PROGRAM and ABSTRACTS

of the

One Hundred Forty - Sixth
Annual Meeting

AMERICAN OTOLOGICAL SOCIETY, INC.

April 13 - 14, 2013

Mediterranean Ballroom
1 - 3

JW Marriott Grande Lakes Resort
Orlando, FL

OFFICERS
JULY 1, 2012—JUNE 30, 2013

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Medical University of South Carolina
Charleston, SC

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Samuel H. Selesnick, M.D.

Accreditation Statement
This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship of the American College of Surgeons and the American Otological Society. The American College of Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

AMA PRA Category 1 Credits™
The American College of Surgeons designates this live activity for a maximum of 7.75 *AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

American College of Surgeons
Division of Education

American Otological Society, Inc.
Mission Statement

Purpose

The American Otological Society, created in 1868, is dedicated to fostering a dialog on and dissemination of, information pertaining to advances in evidence based diagnosis and management of otologic and neurotologic disorders. The focus on otologic and neurotologic disorders and scientific advances are translated to the provision of quality care that is consistent with the ACGME general competency areas and the Institute of Medicine competencies.

Target Audience

The primary target audience for the educational efforts of the American Otological Society is the current and potential members of the society. These members are physicians, otologists, residents, fellows, and researchers in the fields of otology and neurotology. Educational activities are also open to nurses, occupational and speech therapists and other healthcare professionals who are involved in the care of patients with otologic and neurotologic conditions.

Activities

The primary activity of the American Otological Society is the Annual Meeting that focuses on the advancement of the scientific and clinical evidence that supports advances in otologic and neurotologic care to patients. Additionally, non certified educational support and resources include the publication and dissemination of peer reviewed and evidence-based content through the Otology & Neurotology Journal and support for research in otology/neurotology and lateral skull base surgery and related disciplines.

Content

The content for the Annual Meeting and other related educational efforts are limited to the otologic and neurotologic evidence based science, clinical standards of care, and effects on communication.

Expected Results

The expected results are focused on enhancing knowledge translation and promoting competence for the membership and other identified target audiences. The Annual Meeting, the CME certified annual activity of the society, and the other scholarly activities such as the publication of the Journal and support for research provide a rich and robust environment for self assessment and reflection, access to resources for lifelong learning and opportunities for discussion and re-evaluation

2013 AOS Spring Meeting CME Activity Planning

The American Otological Society (AOS) is committed to improving public health care through the provision of high-quality continuing medical education (CME) to our members. The overall goal is to provide CME activities that will address the knowledge gaps and enhance the clinical competence of the participants.

Planning an educational activity that meets the needs of our members is of the utmost importance to the leadership of the AOS. At the close of each annual meeting, we ask that you complete an exit-evaluation. The evaluation is used as a tool to determine the success of the CME program in meeting program objectives, addressing professional practice gaps and educational needs. Your responses provide extensive feedback on what was learned from the Program as well as what you would like to see in the future. The responses are peer-reviewed by the Council prior to the next meeting to assist the Program Committee in developing future AOS Continuing Medical Education programs. The educational program is designed to address the topics identified as practice gaps through individual presentations and in depth panel discussions. Based on the response, the following data regarding professional practice gaps among attendees were noted:

- There is limited knowledge of the relevance of temporal bone histopathology for contemporary clinical otological practice.

- Hearing restoration by attempts to regenerate cochlear hair cells is a complicated and poorly understood area of research.

- The etiology of otosclerosis is incompletely understood, resulting in the inability to offer contemporary treatments to patients.

Highlights of the AOS 146th Annual Meeting include two Basic Science presentations; the first is entitled, *"Can We Restore Lost Hearing? Molecular Control of Cell Fate and Cell Division in the Development and Regeneration of the Inner Ear"*, presented by Dr. Neil Segril. On Sunday, Dr. Michael J. McKenna will present *"Progress Understanding the Etiology of Otosclerosis and Implications for Future Treatment"*. Dr. Paul Lambert, AOS President, selected Dr. Bruce J. Gantz as the Guest of Honor. Dr. Gantz's presentation is entitled, *"Acoustic + Electric Speech Processing: What Have We Learned about the Auditory System"*. A panel of experts will address the latest *"Innovations and New Technologies"* in Otology, moderated by Dr. John Carey. Dr. Joseph B. Nadol put together a top-notch panel to discuss *"Contemporary Relevance of Human Temporal Bone Histopathology"*.

In addition, there are a vast number of oral presentations exploring the latest otological research and findings. Be sure to visit the Exhibit Hall where you will find an outstanding display of AOS poster submissions. Posters will be available for viewing on Friday, April 12th through Saturday, April 13th. The Combined Poster Reception will take place Friday evening, April 12 at 5:30.

To close the identified practice gaps, participants of this activity will need to learn:

1) The importance and relevance of temporal bone histopathologic studies to their medical and surgical practice. Many prior findings from these types of studies have had critically important implications for our practice. Further findings and advancements in technique will be discussed. Attendees will also understand the importance of continued procurement of specimens and continued NIH funding support for these studies.

2) The current state of knowledge and current approaches to hearing restoration research. Although current studies are still in the pre-clinical stages, practitioners must understand what approaches are being used and gage progress in recent research. Patients often look to us to help them understand the current state of research into treatment of hearing loss, particularly in light of publications in the lay media.

3) The current state of knowledge about the causes of otosclerosis, an otologic disorder that we commonly treat. Physicians must have a contemporary and thorough knowledge of the causes of the disorders we treat.

Patient outcomes will be improved by:
1) Offering the best counseling and treatment for otosclerosis
2) Offering the best counseling and treatment for sensorineural hearing loss
3) Offering the best counseling and treatment for otological disorders that can be studied in more detail utilizing techniques of temporal bone histopathology.

Learning Objective (s) - At the end of this activity, participants will be able to:

- Identify new findings derived from otopathology as relevant to clinical otology, as well as new techniques that will add to knowledge base.
- Describe contemporary research trends in hair cell regeneration and know how this may apply to patient care in the future.
- Apply the current understanding of etiology of otosclerosis as appropriate to medical and surgical otological practice.

The following ACGME competency areas will be addressed throughout this CME activity
Patient Care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.
Medical Knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.
Practice-Based Learning and Improvement that involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care.
Interpersonal and Communication Skills that result in effective information exchange and teaming with patients, their families, and other health professionals.
Professionalism as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population.
Systems-Based Practice as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

The following statement was read, submitted, and signed by every individual connected with this educational activity. Failure to comply disqualifies the individual from planning or speaking at any AOS Continuing Medical Education program.

All authors were advised that the submitted paper becomes the property of *Otology & Neurotology* and cannot be reprinted without permission of the Journal.

In accordance with the ACCME Accreditation Criteria, the American College of Surgeons, as the accredited provider of this activity, must ensure that anyone in a position to control the content of the educational activity has disclosed all relevant financial relationships with any commercial interest. Therefore, it is mandatory that both the program planning committee and speakers complete disclosure forms. Members of the program committee were required to disclose **all** financial relationships and speakers were required to disclose any financial relationship **as it pertains to the content of the presentations**. The ACCME defines a 'commercial interest' as "any entity producing, marketing, re - selling, or distributing health care goods or services consumed by, or used on, patients". It does not consider providers of clinical service directly to patients to be commercial interests. The ACCME considers "relevant" financial relationships as financial transactions (in any amount) that may create a conflict of interest and occur within the 12 months preceding the time that the individual is being asked to assume a role controlling content of the educational activity.

ACS is also required, through our joint sponsorship partners, to manage any reported conflict and eliminate the potential for bias during the activity. All program committee members and speakers were contacted and the conflicts listed below have been managed to our satisfaction. However, if you perceive a bias during a session, please report the circumstances on the session evaluation form.

Please note we have advised the speakers that it is their responsibility to disclose at the start of their presentation if they will be describing the use of a device, product, or drug that is not FDA approved or the off - label use of an approved device, product, or drug or unapproved usage.

The requirement for disclosure is not intended to imply any impropriety of such relationships, but simply to identify such relationships through full disclosure, and to allow the audience to form its own judgments regarding the presentation.

Disclosure Information

In compliance with ACCME Accreditation Criteria, the American College of Surgeons, as the accredited provider of this activity, must ensure that anyone in a position to control the content of the educational activity has disclosed all relevant financial relationships with any commercial interest. All reported conflicts are managed by a designated official to ensure a bias - free presentation.

PUBLICATION STATEMENT

The material in this abstract, (Name of Abstract), has not been submitted for publication, published, nor presented previously at another national or international meeting and is not under any consideration for presentation at another national or international meeting. The penalty for duplicate presentation/publication is prohibition of the author and co - authors from presenting at a COSM society meeting for a period of three years. Submitting Author's Signature (required)

*****Disclosures - Oral Presentations *****

Authors were instructed to read and sign the following Attestation statement, indicating their understanding of and willingness to comply with each statement below.

1. I will disclose all relevant financial relationships to the AOS. disclose this information to learners verbally (for live activities) and in print.
2. The content and/or presentation of the information with which I am involved will promote quality or improvements in healthcare and will not promote a specific proprietary business interest of a commercial interest. Content for this activity, including any presentation of therapeutic options, will be well - balanced, evidence - based and unbiased.
3. I have not and will not accept any honoraria, additional payments or reimbursements beyond that which has been agreed upon directly with the AOS.
4. If I am presenting at a live event, I am aware that a CME monitor will attend the event to ensure that my presentation is educational, and not promotional, in nature. If presentation is found to be promotional in any way, I understand I will be ineligible to participate in an *AOS/ACS* jointly sponsored CME accredited activity for a period up to two years.
5. If I am providing recommendations involving clinical medicine, they will be based on evidence that is accepted within the profession of medicine as adequate justification for their indications and contraindications in the care of patients. All scientific research referred to, reported or used in CME in support of justification of a patient care recommendation will conform to the generally accepted standards of experimental design, data collection and analysis.
6. If I am discussing specific healthcare products or services, I will use generic names to the extent possible. If I need to use trade names, I will use trade names from several companies when available, not just trade names from any single company.
7. If I am discussing any product use that is off label, I will disclose that the use or indication in question is not currently approved by the FDA for labeling or advertising.
8. If I have been trained or utilized by a commercial entity or its agent as a speaker (e.g., speaker's bureau) for any commercial interest, the promotional aspects of that presentation will not be included in any way with this activity.
9. If I am presenting research funded by a commercial company, the information presented will be based on generally accepted scientific principles and methods, and will not promote the commercial interest of the funding company.

