

*Purpose:* Changes in the pretarsal skin height (PTSH) as a proxy indicator of deepening of the upper eyelid sulcus in children treated with topical prostaglandins for primary congenital glaucoma (PCG).

*Methods:* The PTSH in age-matched children with PCG treated with topical prostaglandins >6 months (PCG group), healthy children (control 1) and children with PCG but not using PGA (control 2) was measured on high quality photographs using 'ImageJ' software. Association of PTSH changes with gender, age, type and duration of PGA treatment was analyzed.

*Results:* There were 34 children (20 males) with PCG using PGAs, 31 control group 1 (20 males) and 9 children in control group 2. The difference in PTSH between cases and control 1 was statistically significant [mean difference = 2.2 mm (95% Confidence Intervals (CI): 1.7 - 2.8), \( P < 0.0001 \)]. The PTSH in control 1 and control 2 was similar \( (P = 0.06) \). In 14 Saudi girls with PCG, the PTSH was 5.6±1.6 mm. In 20 Saudi boys with PCG, the PTSH was 3.5 ± 1.4 mm. The PTSH was significantly greater in females compared to males in the PCG group [mean difference = 0.6 mm (95% CI 0.5 - 0.8)]. PTSH in PCG treated with Bimatoprost \( (n=7) \) was 4.4±1.6 mm; Travoprost \( (n=10) \) was 4.9±1.4 mm and 3.9±1.7 mm with Latanoprost \( (n=17) \) was not different \( (P = 0.4) \).

*Conclusion:* Eyelid sulcus deepening as measured by PTSH was significantly greater in children with PCG using PGAs for more than 6 months. Girls with PCG treated with PGA had significantly greater PTSH than boys with PCG. The change in PTSH was similar regardless of age, duration of treatment, or type of PGA administered.

*Discussant:* Alex V. Levin
RETINAL THICKNESS AND AXIAL LENGTH

Jost Jonas**, Liang Xu, WenBin Wei, Leonard Holbach, Songhomitra Panda-Jonas†, YaXing Wang

Purpose: To examine the relationship between axial length and foveal and peripheral retinal thickness.

Methods: Using optical coherence tomography, foveal retinal thickness was measured in participants of the population-based Beijing Eye Study without optic nerve or macula diseases. Inner and outer nuclear layer thickness as surrogate for retinal thickness was assessed in the fundus periphery in human globes enucleated due to malignant uveal melanoma or painful glaucoma.

Results: The study included 1117 individuals with a mean age of 64.2±9.7 years (range:50-93 years) and mean axial length of 23.4±1.04 mm (range: 20.29-28.68mm). In multivariate analysis, thicker central foveal thickness was associated with male gender (P<0.001;standardized regression coefficient beta:-0.13; non-standardized regression coefficient B: -5.84; 95% confidence interval (CI):-8.56,-3.13), urban region of habitation (P=0.02;beta:0.07; B:3.56; 95%CI:0.55,6.57), thinner lens thickness(P=0.01; beta:-0.08; B:-5.11; 95%CI:-9.01,-1.21), thinner subfoveal choroidal thickness (P=0.04; beta:-0.07; B:-0.01; 95%CI:-0.03,-0.001), and longer axial length (P<0.001; beta:0.08; B:3.79; 95%CI:2.41,5.17). In the same multivariate model, superior, inferior and temporal foveal thickness were not significantly associated with axial length (P=0.26, P=0.19, P=0.08, respectively), while thicker nasal foveal thickness was associated with longer axial length (P=0.009; beta:0.09; B:1.50; 95%CI:0.37,2.62). In the histomorphometric part of the study including 32 eyes (sagittal diameter: 27.0±4.2mm; range: 22-37mm), mean thickness of inner and outer nuclear layer at the equator and at the midpoint equator/posterior pole decreased with longer axial length (P=0.004; beta:-0.48; and P=0.02; beta:-.44, respectively).

Conclusion: Myopic axial globe elongation led to retinal thinning in the equatorial and pre-equatorial region, while foveal retinal thickness was mostly unaffected by axial length. It suggests that axial elongation takes place predominantly in the equatorial and pre-equatorial region of the eye.