American Otological Society, Inc. Statement

All authors, presenters, panelists, guest lecturers, Council members, Program Advisory Committee members, Administrative staff and any other contributing individuals who may be in a position to control content of a CME activity were required to complete a Disclosure/ Conflict of Interest/Attestation declaration prior to consideration for presentation or appointment to a CME planning Committee. All potential conflicts of interest were resolved prior to participation in the planning of this activity.

Position Statement: Any presentations, conversations, exhibits, or other meeting communications, including descriptions of the use of drugs or devices, does not imply or constitute endorsement of any company, product, application, or use by the American Otological Society.

FACULTY DISCLOSURES
(In alphabetical order)

American Otological Society Council 2012-2013

The following Council Members disclose:

Steven A. Telian, MD
Cochlear Americas - Medical Advisory Board

Debara L. Tucci, MD
Otonomy Inc. - Consultant

The following Council Members have nothing to disclose:

C. Phillip Daspit, MD
John W. House, MD
Herman A. Jenkins, MD
Paul R. Lambert, MD
Samuel H. Selesnick, MD
D. Bradley Welling, MD, PhD

Program Advisory Committee 2013

The following Committee Members disclose:

Douglas D. Backous, MD
Medtronics - Consultant
Cochlear Corporation - Surgical Advisory Board

M. Jennifer Derebery, MD
Epic Hearing Healthcare - Board of Directors, Stockholder
Alcon Laboratories - Speaker Bureau
Sonitus Medical Inc. - Board of Directors, Stockholder, Scientific Advisory Board
SRxA - Advisory Board
Sunovion Inc. - Advisory Board
Teva - Advisory Board, Speakers Bureau
Pfizer - Advisory Board

Colin L. W. Driscoll, MD
Med - El - Consultant, Surgical Advisory Board
Cochlear Corporation - Consultant , Surgical Advisory Board
Advanced Bionics - Consultant , Surgical Advisory Board

Debara L. Tucci, MD - (see above)

Nancy M. Young, MD
Advanced Bionics - Medical Advisory Board
Cochlear Americas - Medical Advisory Board

The following Committee Members have nothing to disclose:

Hilary A. Brodie, MD, PhD
John L. Dornhoffer, MD
Marlan R. Hansen, MD
George T. Hashisaki, MD
Michael J. Ruckenstein, MD
Jeffrey T. Vrabec, MD

AOS Administrative Staff has nothing to disclose:
Kristen Bordignon
Ashley Westbrook

*****Disclosures—Oral Presentations *****
Saturday April 13, 2013, Scientific Session
Oral Presentations: Authors/Presenters
& Panel Participants
(listed in order of presentation)

7:45am - GUEST OF HONOR
The following individual disclose:
Bruce J. Gantz, MD
Anspach Corp - Consultant
Advanced Bionics - Consultant
Cochlear Corp - Consultant

8:10am
The following individuals have nothing to disclose:
Chad W. Whited, MD (Primary)
Sara C. Unrein, AuD
David M. Kaylie, MD
The following individual disclose:
Debara L. Tucci, MD
Otonomy Inc.- Consultant

8:18am
The following individuals have nothing to disclose:
Garani S. Nadaraja, MD (Primary)
Richard K. Gurgel, MD
Kay W. Chang, MD

8:26am
The following individuals have nothing to disclose:
J. Eric Lupo, MD (Primary)
Kanthaiah Koka, PhD
Herman A. Jenkins, MD
Daniel J. Tollin, PhD

8:34am
The following individual disclose:
Anil K. Lalwani, MD (Primary)
Advanced Bionics - Medical Advisory Board
The following individuals have nothing to disclose:
Hirobumi Watanabe, PhD
Jeffrey W. Kysar, PhD

8:48am - BASIC SCIENCE LECTURE
The following individual has nothing to disclose:
Neil Segil, PhD

9:18am
The following individuals have nothing to disclose:
Judith E. C. Lieu, MD, MSPH (Primary)
Roanne K. Karzon, PhD
Banan Ead, MA
Nancy Tye - Murray, PhD

9:26am
The following individuals have nothing to disclose:
Richard K. Gurgel, MD (Primary)
P. Daniel Ward, MD
Sarah Schwartz PhD
Maria C. Norton, PhD
JoAnn T. Tschanz, PhD

*****Disclosures—Oral Presentations*****
Saturday April 13, 2013, Scientific Session

9:34am
The following individuals have nothing to disclose:
Tjeerd Muurling (Primary)
Konstantina M. Stankovic, MD, PhD

10:15am
The following individuals have nothing to disclose:
Joni K. Doherty MD, PhD (Primary)
Céline Richard MD, PhD
Fred H. Linthicum Jr., MD
Jose N. Fayad MD

10:23am
The following individuals have nothing to disclose:
Craig Miller, BS (Primary)
Abraham Jacob, MD (Presenter)
Suzu Igarashi, BS
Allison M. Dunn, BA
Kate A. Woodworth
Maki Niihori, PhD

10:31am
The following individuals have nothing to disclose:
John W. Wood, MD
Esperanza Bas, PhD
Chhavi Gupta, PhD
Yamil Selman, MS
The following individuals disclose:
Thomas Van De Water, PhD
MED-EL- pre-clinical grant
Fred Telischi, MD
MED-EL-Consultant
Cochlear Corp-Consultant
Adrien Eshraghi, MD
MED-EL-Consultant

10:39am
The following individuals have nothing to disclose:
Bing Mei Teh, MBBS (Primary)
Sharon L. Redmond
Ben Allardyce, PhD
Marcus D. Atlas, FRACS
Rangam Rajkhowa, PhD
Robert J. Marano, PhD
Rodney J. Dilley, PhD

10:47am
The following individuals have nothing to disclose:
Paul C. Walker, MD (Primary)
Sarah E. Mowry, MD
Rick F. Nelson, MD, PhD
Marlan R. Hansen, MD
Bruce J. Gantz, MD

11:02am - PANEL
The following individuals have nothing to disclose:
Joseph B. Nadol, Jr., MD
Joni K. Doherty, MD, PhD
Alicia M. Quesnel, MD
Felipe Santos, MD
The following individual disclose:
Peter A. Santi, PhD
Cochlear Americas - P.I.

***Disclosures - Oral Presentations ***
Sunday, April 14, 2013, Scientific Session
Oral Presentations: Authors/Presenters & Panel Participants
(listed in order of presentation)

7:30am
The following individuals have nothing to disclose:
Jack E. Russo, MD (Primary)
Matthew G. Crowson, BA
Edward J. DeAngelo, MD
Clifford J. Belden, MD
James E. Saunders, MD

7:38am
The following individuals have nothing to disclose:
Ameet K. Grewal, MD (Primary)
Han Y. Kim, MD
Richard H. Comstock, III, MD
Ann K. Jay, MD
H. Jeffrey Kim, MD

7:46am
The following individuals have nothing to disclose:
William H. Slattery, MD (Primary)
Adam M. Cassis, MD (Presenter)
Eric P. Wilkinson, MD
Felipe Santos, MD
Karen Berliner, PhD

7:54am
The following individuals have nothing to disclose:
Joseph P. Roche, MD (Primary)
Oliver F. Adunka, MD
Harold C. Pillsbury, MD
Craig A. Buchman, MD

8:02am
The following individuals have nothing to disclose:
Emily M. Luxford, BA (Primary)
Karen I. Berliner, PhD
William M. Luxford, MD

8:18am - BASIC SCIENCE LECTURE
The following individual has nothing to disclose:
Michael J. McKenna, MD

8:48am
The following individuals have nothing to disclose:
Baishakhi Choudhury, MD (Primary)
Omar Awan, BS
J. Maxwell Pike, BA
The following individuals disclose:
Douglas C. Fitzpatrick, PhD
Med El - Research Support
Oliver F. Adunka, MD
Med El - Consultant
Craig A. Buchman, MD
Med - El - Consultant
Advanced Bionics - Consultant
Cochlear Corp - Consultant

8:56am
The following individuals disclose:
David S. Chen, BS
Johns Hopkins - Research Stipend
Danisa M. Clarrett, MS
(MSTAR) - Research Funding
Frank R. Lin, MD, PhD
NIH - Research funding
TRIO/ACS Clinician Scientist Award - Research funding
Cochlear - Consultant
Autifony - Consultant
Pfizer: Consultant
The following individuals have nothing to disclose:
Lingsheng Li, MHS
Steve P. Bowditch, MS
John K. Niparko, MD

9:04am
The following individuals have nothing to disclose:
Peter Luke Santa Maria, MBBS, PhD (Primary)
Chloe Domville - Lewis, MBBS
Marcus D. Atlas, MBBS

9:12am
The following individuals have nothing to disclose:
Stanley Pelosi, MD (Primary)
Jack H. Noble, PhD
Benoit M. Dawant, PhD
The following individuals disclose:
Robert F. Labadie, MD, PhD
Med - El - Advisory Board
Ototronix - Advisory Board
Cochlear - Consultant

9:20am
The following individuals have nothing to disclose:
Theodore R. McRackan, MD (Primary)
Rene H. Gifford, PhD
Robert F. Labadie, MD, PhD
George B. Wanna, MD
David S. Haynes, MD
Marc L. Bennett, MD

*****Disclosures—Oral Presentations*****
Sunday, April 14, 2013, Scientific Session

9:28am
The following individuals disclose:
Adrien A. Eshraghi, MD (Primary)
Med - El Corporation - Consultant, Research Support
Fred F. Telischi MD
Med - El Corporation - Surgical Advisory Board
Cochlear Corporation - Surgical Advisory Board
Thomas J. Balkany MD
Med - El Corporation - Surgical Advisory Board
Advanced Bionics - Surgical Advisory Board
Cochlear Corporation - Consultant
The following individuals have nothing to disclose:
Ronen Nazarian, MD
Annelle Hodges, PhD
Alina Gomez
Lochet Domitille

10:15am
The following individuals have nothing to disclose:
Matthew L. Carlson, MD (Primary)
Kathryn M. Van Abel, MD
Stanley Pelosi, MD
Charles W. Beatty, MD
George B. Wanna, MD
The following individuals disclose:
David S Haynes, MD
Grace - Consultant
Cochlear Americas - Medical Advisory Board
Advanced Bionics - Medical Advisory Board
Anspach - Medical Advisory Board
Colin L W. Driscoll, MD
Cochlear Americas - Consultant
Advanced Bionics - Consultant
Med - El - Consultant