Discussant: Michael H. Goldbaum†
Purpose: To present the outcome of a case series associated with pneumatic vitreolysis with C$_3$F$_8$ gas (intraocular gas injection without a vitrectomy for induction of a posterior vitreous detachment [PVD]) and limited face-down positioning in the treatment of focal vitreomacular traction (VMT) (within 2-disc areas) with or without a macular hole (MH).

Methods: A retrospective review of eyes was performed for treatment of focal VMT with intravitreal injection of 0.3 mL of C$_3$F$_8$ gas in the office setting. Treated patients were asked to avoid the supine position until gas resolution. Patients with small stage-2 macular holes (< 250 microns) were asked to maintain partial face-down position during waking hours and continue face-down position as much as possible when sleeping at night.

Results: Thirty two patients (33 eyes) with focal VMT underwent pneumatic vitreolysis between 2010 and 2014. A complete PVD developed in 29 eyes (87.9%) at a mean of 3.4 weeks after gas injection. Nineteen of 23 eyes (83.0%) with VMT only developed a PVD with resolution of VMT, and all 10 eyes (100%) with a stage-2 MH developed a PVD with MH closure in 7 of the 10 eyes (70%). The mean pre-operative best spectacle-corrected visual acuity (BSCVA) was 20/50, and the mean BSCVA was 20/35 at last visit. The mean follow-up time was 12.6 months. There were few adverse events. One eye with initial stage-1B impending MH developed a full-thickness MH, and one eye with initial stage-2 MH developed a retinal detachment. Both eyes were successfully repaired with a vitrectomy and final VA was 20/30 for both.

Conclusion: Intravitreal C$_3$F$_8$ gas injection alone with limited face-down positioning appears to be a viable low-cost treatment modality associated with high success and low morbidities for resolving focal VMT, and closing select stage-2 MH. More studies are needed to elucidate the indication, benefits and risks of pneumatic vitreolysis.

Discussant: J. Sebag*
LONG-TERM RESULTS OF TWO-PIECE MICROKERATOME-ASSISTED MUSHROOM KERATOPLASTY

Massimo Busin*

*Purpose: To evaluate the long-term outcomes of a new penetrating keratoplasty technique employing transplantation of a two-piece mushroom-shaped graft prepared by microkeratome-assisted dissection.

Methods: Retrospective chart review of 142 eyes at low risk and 101 eyes at high risk for immunologic rejection, undergoing mushroom PK between 2004 and 2015 at a tertiary care institution. Only eyes with stromal disease and otherwise healthy endothelium were included. Outcome measures were best-corrected visual acuity (BCVA), refractive error, corneal topography, endothelial cell density, graft rejection and survival probability.

Results: Five or more years postoperatively, BCVA of 20/40 and 20/20 was recorded in 100% and over 50% of eyes respectively. Mean spherical equivalent of refractive error did not vary significantly after the first postoperative year; refractive astigmatism averaged always below 4 diopters, with no statistically significant change over time and was of the regular type in over 90% of eyes, as shown by corneal topography. Endothelial cell density decreased to about 40% of the eye bank count 2 years after surgery and did not change significantly thereafter. Five years postoperatively, probabilities of graft immunologic rejection and graft survival were below 5% and above 95% respectively. There was no statistically significant difference in endothelial cell loss, graft rejection and survival probability between low risk and high risk sub-groups.

Conclusion: Refractive and visual outcomes of mushroom PK compare favorably with those of conventional full-thickness keratoplasty. In eyes at high risk for immunologic rejection, mushroom keratoplasty provides a considerably higher probability of graft survival than PK.

Discussant: Jayne S. Weiss
Errors in Retinal Nerve Fiber Layer Thickness Measurements Using Automated Segmentation of Optical Coherence Tomography

Steven Mansberger*, Brad Fortune, Stuart Gardiner, Shaban Demirel

Purpose: Optical coherence tomography (OCT) uses automated retinal layer segmentation algorithms to delineate retinal nerve fiber layer thickness (RNFL). However, these algorithms may fail and OCT manufacturers recommend manual refinement. Little is known about the magnitude, associations, and sources of variability of RNFL thickness estimates between machine-derived automated estimates and manual refinement in participants with early and suspected glaucoma.