10:23am
The following individuals have nothing to disclose:
Seiji Kakehata, MD (Primary)
Tomoo Watanabe, MD
Tsukasa Ito, MD
Toshinori Kubota, MD
Takatoshi Furukawa, MD

10:31am
The following individual has nothing to disclose:
Michael B. Gluth, MD (Primary)

10:39am
The following individuals have nothing to disclose:
Shin - ichi Kanemaru, MD, PhD (Primary)
Hiroo Umeda, MD, PhD
Rie Kanai, MD
Takuya Tsuji, MD
Fumiko Kuboshima, MD
Misaki Yamamoto, MD

10:47am
The following individual disclose:
Stephen J. Wetmore, MD (Primary)
Guidepoint Global - Advisor
Gyrus Corporation - Royalty
The following individuals have nothing to disclose:
Hope A. Bueller, MD
Jamey L. Cost, MD

11:02am - PANEL
The following individuals disclose:
John P. Carey, MD - Moderator
Otonomy-P.I.
Pfizer-P.I.
Lawrence R. Lustig, MD
Med-El - Surgical Advisory Board
Claus-Peter Richter, MD, PhD
Lockheed Martin Aculight-P.I.
The following individual has nothing to disclose:
Albert Edge, PhD

Disclosures - Poster Presentations
(in numerical order 2-069 thru 2-090)

Identification of COCH gene mutation in exon 5 of the LCCL Domain in Archived DFNA9 Temporal Bone
The following individuals have nothing to disclose:
Joni K. Doherty, MD, PhD (Primary)
Jamie Treadway
Jose N. Fayad, MD
Robert Gellibolian, PhD
Fred H. Linthicum, Jr., MD

Social Media Effectively Increased the Awareness of Cochlear Implants as a Treatment for Severe to Profound Hearing Loss
The following individuals disclose:
Douglas D. Backous, MD (Primary)
Cochlear Corporation - Surgical Advisory Board
Medtronics Neurotechnologies - Consultant
The following individual has nothing to disclose:
Dana Lewis

Timing Discrepancies of Early Intervention Hearing Services in Urban and Rural Cochlear Implant Recipients
The following individuals have nothing to disclose:
Matthew L. Bush, MD (Primary)
Mary Burton, AuD
Ashley Loan
Jennifer B. Shinn, PhD

Contemporary Surgical Management of Cholesteatoma in the Only Hearing Ear
The following individuals have nothing to disclose:
Matthew L. Carlson, MD (Primary)
Richard F. Latuska Jr, BS
Alejandro Rivas, MD
Marc L. Bennett, MD
George B. Wanna, MD
The following individuals disclose:
Michael E. Glasscock, III, MD **(see page 13)**
David S. Haynes, MD **(see page 11)**

Disclosures—Poster Presentations

Melanin - An Inflammatory Marker in Chronic Middle Ear Disease?
The following individuals have nothing to disclose:
Mark A. Fritz, MD (Primary)
Pamela C. Roehm, MD, PhD
Michael A. Bannan, MD
The following individuals disclose:
Anil K. Lalwani, MD
Advanced Bionics - Medical Advisory Board

Management of Endolymphatic Sac Tumor: Sporadic Cases and Von Hippel - Lindau Disease
The following individuals have nothing to disclose:
Jerome Nevoux, MD
Catherine Nowak, MD
Christine Lepajolec, MD
Olivier Sterkers, MD, PhD
Stéphane Richard, MD, PhD
Serge Bobin, MD

Auditory and Vestibular Phenotypes Associated with GATA3 Mutation
The following individuals have nothing to disclose:
Wade Chien, MD (Primary)
Jennifer W. Leiding, MD
Amy P. Hsu, BA
Chris Zalewski, MA
Kelly King, AuD, PhD
Steven M. Holland, MD
Carmen Brewer, PhD

High-resolution CT Scan in Superior Canal Dehiscence Diagnosis: a Correlation Between Coronal and Multiplanar Reformatted Images
The following individuals have nothing to disclose:
Lina Zahra Benamira (Primary)
Musaed Alzahrani MD
Manon Bélair MD
Issam Saliba MD

Reversible Cochlear Function with ANCA - associated Vasculitis Initially Diagnosed by Otologic Symptoms
The following individuals have nothing to disclose:
Naohiro Yoshida, MD, PhD (Primary)
Mariko Hara, MD
Masayo Hasegawa, MD
Akihiro Shinnabe, MD
Hiromi Kanazawa, MD
Yukiko Iino, MD, PhD

Advantages and Feasibility of Transcanal Endoscopic Myringoplasty
The following individuals have nothing to disclose:
Takatoshi Furukawa, MD (Primary)
Tomoo Watanagbe, MD
Tsukasa Ito, MD
Toshinori Kubota, MD
Seiji Kakehata, MD

Disclosures—Poster Presentations

Complicated Otitis Media - a Modern Reappraisal
The following individuals have nothing to disclose:
William R. Schmitt, MD (Primary)

Irradiated Rib Cartilage Tympanoplasty - Does it Last?
The following individual has nothing to disclose:
William R. Schmitt, MD (Primary)

Traumatic Superior Semicircular Canal Dehiscence: Case Series and Review of the Literature
The following individuals have nothing to disclose:
Sameer Ahmed, MD (Primary)
Isaac Yang, MD
Quinton Gopen, MD

Beta-actin Upregulated in Sporadic Vestibular Schwannomas
The following individuals have nothing to disclose:
Sonam Dilwali, BS (Primary)
Martijn Briet, BS
Konstantina Stankovic, MD, PhD

Where Do Middle Ear Implants Fit in the Rehabilitation of Patients With Sensorineural Hearing Loss?
The following individuals disclose:
Michael E. Glasscock, III, MD (Primary)
Otomed - Stock, Salary, Chairman of Board of Directors
Envoy Medical - Chairman of MAB, Stock, Salary
Ototronix - Chairman of MAB, Stock, Salary
The following individual has nothing to disclose:
Matthew L. Carlson, MD

Intraoperative Measurement of Skull Bone Vibration during Mastoidectomy Using an Ultrasonic Bone Curette
The following individuals have nothing to disclose:
Tsukasa Ito, MD, PhD (Primary)
Hideyuki Mochizuki
Tomoo Watanabe, MD, PhD
Toshinori Kubota, MD, PhD
Takatoshi Furukawa, MD, PhD
Takuji Koike, PhD
Seiji Kakehata, MD, PhD

Microbial Flora of Cochlear Implants by Gene Pyrosequencing
The following individuals disclose:
Patrick J. Antonelli, MD (Primary)
Medtronic - Grant Support
Alcon Laboratories - Grant Support
Auris Medical - Grant Support
Sound Pharmaceutical - Grant Support
Medtronic - Consulting Fees
Otonomy - Consulting Fees
Med El - Consulting Fees
Foresight Biotherapeutics - Consulting Fees
Sharklet Technologies - Consulting Fees
The following individuals have nothing to disclose:
Carolyn P. Ojano - Dirain, PhD
Scot E. Dowd, PhD

EAR MAPS a New Classification for Congenital Microtia/Atresia Based on the Evaluation of 742 patients
The following individuals disclose:
Joseph B. Roberson, Jr., MD (Primary)
Consulting, Advisory Relationships, Equity and/or Ownership interests in the following were disclosed:
Acclarent; Autonomic Technologies Inc; Vigilo Networks; Lumenis; Kurz Dusslingen; The Doctor's Company; Inspire; Neuropace; Global Hearing
Hernan Goldsztein, MD (presenter)
Acclarent Inc. - Consulting Fees
The following individuals have nothing to disclose:
Ashley Balaker, MD
John F. Reinisch, MD

Histological Study of Cochleostomy and Titanium Microactuator Implanted in Lateral Wall of Cat Scala Tympani
The following individuals disclose:
S. George Lesinski, MD (Primary)
OtoKinetics, Inc. - Co - founder, Board, Co - inventor, Stocks, Salary
Gregory L. Koskowich, PhD
OtoKinetics, Inc. - VP of R&D, Salary
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Matthew A. Buccellato, DVM, PhD
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Improved Sound Localization Following Cochlear Implantation
The following individuals have nothing to disclose:
Jessica J. Kepchar, DO (Primary)
Arnaldo Rivera, MD (Presenter)
Joshua G.W. Berstein, PhD

Access to Cadaveric Temporal Bone Dissection Improves Resident Performance on a Standardized Skill Assessment Instrument
The following individuals have nothing to disclose:
Sarah E. Mowry, MD (Primary)
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Reevaluation of Eustachian Tube Function and Habitual Sniffing in Middle Ear Cholesteatoma
The following individuals have nothing to disclose:
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THE AMERICAN OTOLOGICAL SOCIETY WOULD LIKE TO THANK THE FOLLOWING MEMBERS FOR THEIR CONTRIBUTION TO THE 2013 AOS SCIENTIFIC PROGRAM

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Combined Poster Reception
ANS/AOS/TRIO/ARS/AAFPRS
Friday, April 12, 2013
5:30 pm - 7:00 pm
Coquina Ballroom

AOS President's Reception & Banquet
Saturday, April 13, 2013

Reception - 6:30 pm
Mediterranean Ballroom 6

Dinner/Dance - 7:30 pm
Mediterranean Ballroom 7

Formal attire/Black tie optional
{Advanced ticket purchase required
Members & Invited Guests only}

Upcoming meetings

147th AOS Annual Spring Meeting
in conjunction with COSM
May 14-18, 2014
Caesar's Palace
Las Vegas, NV

AAO-HNSF 2013 Annual Meeting & OTO EXPO
September 29 - October 2, 2013
Vancouver Convention Centre
Vancouver, BC

Abstract Deadline: Tuesday, October 15, 2013
Abstract Instructions and submission form will be available on website after July 1, 2013.
Website - www.americanotologicalsociety.org
All primary and contributing authors are required to sign a disclosure/conflict of interest document at time of abstract submission in order for the abstract to be considered by the Program Advisory Committee

Journal Requirements/Instructions to Authors/Presenters
Manuscripts are required of oral & poster submissions. Manuscripts must be submitted online **a minimum of four weeks** prior to the annual meeting, via the journal's web-site. Instructions for registering, submitting a manuscript, and the author guidelines can be found on the Editorial Manager site:
https://www.editorialmanager.com/on/
The journal of ***OTOLOGY & NEUROTOLOGY*** does not accept paper manuscripts. Manuscripts will be peer reviewed prior to the Annual Meeting for conflict of interest review and resolution.
Failure to comply with the guidelines & requirements of the American Otological Society and the O&N Journal will result in the disqualification of your presentation.