Methods: The Spectralis OCT (Heidelberg Engineering, Heidelberg, Germany) used 1536 A-scans during 9 circle scans to measure a 6-degree radius of peripapillary RNFL thickness centered on the optic disc. We downloaded the native retinal layer automated segmentation results. An operator manually refined the automated segmentation to delineate the anterior (internal limiting membrane) and the posterior boundary of the RNFL. We determined RNFL thickness measurements and the glaucoma classification of images (normal, borderline (P<0.05 of normative limits), or outside normal limits (p<.01 of normative limits) when an operator uses only automated segmentation and compared these measurements to manual refinement. We excluded scans with signal strength of less than 15.

Results: We included 3576 scans from 423 eyes of 215 participants. Automated segmentation had a thinner mean NFL thickness (-1.9 microns thinner, 1st /3rd quartile 0.0/-3.0 microns, P<0.001) when compared to manual refinement. A univariate and multivariate linear mixed effects model showed increased differences with decreasing RNFL thickness (P<0.001), decreasing scan quality (P<0.001), and increasing age (P<0.001). Manual refinement changed 8.4% (301/3576) of scans to a different glaucoma classification and 30.7% (148/581) of borderline classifications became normal.

Conclusion: Automated segmentation without manual refinement results in reduced average RNFL thickness and overestimation of glaucoma. Differences between automated and manual refinement were increased in eyes with thinner RNFL thickness, older age, and decreased scan quality. Operators should inspect and manually refine OCT retinal layer segmentation when assessing RNFL thickness in the management of patients with glaucoma.

Discussant: Richard K. Parrish, II
Scientific Program

POSTER ABSTRACTS

Posters will be displayed from Thursday, May 19 through Saturday, May 21.

A poster session with authors is scheduled on Thursday, May 19 from 3:30 PM – 4:30 PM.

Poster authors will be available to discuss their work on Saturday, May 21 from 9:30 AM – 10:00 AM.

Please note the following program key:

Bold = AOS Member
* = Presenter
* = Financial Disclosure

(Posters will indicate relevant financial disclosures.)
NORTH CAROLINA MACULAR DYSTROPHY (MCDR1): MUTATIONS FOUND AFFECTING PRDM13

Kent Small*, Edwin Stone, Adam DeLuca, Frans Cremers, Carl Hoyng, Monique Leys, Benjamin Bakall, Richard Allen Lewis, Virginia Puech, Rosemary Silva-Garcia, Klaus Rohrschneider, Fadi Shaya

**Purpose:** To identify mutations causing North Carolina macular dystrophy (NCMD, MCDR1).

**Methods:** We performed targeted Nex Gen sequencing of the MCDR1 region (870kb) in 8 affected individuals from 3 families representing 3 different haplotypes affected with chromosome 6 linked NCMD (MCDR1). In addition to our original 11 MCDR1 families recently published (141 total subjects), we now have an additional cohort of 23 families with the NCMD phenotype available for study (total of 367 subjects, 32 families). The RT-PCR analysis of selected genes was performed in stem cell derived human retinal cells. IRB approval was obtained.

**Results:** We initially found 14 rare variants spanning 870kb of the disease-causing allele. One of these variants (V1, ch6:1000400906) was absent from all published databases and all 261 controls, but was found in a total of 13 NCMD kindreds. This variant lies in a DNase 1 hypersensitivity site (DHS) upstream of both the PRDM13 and CCNC genes. Sanger sequencing of 1 kb centered on V1 was performed in the remaining NCMD probands, and 2 additional novel single nucleotide variants (V2, ch6:10000987, in 6 families and V3, ch6:100041040 in 1 family) were identified in the DHS within 134 bp of the location of V1. A complete duplication of the PRDM13 gene was also discovered in a single family (V4). The RT-PCR analysis of PRDM13 expression in developing retinal cells revealed marked developmental regulation. The 4 mutations V1 to V4 segregated perfectly in the 118 affected and 33 unaffected members of the 21 NCMD families. We have yet to find the mutation in the remaining 11 families.

**Conclusion:** We identified 4 rare mutations in a non-coding region, each capable of arresting human macular development by causing over expression of PRDM13. Additional families with the NCMD phenotype continue to support that these mutations are causative of MCDR1/NCMD.
THE GLOBAL EDUCATION NETWORK FOR RETINOPATHY OF PREMATURITY (GEN-ROP): DEVELOPMENT, IMPLEMENTATION, AND EVALUATION OF A NOVEL TELE-EDUCATION SYSTEM

R.V. Paul Chan*, Samir Patel, Michael Ryan, Karyn Jonas, Susan Ostmo, Alexander Port, Grace Sun, Andreas Lauer*, Michael Chiang*

Purpose: To describe the design, implementation, and evaluation of a tele-education system developed to improve diagnostic competency in retinopathy of prematurity (ROP) by ophthalmology residents.

Methods: A secure Web-based tele-education system was developed utilizing a repository of over 2,500 unique image sets of ROP. For each image set used in the system, a reference standard ROP diagnosis was established. Performance by ophthalmology residents (postgraduate years 2 to 4) from the United States and Canada in taking the ROP tele-education program was prospectively evaluated. Residents were presented with image-based clinical cases of ROP during a pretest, posttest, and training chapters. Accuracy and reliability of ROP diagnosis (eg, plus disease, zone, stage, category) were determined using sensitivity, specificity, and the kappa statistic calculations of the results from the pretest and posttest.

Results: Fifty-five ophthalmology residents were provided access to the ROP tele-education program. Thirty-one ophthalmology residents completed the program. When all training levels were analyzed together, a statistically significant increase was observed in sensitivity for the diagnosis of plus disease, zone, stage, category, and aggressive posterior ROP \((P<0.05)\). Statistically significant changes in specificity for identification of stage 2 or worse \((P=0.027)\) and pre-plus \((P=0.028)\) were observed.

Conclusion: A tele-education system for ROP education is effective in improving diagnostic accuracy of ROP by ophthalmology residents. This system may have utility in the setting of both healthcare and medical education reform by creating a validated method to certify telemedicine providers and educate the next generation of ophthalmologists.
CHANGE IN VISUAL ACUITY IN ALBINISM IN THE SECOND DECADE OF LIFE

C. Gail Summers*

Purpose: To determine if binocular best-corrected visual acuity (B-BCVA) improves during the second decade of life in patients with albinism. A previous study demonstrated moderately improved B-BCVA in 80% in those with albinism in the early school years (1), and here, the aim is to determine if continued improvement in visual acuity occurs in the second decade of life.

Methods: A review of the albinism database at the University of Minnesota was performed to identify patients with albinism who had B-BCVA measured between ages 10 and 13 years (Visit A) and again, between ages of 17 and 20 years (Visit B). Those with gestational age at birth of < 36 weeks were excluded. In addition to recording B-BCVA, notation was made of type of albinism, age, ocular characteristics, and ocular surgery between Visits A and B.

Results: Review of the database yielded 41 patients who met the study criteria. As a whole, there was a positive trend of mild vision improvement from Visit A to Visit B in 33 patients (80%), with 6 patients (15%) having the same visual acuity from Visit A to Visit B, and 2 patients (5%) with worse visual acuity between the two visits. Improvement in B-BCVA was not significantly related to type of albinism or extraocular muscle surgery performed within the study interval.

Conclusion: Similar to the early school years, B-BCVA in albinism often continues to improve in the second decade of life. The percentage of patients with improved B-BCVA is similar to that in the early school years (80%).(1) This information is important in patient counseling. The improvement in visual acuity may be related to changes in the nystagmus or other unknown factors.
GREEN CATARACT SURGERY: WASTE GENERATION AND CARBON FOOTPRINT OF PHACOEMULSIFICATION AT ARAVIND EYE HOSPITAL IN PONDICHERY, INDIA

Cassandra Thiel*, Alan Robin, Joel Schuman, Rengaraj Venkatesh, Ravilla Thulasiraj, R. D. Ravindran, Osamah Saeedi, Emily Schehlein

Purpose: There are increasing concerns about global greenhouse gas (GHG) emissions, and healthcare is found to emit 3-8% of developed country’s GHGs. The Aravind Eye Care System (AECS) has created an effective surgical model based on efficiency of time and cost. We quantify the waste generated and carbon footprint resulting from phacoemulsification.