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Saturday, April 13, 2013

7:00 **Business Meeting** (*Members Only*)
Room: *Mediterranean Ballroom 1-3*
Committee Reports {Saturday & Sunday}
GROUP PHOTOGRAPH (*AOS Members only*)

7:30 **Scientific Program** (*Open to Registered AOS Members and Registered Non-Members Badge required for admittance*)
Room: *Mediterranean Ballroom 1-3*

7:30 **Opening Remarks by the President**
Paul R. Lambert, MD

Presidential Citations
George T. Hashisaki, MD
William M. Luxford, MD
Richard A. Chole, MD, PhD
Harold C. Pillsbury, MD
Judy R. Dubno, PhD

7:45 **GUEST OF HONOR LECTURE**
Acoustic + Electric Speech Processing: What Have We Learned about the Auditory System
Bruce J. Gantz, MD

8:05 **DISCUSSION**

ACTIVE MIDDLE EAR IMPLANTS/BAHA

8:10 **Evaluation of Preoperative Hearing-in-Noise Protocol for Osseointegrated Hearing (Baha) Implants**
Chad W. Whited, MD
Sara C. Unrein, AuD
Debara L. Tucci, MD
David M. Kaylie, MD

8:18 **Hearing Outcomes of Atresia Surgery versus Bone-Anchored Hearing Aid in Patients with Congenital Aural Atresia: A Systematic Review**
Garani S. Nadaraja, MD
Richard K. Gurgel, MD
Kay W. Chang, MD

8:26 **Vibromechanical Assessment of Active Middle Ear Implant Stimulation in Simulated Middle Ear Effusion: A Temporal Bone Study**
J. Eric Lupo, MD
Kanthaiah Koka, PhD
Herman A. Jenkins, MD
Daniel J. Tollin, PhD

8:34 **Implication of Microanatomy and Mechanical Properties of the Round Window Membrane for Designing Transducer for Mechanical Stimulation**
Anil K. Lalwani, MD
Hirobumi Watanabe, PhD
Jeffrey W. Kysar, PhD

8:42 **DISCUSSION**

8:48 **BASIC SCIENCE LECTURE**
Can We Restore Lost Hearing? Molecular Control of Cell Fate and Cell Division in the Development and Regeneration of the Inner Ear
Neil Segil, PhD

9:13 **DISCUSSION**

HEARING LOSS

9:18 **Do Audiologic Characteristics Predict Outcomes in Children with Unilateral Hearing Loss?**
Judith E. C. Lieu, MD, MSPH
Roanne K. Karzon, PhD
Banan Ead, MA
Nancy Tye-Murray, PhD

9:26 **Relationship of Hearing loss and Dementia: a Prospective, Population-based Study**
Richard K. Gurgel, MD
P. Daniel Ward, MD
Sarah Schwartz PhD
Maria C. Norton, PhD
JoAnn T. Tschanz, PhD

9:34 **Metabolomic Analysis of Pharmacotherapies for Sensorineural Hearing Loss**
Tjeerd Muurling
Konstantina M. Stankovic, MD, PhD

9:42 **DISCUSSION**

9:45 **BREAK WITH EXHIBITORS**

BASIC SCIENCE/CLINICAL TRIALS

10:15 **Identification of Target Proteins Involved in Cochlear Otosclerosis**
Joni K. Doherty MD, PhD
Céline Richard MD, PhD
Fred H. Linthicum Jr., MD
Jose N. Fayad MD

10:23 **Inhibiting p21-Activated Kinase as Treatment for Vestibular Schwannomas and Meningiomas**
Craig Miller, BS
Suzu Igarashi, BS
Allison M. Dunn, BA
Kate A. Woodworth
Maki Niihori, PhD
Abraham Jacob, MD

10:31 **Mannitol Protects Hair Cells Against Gentamicin-Induced Losses In Vitro**
John W. Wood, MD
Esperanza Bas, PhD
Chhavi Gupta, PhD
Yamil Selman, MS
Adrien Eshraghi, MD
Fred F. Telischi, MEE, MD
Thomas R. Van De Water, PhD

10:39 **Bio-engineered Tympanic Membrane using Silk Fibroin: an In Vitro Study**
Bing Mei Teh, MBBS
Sharon L. Redmond
Ben Allardyce, PhD
Marcus D. Atlas, FRACS
Rangam Rajkhowa, PhD
Robert J. Marano, PhD
Rodney J. Dilley, PhD

10:47 **Long Term Results of Canal Wall Reconstruction Tympanomastoidectomy**
Paul C. Walker, MD
Sarah E. Mowry, MD
Rick F. Nelson, MD, PhD
Marlan R. Hansen, MD
Bruce J. Gantz, MD

10:55 **DISCUSSION**

11:02 **PANEL – Contemporary Relevance of Human Temporal Bone Histopathology**
Joseph B. Nadol, Jr., MD - Moderator

Deafness Genes and Genotype-Phenotype Correlations
Joni K. Doherty, MD, PhD

Thin Sheet Laser Imaging of Whole Cars for 3.D Reconstruction of the Structures
Peter A. Santi, PhD

New Clinical Insights in Otosclerosis from the Study of Human Temporal Bone Histopathology
Alicia M. Quesnel, MD

Otopathology of Osteogenesis Imperfecta
Felipe Santos, MD

12:00 **ADJOURNMENT**

6:30 **AOS President's Reception**
(*Members and Invited Guests Only - formal attire black tie optional*)
Room: *Mediterranean Ballroom 6*

7:30 **AOS President's Banquet & Dance**
Room: *Mediterranean Ballroom 7*

Sunday, April 14, 2013

7:00 **Business Meeting** (*Members Only*)
Room: *Mediterranean Ballroom 1-3*
Committee Reports {Saturday & Sunday}
Board of Trustees of the Research Fund
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AAO - HNS
AAO - HNS Board of Governors
Audit Committee
AOS Education Committee
Membership Development Committee
Nominating Committee
Unfinished Business
New Business

7:30 **Scientific Program** (*Open to Registered AOS Members and Registered Non-Members – Badge required for admittance*)
Room: *Mediterranean Ballroom 1-3*

7:30 **Posterior Semicircular Canal Dehiscence: CT Prevalence and Clinical Symptoms**
Jack E. Russo, MD
Matthew G. Crowson, BA
Edward J. DeAngelo, MD
Clifford J. Belden, MD
James E. Saunders, MD

7:38 **Clinical Features of Patients with Pulsatile Tinnitus and Sigmoid Sinus Diverticulum/ Dehiscence**
Ameet K. Grewal, MD
Han Y. Kim, MD
Richard H. Comstock, III, MD
Ann K. Jay, MD
H. Jeffrey Kim, MD

7:46 **Side-to-End Hypoglossal to Facial Anastomosis with Transposition of the Intratemporal Facial Nerve**
William H. Slattery, MD
Adam M. Cassis, MD (presenter)
Eric P. Wilkinson, MD
Felipe Santos, MD
Karen Berliner, PhD

7:54 **Cost Of Cholesteatoma Care At A Tertiary Medical Center**
Joseph P. Roche, MD
Oliver F. Adunka, MD
Harold C. Pillsbury, MD
Craig A. Buchman, MD

8:02 **Dietary Modification as Adjunct Treatment in Ménière's Disease: Patient Willingness and Ability to Comply**
Emily M. Luxford, BA
Karen I. Berliner, PhD
William M. Luxford, MD

8:10 **DISCUSSION**

8:18 **BASIC SCIENCE LECTURE**
Progress Understanding the Etiology of Otosclerosis and Implications for Future Treatment
Michael J. McKenna, MD

8:43 **DISCUSSION**

COCHLEAR IMPLANTS

8:48 **Physiologic Consequences of Flexible Electrode Insertion into a Gerbil Model of Cochlear Implantation Featuring Noise Induced Sensorineural Hearing Loss**
Baishakhi Choudhury, MD
Omar Awan, BS
J. Maxwell Pike, BA
Craig A. Buchman, MD
Douglas C. Fitzpatrick, PhD
Oliver F. Adunka, MD

8:56 **Cochlear Implantation in Older Adults: Long-term Analysis of Complications and Device Survival in a Consecutive Series**
David S. Chen, BS
Danisa M. Clarrett, MS
Lingsheng Li, MHS
Steve P. Bowditch, MS
John K. Niparko, MD
Frank R. Lin, MD, PhD

9:04 **The Medium Term Results of Hearing Preservation Surgery for Cochlear Implantation**
Peter Luke Santa Maria, MBBS, PhD
Chloe Domville-Lewis, MBBS
Marcus D. Atlas, MBBS

9:12 **Analysis of Inter-Subject Variations in Promontory and Intracochlear Anatomy for Cochlear Implantation**
Stanley Pelosi, MD
Jack H. Noble, PhD
Benoit M. Dawant, PhD
Robert F. Labadie, MD, PhD

9:20 **Cochlear Implantation in Meniere's Disease Patients**
Theodore R. McRackan, MD
Rene H. Gifford, PhD
Robert F. Labadie, MD, PhD
George B. Wanna, MD
David S. Haynes, MD
Marc L. Bennett, MD

9:28 **Cochlear Implantation in Patients with Autism Spectrum Disorder**
Adrien A. Eshraghi, MD
Ronen Nazarian, MD
Fred F. Telischi, MD
Thomas J. Balkany, MD
Annelle Hodges, PhD
Alina Gomez
Lochet Domitille

9:36 **DISCUSSION**

9:45 **INTERMISSION**

OTOSCLEROSIS/CHRONIC EAR DISEASE

10:15 **Outcomes Following Stapedectomy for Congenital Stapes Footplate Fixation and Juvenile Otosclerosis**
Matthew L. Carlson, MD
Kathryn M. Van Abel, MD
Stanley Pelosi, MD
Charles W. Beatty, MD
David S. Haynes, MD
George B. Wanna, MD
Colin L.W. Driscoll, MD