Methods: This observational study mapped material flow and audited phacoemulsification waste at Aravind. We used a life cycle assessment (LCA) framework to calculate the GHGs emitted from the production, use, and disposal of materials needed for a single phacoemulsification. Energy use in the operating theatre was estimated from facilities data and the resulting GHGs were also included in the LCA.

Results: One phaco at Aravind generates 0.25kg of waste, 2/3 of which is recycled. IOL packaging and regulatory documents is 25% of this waste by weight, while the surgical drape is 20% of the waste. Carbon emissions from Aravind’s surgical materials and their disposal average about 0.8kg CO2-equivalents per phaco, well below the reported average of 63.5kg CO2-eq/phaco in the UK.

Conclusion: Aravind’s model minimizes waste and carbon emissions associated with surgery. Changes to IOL packaging and documentation will further reduce Aravind’s waste per case. As global leaders set GHG emissions goals (COP21), we should consider components of Aravind’s model to reduce the environmental burdens of surgical care without compromising quality.
MENINGIOMAS OF THE ANTERIOR VISUAL PATHWAY. EVOLUTION OF DIAGNOSIS AND TREATMENT

Steven Newman*

Purpose: The last four decades have seen a dramatic change in the practice of ophthalmology. In retina the advent OCT, and treatment options with anti-VEGF agents have dramatically changed treatment. A similar evolution in neuro-ophthalmology has been changes in our ability to diagnosis and treat meningiomas involving the anterior visual pathways.

Methods: A retrospective study of patients seen over the last 35 years. Thirty-one patients with meningiomas involving the optic nerve sheath, clinoid, or anterior visual pathways were identified. Follow up was up to 34 years.

Results: The advent of imaging with CT and MR has dramatically improved our ability to recognize and diagnosis meningiomas. Change in imaging does not necessarily correspond to change in psychophysical testing, emphasizing the importance of continued psychophysical monitoring of these patients. Most patients were referred for decreasing visual acuity. The advent of OCT permits recognition of damage to the axons with thinning of nerve fiber layer. Meningiomas in particular, however, may compress the optic nerve producing normal or even super normal NFL thickness, so called "green disease." The recent advent of segmentation analysis of the ganglion cell layer in the macula permits recognition of early damage even where the NFL is normal. Fractionated radiation therapy has had a dramatic effect on slowing growth and even improving optic nerve function, dramatically reducing nerve fiber layer swelling, even in patients with preserved central acuity.

Conclusion: OCT offers an extremely useful tool to quantitate the anatomic effect of meningiomas on the anterior visual pathways. It is likely that segmentation analysis will be even more useful for documenting the level of damage. Fractionated radiation therapy, either with conventional radiation sources (IMRT) or proton beam can be extremely effective in preventing further damage and improving visual outcomes.
INTRAVITREAL DEXAMETHASONE FOR RECALCITRANT CME FOLLOWING BRACHYTHERAPY TREATMENT OF UVEAL MELANOMA

William F. Mieler *

Purpose: To determine the efficacy of intravitreal dexamethasone in the treatment of recalcitrant radiation maculopathy following iodine-125 brachytherapy treatment of uveal melanoma.

Methods: Consecutive retrospective analysis of patients treated in a University setting between the years of 2010-12 (with minimum of 24 months follow-up).

Results: Fifty-eight patients were diagnosed clinically and echographically with uveal melanoma, with a mean base of 12.0 mm and height of 6.5 mm at the time of diagnosis. I-125 brachytherapy, with a mean dosage of 85.5 Gray, was applied over an average of 152 hours. Patients were then followed quarterly for an average of 32.1 months (range 24 - 52 months). Twenty-three patients (40%) developed radiation maculopathy an average of 17.7 months (range 12 - 31 months) post-brachytherapy, correlating with dosage of the radiation and proximity of the tumor to the macula. All patients were initially treated with intravitreal bevacizumab, often times alternating with triamcinolone. Recalcitrant CME remained in seven patients, in spite of an average of 16 injections (range of 13-20 injections). These seven patients were switched to intravitreal dexamethasone (Ozurdex), with resolution of the CME after 1 to 2 injections, and stability for up to one year. Visual results were wide ranging, from 20/25 to 20/400, with five of these seven patients also requiring cataract extraction.