10:23 **Extension of Indications for Transcanal Endoscopic Ear Surgery using an Ultrasonic Bone Curette**
Seiji Kakehata, MD
Tomoo Watanabe, MD
Tsukasa Ito, MD
Toshinori Kubota, MD
Takatoshi Furukawa, MD

10:31 **Vascularized Reconstruction of Partial External Auditory Canal Wall Defects**
Michael B. Gluth, MD

10:39 **Regenerative Treatment for the Soft Tissue Defect of External Auditory Meatus**
Shin-ichi Kanemaru, MD, PhD
Hiroo Umeda, MD, PhD
Rie Kanai, MD
Takuya Tsuji, MD
Fumiko Kuboshima, MD
Misaki Yamamoto, MD

10:47 **Split Thickness Skin Grafting in Canal Wall Down Tympanomastoidectomy**
Stephen J. Wetmore, MD, MBA
Hope A. Bueller, MD
Jamey L. Cost, MD

10:55 **DISCUSSION**

11:02 **PANEL – Innovations and New Technologies**
John P. Carey, MD - Moderator

Laser Stimulation of Cochlear Neurons
Claus-Peter Richter, MD, PhD

Gene Therapy for the Inner Ear
Lawrence R. Lustig, MD

Stem Cells and Inner Ear Regeneration
Albert Edge, PhD

12:00 **INTRODUCTION OF INCOMING AOS PRESIDENT** – *John W. House, MD*

12:05 **ADJOURNMENT**

8:10 am

Evaluation of Preoperative Hearing-in-Noise Protocol for Osseointegrated Hearing (Baha) Implants

Chad W. Whited, MD; Sara C. Unrein, AuD
Debara L. Tucci, MD; David M. Kaylie, MD

Objective: Evaluate the clinical utility of a preoperative protocol using hearing-in-noise improvement as measured by Adaptive HINT and Quick SIN in patients undergoing ossseointegrated hearing (Baha) implantation for single sided deafness (SSD).

Study Design: Prospective cohort

Setting: Tertiary academic hospital and clinic

Patients: All consecutive English-speaking patients with SSD undergoing Baha implantation whom we have preoperative and postoperative Quick SIN and Adaptive HINT measurements.

Interventions: Measure preoperative unaided and aided (Baha Intenso headband stimulator) hearing-in-noise ratio improvement and compare to postoperative results.

Main Outcome Measures: The improvement in hearing-in-noise in preoperative unaided to aided, and then correlate to postoperative hearing-in-noise results.

Results: Total of 10 patients participated in the study. There was a statistically significant improvement from preoperative unaided Quick SIN and Adaptive HINT scores to preoperative aided scores (-5.02dB p=.001; -2.32dB p=.002). There was statistically significant improvement from preoperative unaided Quick SIN and Adaptive HINT to postoperative Baha scores (-5.68dB p=.004; -4.78dB p=.002). There was no statistically significant difference between preoperative aided Quick SIN and Adaptive HINT and postoperative measurements.

Conclusions: This is the first study evaluating a preoperative protocol utilizing both Quick SIN and Adaptive HINT testing for Baha implants. After implantation, there was a statistically significant improvement in both of the hearing-in-noise measures. There was significant correlation between the preoperative stimulator and postoperative Baha hearing-in-noise measures signifying the benefit of using either Quick SIN or Adaptive HINT as a predictive preoperative tool to evaluate surgical candidacy and improve patient education and expectations.

Define Professional Practice Gap and Educational Need: There is no currently accepted testing protocol to assess potential benefit of performance with the Baha implant. We suggest a protocol and give preliminary results, comparing pre and post implant assessment.

Learning Objective: To appreciate the need for better preoperative objective testing for osseointegrated hearing implant candidacy. To appreciate that hearing-in-noise testing may be a reliable preoperative tool for assessment and improved patient education and expectations.

Desired Result: Physicians will appreciate the need and clinical value in preoperative hearing-in-noise testing protocol for osseointegrated hearing implantation.

Received IRB approval

8:18 am

Hearing Outcomes of Atresia Surgery versus Bone-Anchored Hearing Aid in Patients with Congenital Aural Atresia: A Systematic Review

Garani S. Nadaraja, MD; Richard K. Gurgel, MD
Kay W. Chang, MD

Objective: To perform a systematic review, comparing the hearing outcomes of atresia surgery versus bone-anchored hearing aid (BAHA) in congenital aural atresia (CAA) patients.

Data Sources: Eighty-one English articles, published from 1975-2012, that evaluate hearing outcomes after reconstructive surgery and/or BAHA in CAA patients were identified through a PubMed search.

Study Selection: Papers that evaluated external auditory canal stenosis alone, did not report speech reception threshold (SRT), pure tone average (PTA), hearing gain or air-bone gap (ABG), or had less than 5 patients were excluded. For authors or institutions with multiple reports, the largest or most recent study was included for review. 41 of the 81 articles satisfied our inclusion and exclusion criteria.

Data Extraction: The number and percentage of ears with a postoperative SRT, PTA, ABG less than 30dB and/or average hearing gain were extracted. The total number of ears and the timing of the postoperative audiogram were also noted.

Data Synthesis: Of the ears that received atresia surgery, 71% had a SRT less than 30dB (239/338 ears), 60% had a PTA < 30dB (193/320 ears), 67% had a ABG <30dB (446/665 ears). The average hearing gain was 22dB (775 ears evaluated, Standard Deviation (SD) 6.8). Hearing outcomes deteriorated with time. Of BAHA patients, 96% had a PTA <30dB (74/77 ears), 100% had an ABG <30dB (47/47 ears) and the average hearing gain was 38dB (100 ears evaluated, SD 5.1).

Conclusion: The bone-anchored hearing aid has better hearing outcomes compared to atresiaplasty in patients with congenital aural atresia.

Define Professional Practice Gap and Educational Need: To date there is no systematic study that compares the hearing outcomes of atresia surgery to the bone-anchored hearing aid in patients with congenital aural atresia.

Learning Objective: The objective is to provide a systematic review of the literature that will contribute to the hearing rehabilitation decision process for congenital aural atresia patients.

Desired Result: The provider will learn the overall hearing outcomes in the literature for each procedure. He/she will thus be able to utilize this knowledge to optimally counsel the congenital aural atresia patients with regards to hearing rehabilitation.

Received IRB Exemption

8:26 am
Resident Research Travel Award

Vibromechanical Assessment of Active Middle Ear Implant Stimulation in Simulated Middle Ear Effusion: A Temporal Bone Study

J. Eric Lupo MD; Kanthaiah Koka, PhD
Herman A. Jenkins, MD; Daniel J. Tollin, PhD

Hypothesis: Active middle ear implant (AMEI) generated vibromechanical stimulation of the ossicular chain (ossicular chain vibroplasty, OCV) or the round window (round window vibroplasty, RWV) is not significantly affected by simulated middle ear effusion in a human temporal bone model.

Background: OCV and RWV may be employed for sensorineural, mixed and conductive hearing losses. Although middle ear effusions may be encountered across patient populations, little is known about how effusions may affect AMEI vibromechanical efficiency.

Methods: Laser Doppler vibrometry of stapes velocities (SV) were performed in a human temporal bone model of simulated effusion (N=5). Baseline measurements to acoustic sinusoidal stimuli, OCV and RWV (0.25-8kHz) were made without effusion. The measurements were repeated with simulated middle ear effusion and compared to baseline measurements. Data were analyzed across three frequency bands: low (0.25-1 kHz), medium (1-3 kHz), high (3-8 kHz).

Results: Acoustic stimulation with simulated middle ear effusion resulted in a significant ($p<0.001$) frequency-dependent attenuation of SVs of 4, 10, 7 dB (low, medium and high ranges, respectively). OCV in simulated effusion resulted in attenuated SVs of 1, 5, and 14 dB (low, medium, high) compared to without effusion, however this attenuation was not significant ($p=0.07$). Interestingly, in the setting of RWV, simulated effusion resulted in significantly ($p=0.001$) increased SVs of 16, 11, and 8 dB (low, medium, high). A 3 dB variance in AMEI efficiency was observed in repeated measurements in a single temporal bone.

Conclusions: The efficiency of OCV was not significantly affected by the presence of a middle ear effusion. Improved efficiency, however, was observed with RWV.

Define Professional Practice Gap and Educational Need: Round window stimulation with an active middle ear implant is a technique utilized for conductive and mixed hearing losses however understanding of implant performance in pathological conditions is limited.

Learning Objective: The attendee will understand how the performance of round window vibroplasty may be affected by middle ear effusion.

Desired Result: Attendees will be able to address questions surrounding how active middle ear implants applied to the round window may perform in the setting of middle ear effusion.

IRB Approval-Exempt

8:34am

Implication of Microanatomy and Mechanical Properties of the Round Window Membrane for Designing Transducer for Mechanical Stimulation

Anil K. Lalwani, MD; Hirobumi Watanabe, PhD
Jeffrey W. Kysar, PhD

Hypothesis: Microanatomy and mechanical properties of round window membrane (RWM) have important implication for transducer design.

Background: Mechanical stimulation of RWM is exciting new frontier in auditory amplification. However, the current strategy of using commercially available transducers originally designed for other uses is fraught with danger as it may have negative consequences for RWM. We investigate the micromechanical properties of the RWM using state of the art technology to determine the ideal driver for RWM.

Methods: Topography and mechanical properties of the Guinea pig RWM were studied using microCT, full-field optical interferometry, and nanoindenter. The 3-dimensional structure, stiffness/compliance, and energy and force required to perforate the RWM with two different micro-needles were determined.

Results: RWM has the shape of Pringle potato chip with the top down shape approximating an ellipse with minor/major axis radius of 0.45mm and 1.15mm, respectively. The 3D structure of the RWM can be approximated as a torus with curvature of 0.45mm in minor axis and 1.76mm in major axis. A 0.4μm and 20μm diameter tungsten needle perforated the RWM at 7mN and 25mN following displacement of 75μm and 200μm, respectively; the RWM had stored elastic energy of 0.3 and 3μJ at time of perforation with the small and large needle.

Conclusion: Our results suggest that the ideal radius of curvature of the transducer tip should be >0.450mm to closely conform to RWM topology. Additionally, maximal displacement and peak energy imparted by the driver to the RWM should be well below that necessary to induce perforation.

Define Professional Practice Gap and Educational Need: There is lack of contemporary knowledge regarding the micromechanical properties of the round window membrane (RWM) using state of the art technology and its implication for designing driver for the RWM.