Conclusion: Radiation maculopathy develops quite frequently following I-125 brachytherapy of uveal melanoma. Initial treatment with bevacizumab and/or triamcinolone is variably effective. Recalcitrant CME appears to respond quite readily to intravitreal dexamethasone (Ozurdex), and perhaps should be considered earlier in the treatment regimen of radiation-induced maculopathy.
ALGORITHMS FOR APPLICATION OF RESULTS OF CYTOPATHOLOGICAL ANALYSIS AND GENE EXPRESSION PROFILE TESTING IN CLINICALLY DIAGNOSED POSTERIOR UVEAL MELANOMA EVALUATED BY FNAB

Zélia M. Corrêa*, James J. Augsburger*

Purpose: Gene expression profile (GEP) testing of clinically diagnosed posterior uveal melanomas prior to or at the time of initial treatment is fast becoming the standard of care in ocular oncology practices in North America. Unfortunately, there are no current consensus guidelines about how the results of this prognostic testing and cytopathologic features of tumor cells should be used in patient management.

Methods: Retrospective study of 275 cases of posterior uveal melanoma evaluated by fine needle aspiration biopsy (FNAB) with aspirates submitted for both cytology and GEP testing (9/2007 through 9/2012). The authors prepared algorithms explaining how they apply the results of cytopathological analysis and GEP testing of tumor cells in their clinical practice.

Results: These 275 tumors were classified cytopathologically as unequivocal melanoma in 243 (87.7%) [spindle = 114, mixed = 76, epithelioid = 53], borderline in 7 (2.5%), nevus in 8 (2.9%) and insufficient specimen in 17 (6.3%). Tumors were categorized by GEP into class 1 in 154 (56.0%) and class 2 in 121 (44.0%). In patients with an unequivocal melanoma, the GEP test result was used to advise patients about their metastatic risk and identify those "high risk" persons who would be appropriate candidates for adjuvant therapy clinical trials. In patients with a "nevus versus melanoma" or "probable melanoma with dormant features", the cytopathological findings and GEP test result were used primarily to determine the urgency of intraocular tumor treatment and secondarily to advise patients about their metastatic risk and eligibility for adjuvant therapy trials.

Conclusion: Algorithms for application of the results of cytopathological analysis and prognostic GEP testing of clinically diagnosed posterior uveal melanoma are presented for information and discussion. The authors do not currently recommend differential surveillance testing for patients in the different GEP groups except in the context of prospective clinical trials.
PARS PLANA VITRECTOMY IN COMBINATION WITH PENETRATING KERATOPLASTY

Randee Watson, Sherif Dawood, Dingcai Cao, **William Mieler**, Yannek Leiderman*

**Purpose:** To report the indications for and outcomes of combined pars plana vitrectomy and penetrating keratoplasty (PPV-PKP). Contemporary surgical techniques will be illustrated.

**Methods:** Single-center, multisurgeon, retrospective, consecutive interventional case series. A review of all patients who underwent combined PKP-PPV at the Illinois Eye and Ear Infirmary from January 1, 2001 to May 31, 2013 was performed. Ninety eyes of 90 patients were identified. Survival analysis was utilized to assess the differences in retinal detachment and corneal graft failure rates among groups based on clinical and surgical variables.

**Results:** Seventy-nine eyes met inclusion criteria. The most common indications for vitrectomy and corneal transplantation were retinal detachment (65%) and corneal decompensation (43%), respectively. The preoperative and final visual acuity (VA) LogMAR values were 2.7 ± 0.31 and 2.5 ± 0.67 (hand motions; mean ± standard deviation) \(P=0.02\); 15% of eyes were ≥ 20/400 and 15% gained ≥ 2 lines of vision following surgery. Corneal graft failure occurred in 51% (40 eyes), recurrent retinal detachment (RD) in 28% (22 eyes), and hypotony in 25% (20 eyes). Silicone oil endotamponade was associated with postoperative retinal detachment \(P=0.045\) and previous ocular trauma was associated with postoperative corneal graft failure \(P=0.023\).

**Conclusion:** Combined PPV-PKP surgery was likely to achieve stabilization of visual acuity, with a minority of eyes achieving modest gains in visual acuity.
FUTURE ANNUAL MEETINGS

2017 AOS Annual Meeting
The Omni Homestead Resort
Hot Springs, Virginia
May 18 – 21, 2017

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