Learning Objective: To learn the microanatomy and mechanical properties of round window membrane and its implication for transducer design.

Desired Result: The attendees will evaluate the appropriateness of the currently available round window transducers for mechanical stimulation of the round window membrane.

Received IRB approval

9:18 am

Do Audiologic Characteristics Predict Outcomes in Children with Unilateral Hearing Loss?

Judith E. C. Lieu, MD, MSPH; Roanne K. Karzon, PhD
Banan Ead, MA; Nancy Tye-Murray, PhD

Objective: To determine whether audiologic characteristics of unilateral hearing loss in children were associated with language, cognitive or achievement scores.
Study design: Case-control study
Setting: Pediatric otolaryngology ambulatory practice
Patients: Cases (n=109) were children aged 6-12 years with permanent unilateral hearing loss; controls (n=95) were siblings with normal bilateral hearing.

Interventions: Audiologic characteristics measured included side and severity of hearing loss, and word recognition scores in quiet and in noise.

Main outcome measures: Cognitive abilities were measured using the Wechsler Abbreviated Scale of Intelligence; reading, math and writing achievement was measured with the Wechsler Individual Achievement Test-Second Edition-Abbreviated; and oral language skills were measured with the Oral Written and Language Scales.

Results: Children with unilateral hearing loss had worse verbal cognitive and oral language scores than children with normal hearing but no differences in achievement scores. Children with profound unilateral hearing loss tended to have worse cognitive scores and had significantly lower oral language scores. Higher word recognition scores in quiet for the normal-hearing ear were associated with higher cognitive, oral language, and reading achievement scores. Higher word recognition scores in noise were slightly correlated with higher oral language scores.

Conclusions: As expected, children with unilateral hearing loss had worse cognitive and language scores than their siblings with normal hearing. Children with profound unilateral hearing loss tended to have worse outcomes than children with normal hearing or less severe unilateral loss. However, there were no differences in outcomes between children with right or left unilateral hearing loss.

Define Professional Practice Gap and Educational Need: Unilateral hearing loss adversely affects speech and language development in children, and subsequently affects school performance. Whether audiologic characteristics specifically affect educationally-important outcomes is not known. Therefore, whether intervening on audiologic characteristics is justified has not yet been determined.

Learning Objective: To learn whether the audiologic characteristics of side and severity of hearing loss or word recognition scores, affect educationally-significant outcomes in children.

Desired Result: Physicians are aware of the adverse consequences of unilateral hearing loss in children, and recommend interventions that could ameliorate these consequences.

Received IRB Approval

9:26 am

Relationship of Hearing loss and Dementia: a Prospective, Population-based Study

Richard K. Gurgel, MD; P. Daniel Ward, MD
Sarah Schwartz PhD; Maria C. Norton, PhD
JoAnn T. Tschanz, PhD

Objective: The goal of this investigation was to determine whether baseline hearing loss increases cognitive decline and risk for all-cause dementia in a population of elderly individuals.

Study design: Prospective, case-control cohort

Setting: Community-based study

Patients: Men and women aged 65 years or older without dementia at baseline

Intervention(s): All subjects completed the Modified Mini-Mental Status Exam (3MS) over 4 triennial waves. Hearing loss (HL) at baseline was based on observation of hearing difficulties or use of hearing aides. Incident dementia was determined by clinical assessment and expert consensus.

Main outcome measure(s): Dementia and 3MS scoring.

Results: At baseline 4,463 subjects were without dementia, 700 of whom had HL. Of those with HL, 16.3% developed dementia, compared to 12.1% of those without HL ($p<0.001$). Mean time to dementia was 10.3 years in the HL group vs. 11.9 years for non-HL ($p<0.0001$). In Cox regression analyses controlling for gender, presence of APOE-e4 allele, education, and baseline age, HL was an independent predictor of developing dementia (Hazard ratio = 1.30, $p<0.0001$). Linear mixed models controlling for age, gender, education and presence of APOE-e4 allele, showed HL was associated with faster decline on the 3MS, at a rate of 0.26 points/ year worse than those without HL.

Conclusions: Subjects age 65 or older with HL have an increased rate of developing dementia and more rapid decline on 3MS scoring than their non-hearing impaired counterparts. These findings suggest that hearing impairment may be a marker for central, cognitive dysfunction in adults age 65 and older.

Define Professional Practice Gap and Educational Need: Lack of awareness of the significance of hearing loss on developing dementia and cognitive decline in adults age 65 and older.

Learning Objective: After this presentation, learners will have a greater understanding of the impact of hearing on developing dementia and cognitive decline in adults age 65 and older.

Desired Result: Attendees will be aware that the patients they see age 65 and older with hearing loss will be at greater risk for developing dementia than those patients without hearing loss. This knowledge can be helpful in patient and family counseling.

Received IRB approval

9:34 am

Metabolomic Analysis of Pharmacotherapies for Sensorineural Hearing Loss

Tjeerd Muurling; Konstantina M. Stankovic, MD, PhD

Hypothesis: Different pharmacotherapies for sensorineural hearing loss (SNHL) are interconnected in metabolic networks with molecular hubs.

Background: Sensorineural hearing loss is the most common sensory deficit worldwide. Dozens of drugs have shown efficacy against SNHL in animal studies, and a few in human studies. Analyzing metabolic pathways that interconnect these drugs will point to and prioritize development of new pharmacotherapies for human SNHL.

Methods: Drugs that have shown efficacy in treating mammalian SNHL were identified through PubMed literature searches. The drugs were analyzed using the metabolomics analysis, and the 'grow-tool function' in Ingenuity Pathway Analysis (IPA). The top 3 most interconnected molecules and drugs (central nodes) within the generated networks were considered important targets for treatment of SNHL.

Results: A total of 70 drugs were investigated with IPA. The metabolomics analysis revealed two statistically significant networks (network 1 and 2). A pathway analysis, using the 'grow-tool function', generated one statistically significant network (network 3). Central nodes of these networks were: P38 mitogen-activated protein kinases (P38 MAPK), p42/p44 MAP Kinase (ERK1/2) and Glutathione for network 1; Protein Kinase B (Akt), Nuclear Factor Kappa B (NFkB) and ERK for network 2; and Dexamethasone, Tretinoin and Cyclosporin A for network 3.
Conclusions: Metabolomic analysis of the existing pharmacotherapies for SNHL has pointed to and prioritized a number of potential novel targets for treatment of SNHL.

Define Professional Practice Gap and Educational Need: Successful pharmacotherapies for human sensorineural hearing loss

Learning Objective: To learn about the existing pharmacotherapies for mammalian sensorineural hearing loss, and to discover potential new targets for this ailment through metabolomic analysis

Desired Result: Novel molecular targets for human sensorineural hearing loss will be identified, which will pave the way for new pharmacotherapies for this most common sensory deficit worldwide.

Received IRB Exemption

10:15 am

Identification of Target Proteins Involved in Cochlear Otosclerosis

Joni K. Doherty MD, PhD; Céline Richard MD, PhD
Fred H. Linthicum Jr. MD; Jose N. Fayad MD

Hypothesis: Investigation of differential protein expression will provide clues to pathophysiology in otoslerosis.

Background: Otosclerosis, is a bone remodeling disorder limited to the endochondral layer of the otic capsule within the temporal bone. Some authors have suggested an inflammatory etiology for otosclerosis due to persistent measles virus infection involving the otic capsule. Despite numerous genetic studies, implication of candidate genes in the otosclerotic process remains elusive. We employed liquid chromatography-mass spectrometry (LC-MS) analysis on formalin fixed celloidin-embedded temporal bone tissues for post-mortem investigation of otosclerosis.

Methods: Proteomic analysis was performed using human temporal bones from a patient with severe otosclerosis and a control temporal bone. Sections were dissected under microscopy to remove otosclerotic lesions and normal otic capsule for proteomic analysis. Tandem 2D chromatography mass spectrometry was employed. Data analysis and peptide matching to FASTA human databases was done using SEQUEST and proteome discoverer software.

Results: TGFβ1 was identified in otosclerosis but not in the normal control temporal bone specimen. Aside from TGFβ1, many proteins and predicted cDNA-encoded proteins were observed, with implications in cell death and/or proliferation pathways, suggesting a possible role in otosclerotic bone remodeling. Immunostaining using.TGFβ1 monoclonal revealed marked staining of the spongiotic otosclerosis lesion.

Conclusions: Mechanisms involved in cochlear extension of otosclerosis are still unclear, but the implication of TGFβ1is supported by the present proteomic data and mmunostaining results. The established role of TGFβ1 in the chondrogenesis process support the theory of a reaction targeting the globulae interossei within the otic capsule.

Define Professional Practice Gap and Educational Need: Lack of knowledge of underlying pathophysiology and/or genetic influence predisposing to otosclerosis.

Learning Objective: The listener will gain an understanding of the potential role for TGF-beta-1 in initiation and progression of otosclerosis.

Desired Result: Attendess will understand the role of genetics and development in etiology of otosclerosis and future potential therapies aimed at TGF-beta-1 based on findings presented.

Received IRB approval

10:23 am

Inhibiting p21-Activated Kinase as Treatment for Vestibular Schwannomas and Meningiomas

Craig Miller, BS; Suzu Igarashi, BS; Allison M. Dunn, BA
Kate A. Woodworth; Maki Niihori, PhD; Abraham Jacob, MD

Hypothesis: All vestibular schwannomas (VS) and many meningiomas exhibit loss of the NF2 gene product merlin. Functioning merlin suppresses p-21 activated kinase (PAK), a molecule that controls cell morphology, growth, and survival. Because merlin loss causes aberrant activation of PAK, inhibiting PAK may be a viable treatment strategy against VS and meningiomas.

Background: Working with medicinal chemists, our laboratory has identified 2 lead compounds (PI-8 and PI-15) that suppress PAK activation. These small molecules were generated from AR12, a PDK1 inhibitor derived from the COX-2 inhibitor Celebrex. Via structure modification, AR12's PDK1 activity was reduced and PAK inhibition enhanced.

Methods: Initially, 32 candidate drugs were screened. The current in vitro study used cell culture (HEI-193 schwannoma, BenMen meningioma, primary human VS, and primary human meningioma), MTT cell proliferation assays, immunoblots, and cell death assays to validate treatment efficacy, molecular targets, and cell death mechanisms for PI-8 and PI-15.

Results: MTT assays determined 50% inhibitory concentrations (IC50) for PI-8 and PI-15 as measures of their treatment efficacy. PI-8 suppressed HEI-193 and BenMen growth with IC50 values of 3.1μM and 1.24μM respectively, while PI-15 demonstrated IC¬50 1.8μM and .6μM. Primary human VS and meningioma cells had IC50 2.1μM and 2.2μM for PI-15 and 3μM and 3.5μM for PI-8. Cell growth was suppressed via apoptosis and cell cycle effects. Western blots for PI-8 and PI-15 demonstrated inhibition of phospho-PAK but at distinct threonine phosphorylation sites.

Conclusions: PAK inhibition warrants further drug development efforts as a viable treatment strategy against vestibular schwannomas and meningiomas.

Define Professional Practice Gap and Educational Need: Vestibular schwannomas and meningiomas are currently treated by surgical resection or stereotactic radiation therapy. Therefore, the development of medical options for these patients would represent a significant clinical advance.

Learning Objective: Understand the pathogenic role of aberrant PAK activation in schwannoma and meningioma proliferation/ survival.

Desired Result: Improvements in our understanding of aberrant intracellular signaling pathways involved in schwannoma and meningioma genesis better informs the drug development process and facilitates early adoption into human clinical trials.

Received IRB Approval

10:31 am

Mannitol Protects Hair Cells Against Gentamicin-Induced Losses In Vitro

John W. Wood, MD; Esperanza Bas, PhD; Chhavi Gupta, PhD
Yamil Selman, MS; Adrien Eshraghi, MD; Fred F. Telischi, MD
Thomas R. Van De Water, PhD

Background: GM is an aminoglycoside antibiotic which causes hearing loss due to damage of both inner (IHCs) and outer hair cells (OHCs). MT has both osmotic and cytoprotective properties, and otoprotection has been demonstrated in a post-ischemic animal model of hearing loss and in vitro against tumor necrosis factor alpha (TNFα)-induced hair cell (HC) loss. While the exact mechanism of MT is unknown, it is thought to be a suppressor of oxidative stress as a free radical scavenger.

Methods: Organ of Corti were dissected from P-3 rats and cultured under the following conditions for 96 hours: (1) Control, (2) GM (10 μM, all experiments), (3) GM + MT 10mM, (4) GM + MT 50mM, (5) GM + MT 100mM. Viable HCs were counted in 3 OC segments. Quantitative RT-PCR was performed after 24 hours in: (1) Control, (2) GM (100 μM), (3) GM +MT 100mM, (4) MT 100mM for TNFα, TNFα receptor 1A (TNFR1A), interleukin-1 beta (IL-1β) and cyclooxygenase-2 (COX-2). Analysis of variance and post hoc Bonferroni statistical tests were performed with determined significance ($p<0.05$).

Results: GM induced loss of IHCs and OHCs with increasing frequency in a apex to base pattern. MT showed a dose-dependent pattern of otoprotection of IHCs and OHCs ($p<0.05$). IL-1β, TNFα and COX-2 genes were upregulated by GM ($p< 0.05$). Mannitol had no effect on COX-2 expression ($p>0.05$). TNFR1A expression was upregulated by MT, and TNFα expression in GM + MT cultures were equivalent to controls.

Conclusions: MT prevents GM-induced HC loss in a dose-dependent manner, protecting all segments of the explants. MT prevents TNFα upregulation by GM.

Define Professional Practice Gap and Educational Need: There is a lack of contemporary knowledge in the treatment of aminoglycoside toxicity. Furthermore, there are few drugs currently used to restore hearing loss.

Learning Objective: Provide a background to understanding aminoglycoside hearing loss and potential treatments for this condition.

Desired Result: Attendees will provide better counseling to patients prior to treatment with aminoglycosides and have improved understanding of current and future treatment alternatives in those who do have hearing loss.

Received IACUC Approval

10:39 am

Bio-engineered Tympanic Membrane using Silk Fibroin: an In Vitro Study

Bing Mei Teh, MBBS; Sharon L. Redmond; Ben Allardyce, PhD
Marcus D. Atlas, FRACS; Rangam Rajkhowa, PhD
Robert J. Marano, PhD; Rodney J. Dilley, PhD

Hypothesis: Species and composition specific variations in silk properties will produce different cell growth outcomes.

Background: Chronic tympanic membrane (TM) perforations remain an ongoing management challenge. Recently, there has been a shift towards the use of a bio-engineered TM with suitable scaffolds, cells and bioactive molecules. Silk fibroin, obtained from silkworm cocoons, has been extensively studied as a potential bio-scaffold due to its many unique properties. However, the choice of which silk types to use has yet to be determined.

Methods: Human-derived TM keratinocytes were obtained and cultured. Silk fibroin was obtained from Bombyx mori (mul), Philosamia ricini (eri) and Antheraea assamensis (muga) silkworms. 1) Cell morphology and adhesion: phase contrast microscopy; 2) cell migration: scratch assay; 3) cell proliferation, cytotoxicity and adhesion: MTT assay; and 4) cell viability: trypan blue assay.

Results: Mul silk films were least cytotoxic and supported highest cell numbers and adhesion compared to muga and eri. Aqueous-based mul promoted better cell migration and growth rate, whilst formic acid-based mul resulted in higher cell adhesion and proliferation.

Conclusions: Mul silk, either aqueous or formic acid-based, are safe and can be used as potential bio-scaffolds for TM perforations. This could represent a paradigm shift in the management of TM perforations in an outpatient setting without surgery.

Define Professional Practice Gap and Educational Need: Lack of contemporary knowledge regarding novel bioscaffolds for tympanic membrane repair

Learning Objective: 1) To understand the principles of tissue engineering of the tympanic membrane
2) To understand the interactions between keratinocytes and various silk types

Desired Result: 1) Improvement in the understanding of novel approaches to tympanic membrane perforation repair

Received IRB Approval

10:47 am

Long Term Results of Canal Wall Reconstruction Tympanomastoidectomy

Paul C. Walker, MD; Sarah E. Mowry, MD
Rick F. Nelson, MD, PhD; Marlan R. Hansen, MD
Bruce J. Gantz, MD

Objectives: This study was designed to evaluate the long term results with canal wall reconstruction (CWR) tympanomastoidectomy with mastoid obliteration in the treatment of chronic otitis media with cholesteatoma.

Study Design: IRB approved retrospective case review.
Setting: Tertiary referral center.
Patients: CWR tympanomastoidectomy with mastoid obliteration was performed on 285 ears for cholesteatoma from 1997 to 2011.
Interventions: CWR tympanomastoidectomy with mastoid obliteration and second look tympanoplasty with ossiculoplasty.
Main outcome measures: Failure requiring open cavity procedure, residual cholesteatoma and location, complications and pre- and postoperative audiometry.

Results: 285 ears in 273 patients underwent CWR tympanomastoidectomy with a mean age of 35 years (range 2 to 80 years). A second look ossiculoplasty was performed in 245 (86%). Residual cholesteatoma was found in the middle ear in 30/245 patients (12%) on second look. Recurrent cholesteatoma occurred in 18/285 (6.3%) ears. Most recurrences were limited to attic retraction pockets managed with atticotomy (n=10). Only 7 ears (2.5%) required a revision open cavity mastoidectomy (n=5) or subtotal petrousectomy (n=2). No ears developed recurrent cholesteatoma in the obliterated mastoid cavity. Postoperative infection occurred in 16 (5.6%) patients. Audiometry results in 148 patients who underwent second look ossiculoplasty demonstrated small improvement in preoperative versus postoperative air-bone gap (ABG), 28 dB vs. 23 dB respectively.

Conclusions: A CWR tympanomastoidectomy provides excellent intraoperative exposure of the middle ear and mastoid without the long term disadvantages of a canal wall down mastoidectomy. Long term follow up demonstrates low rates of recurrent cholesteatoma with stable or improved ABG.

Define Professional Practice Gap & Educational Need:
Many otolaryngologists treat cholesteatoma with either a canal wall down (CWD) or canal wall up (CWU) procedure for cholesteatoma. Each has its advantages and disadvantages. The CWU procedure preserves the ear canal but may limit exposure for complete cholesteatoma removal. The CWD offers excellent exposure but obligates a patient to frequent bowl cleanings and may limit water activities. In this abstract we present long term data on an alternative canal wall reconstructive (CWR) technique with mastoid obliteration which affords the view of a CWD but preserves the ear canal like a CWU.
Learning Objective:
To learn that the canal wall reconstruction technique with mastoid obliteration is a safe technique to treat cholesteatoma in both children and adults. Its long term rate of recurrence is comparable to that obtained with other techniques and preserves the ear canal.
Desired Result: Attendees will learn the technique of canal wall reconstruction with mastoid obliteration and apply it to their practice as a safe and effective treatment for cholesteatoma.

Received IRB Approval

7:30 am

Posterior Semicircular Canal Dehiscence: CT Prevalence and Clinical Symptoms

Jack E. Russo, MD; Matthew G. Crowson, BA
Edward J. DeAngelo, MD; Clifford J. Belden, MD
James E. Saunders, MD

Objective: To estimate the prevalence of and symptoms associated with posterior semicircular canal dehiscence (PSCD) compared to superior semicircular canal dehiscence (SSCD) and no dehiscence.

Study design: Retrospective case review

Setting: Academic tertiary referral center

Patients: Review of 457 consecutive temporal bone CT scans and patient records excluding patients with prior mastoid or skull base surgery

Intervention(s): CT images (0.625mm thick) were reviewed in the planes of the semicircular canals. Patient demographics and symptoms were tabulated and analyzed. Main outcome measure(s): Prevalence of PSCD and SSCD; presence or absence of aural fullness, autophony, tinnitus, pulsatile tinnitus, disequilibrium, vertigo, and Tullio phenomenon.

Results: Review of the 457 CT scans revealed 5 cases of PSCD (1.09%) and 19 cases of SSCD (4.16%). All patients with PSCD were male, aged 16-73. Symptoms were recorded for 4 PSCD patients. PSCD was commonly associated with SSCD. One patient with PSCD reported tinnitus, autophony, disequilibrium, vertigo, and Tullio phenomenon; 2 patients reported only tinnitus and aural fullness and 1 patient had no symptoms. There were no significant differences in symptoms between PSCD patients and the other groups. There were, however, statistically-significant differences between SSCD patients and no-dehiscence patients in the rates of autophony, tinnitus, and disequilibrium.

Conclusions: The prevalence of PSCD in patients undergoing temporal bone CT scans is considerably less than SSCD (1.09% vs. 4.16%) and the two conditions commonly co-exist. Given the small numbers in our study, we were not able to demonstrate any distinguishable clinical features for the PSCD patients.

Define Professional Practice Gap and Educational Need: Lack of awareness of the prevalence and associated clinical symptoms of posterior semicircular canal dehiscence

Learning Objective: To understand better the prevalence and associated clinical symptoms of posterior semicircular canal dehiscence

Desired Result: Recognize posterior canal dehiscence as a possible diagnosis in the appropriate clinical context

Received IRB approval

7:38 am

Clinical Features of Patients with Pulsatile Tinnitus and Sigmoid Sinus Diverticulum/Dehiscence

Ameet K. Grewal, MD; Han Y. Kim, MD
Richard H. Comstock, III, MD; Ann K. Jay, MD
H. Jeffrey Kim, MD

Objective: Pulsatile tinnitus (PT) can have an arterial or venous origin. Sigmoid sinus diverticulum/dehiscence (SSD) is an increasingly recognized venous cause for PT. However, its pathophysiology and clinical manifestations have not yet been established. Since SSD can be amenable to surgical or endovascular intervention, we aim to further understand the clinical features of patients with PT due to SSD.

Study design: Retrospective chart review

Setting: Tertiary care, academic medical center

Patients: Sixty-one patients with PT were reviewed

Intervention(s): All patients underwent a temporal bone CT scan for evaluation of PT. Clinical information was gathered using electronic medical records.

Main outcome measure(s): Clinical presentations including otologic symptoms and physical findings such as body mass index (BMI) and mastoid/neck bruits were analyzed. Temporal bone CT scans were evaluated for SSD by two independent neuroradiologists.

Results: Fifteen patients were identified with PT and CT-confirmed SSD. All were female, average age was 45 years(26-73 years). Tinnitus was reported on the right in 8(53.3%), left in 4 (26.6%) and bilateral in 3(20%). Radiological evaluation revealed 10 SSD cases in right(66.7%), 2 in left(13.3%%) and 3 bilateral(20%). Five(33%) patients had SS diverticulum, while 10(66.7%) had dehiscence. Sensorineural hearing loss, preferentially in lower frequencies, was seen in 8(53%), aural fullness in 12(80%). Average BMI was 32.2(21.0-59.82), and 4(26%) had audible mastoid bruits.

Conclusions: SSD may be the single most common identifiable cause for PT from venous origin. Temporal bone CT scan should be included in a complete evaluation of PT as there is a potential for surgical resolution of SSD.

Define Professional Practice Gap and Educational Need: Lack of knowledge regarding patients who have pulsatile tinnitus due to sigmoid sinus dehiscence or diverticulum

Learning Objective: We aim to further understand the clinical profile of patients with pulsatile tinnitus due to sigmoid sinus dehiscence or diverticulum

Desired Result: To use information regarding otologic history, physical findings and CT temporal bone to identify patients that may be amenable to surgical intervention for correction of sigmoid sinus dehiscence or diverticulum.

Received IRB Approval

7:46 am

Side-to-End Hypoglossal to Facial Anastomosis with Transposition of the Intratemporal Facial Nerve

William H. Slattery, MD; Adam M. Cassis, MD
Eric P. Wilkinson, MD; Felipe Santos, MD
Karen Berliner, PhD

Objective: To describe results in a large series of patients using a recent variation of hypoglossal-facial nerve anastomosis (HFA) in which the intratemporal facial nerve segment is used, obviating the need for a sensory nerve "jump graft".

Study Design: Retrospective chart review.

Setting: Tertiary neurotologic referral center.

Patients: 19 patients (12 females/7 males) with facial paralysis due to posterior fossa surgery for tumor (n=15), Bell's palsy (n=1), facial neuroma (n=1), hemangioma (n=1), and trauma (n=1) who underwent HFA from 1997-2011, with at least one year follow-up. Mean age at surgery=47.4 years (11.2 - 83 years). Mean follow-up=4.0 years.

Intervention: Side-to-end hypoglossal to facial anastomosis with transposition of the intratemporal facial nerve (swingdown HFA)

Main Outcome Measure: House-Brackmann (H-B) facial nerve grade.

Results: Seven patients (36.8%) achieved a H-B grade III, 9 patients (47.4%) a grade IV, and 3 patients (15.8%) a grade V at last follow-up. No patients complained of dysphagia, dysarthria, or had evidence of oral incompetence. One patient complained of mild tongue weakness. Age at time of HFA ($p \leq .049$, III younger than V) and time from facial nerve injury to HFA ($p \leq .02$, III<IV and V) were significant factors for ultimate facial nerve outcome. All patients with an H-B III result had HFA within 6 months of injury. Other factors were not significant.

Conclusion: The HFA swingdown technique is a safe and effective method to restore facial nerve function in patients suffering from facial paralysis, and obviates the need for an interposition jump graft.

Define Professional Practice Gap and Educational Need: New technique of hypoglossal-facial anastomosis for treatment of facial paralysis. This series is larger than any report in the literature for this technique.
Learning Objective: Present a relatively new technique for anastomosis of the hypoglossal and facial nerves that forgoes the need to perform an "end-to-end" anastomosis or the need for a jump graft.
Desired Result: The goal is to present our results of the hypoglossal-facial "swingdown" technique to the audience, which is a break from the traditional "end-to-end" or "end-to-side" technique with a jump graft. This gives the attendee a potential new option in technique for treatment of facial paralysis that may be instituted into his or her clinical practice.

Received IRB approval

7:54 am

Cost Of Cholesteatoma Care At A Tertiary Medical Center

Joseph P. Roche, MD; Oliver F. Adunka, MD
Harold C. Pillsbury, MD; Craig A. Buchman, MD

Objective: Estimate the cost of cholesteatoma care in a university practice.

Study design: Retrospective review of both physician and hospital financial data during a recent 3 year period.

Setting: University-based tertiary referral medical system.

Patients: Adults (≥18 years old) with cholesteatoma.

Intervention(s): Financial information associated with both physician and hospital encounters were analyzed in a de-identified manner.

Main outcome measure(s): Frequency and type of encounter, charges, collections, and payers were tabulated.

Results: 949 physician encounters (817 clinic, 130 surgical, 2 inpatient) among 344 patients resulted in >$700, 000 in charges and >$211,000 in receipts (~30% rate of collection). The average physician charge per patient per year was ~$1,600. 259 hospital encounters among 171 patients resulted in >$1.8 million in charges and >$520,000 in receipts, (~28% collection rate). The average hospital charge per patient per year was ~$10,000. For physician encounters, managed care (37%) and Medicare (25%) were the most common payers while 17% were uninsured. For hospital encounters, managed care (28%) and Medicare (14%) were the most common payers while 24% were uninsured.

Conclusions: The cost of care for patients with cholesteatoma is significant. The current treatment paradigm for this chronic disorder results in repeated health care system access and associated direct (and unmeasured indirect) expenses. Future treatment paradigms should be designed to improve disease specific quality-of-life while mitigating this financial impact.

Define Professional Practice Gap and Educational Need: 1) Lack of understanding of the costs of cholesteatoma care.

Learning Objective: 1) Learners will become aware of the costs of care incurred by patients and the health care system for cholesteatoma care.

Desired Result: Attendees will have a more nuanced understanding of the costs of the care that they provide to patients with cholesteatoma. This information can help with patient counseling as well as long term financial practice management.

Received IRB Exemption

8:02 am

Dietary Modification as Adjunct Treatment in Ménière's Disease: Patient Willingness and Ability to Comply

Emily M. Luxford, BA; Karen I. Berliner, PhD
William M. Luxford, MD

Objective: To evaluate ease of use and compliance with dietary modification in the treatment of vertigo in patients with Ménière's disease (MD).

Study design: Mailed patient questionnaire and retrospective chart review.

Setting: Tertiary referral neurotologic private practice.

Patients: 136 patients with Ménière's disease who returned a mailed questionnaire and signed consent form. Mean age at first visit was 53.4 years (SD=13.6) and at questionnaire was 61.8 years (SD=13.4) with 54.4% female. Median initial hearing was AAO-HNS Stage 1. Most patients also received diuretics and/or other treatments.

Intervention: Reduced sodium and caffeine-free diet.

Main outcome measures: Patient ratings of diet difficulty, length of use, compliance level and nutritional understanding, and AAO-HNS vertigo class and functional rating before (retrospective) and with nutritional intervention.

Results: About half (46.3%) of respondents were given written diet guidelines and only 3.2% were referred for nutritional counseling; another 7.8% sought counseling independently. 77.8% and 84.7% rated a low sodium and a caffeine-free diet, respectively, as manageable or easy to follow, and 77.9% followed the diet ≥ 1 year, but only10.3% could list 5 'correct' foods to eat and 26% 5 foods to avoid. Duration of compliance had a small significant correlation to AAO-HNS vertigo class ($r=-.26$, $p\leq.007$) as did knowledge of which foods to eat and to avoid ($r=-.21$, $p\leq.029$ and $r=-.26$, $p\leq.01$, respectively) with the more foods correctly listed, the lower/better the AAO-HNS class outcome.

Conclusions: Nutrition education by referral to a registered dietitian may improve outcomes in the medical treatment of Ménière's disease.

Define Professional Practice Gap and Educational Need: Diet recommendations are often made as part of the medical first line treatment of Ménière's disease but there are no clinical guidelines for, nor published evidence regarding, effectiveness of such recommendations.

Learning Objective: To recognize the need for better nutritional education for patients when this treatment adjunct is recommended.

Desired Result: Physicians will understand the value of nutritional counseling by a registered dietitian to improve patient compliance with dietary recommendations. This may improve outcomes in the medical management of Ménière's disease.

Received IRB Approval

8:42 am

Physiologic Consequences of Flexible Electrode Insertion into a Gerbil Model of Cochlear Implantation Featuring Noise Induced Sensorineural Hearing Loss

Baishakhi Choudhury, MD; Omar Awan, BS
J. Maxwell Pike, BA; Craig A. Buchman, MD
Douglas C. Fitzpatrick, PhD; Oliver F. Adunka, MD

Hypothesis: Electrode interaction with intracochlear structures in a noise-damaged region of the cochlea can result in electrophysiologic response decline in residual hearing.

Background: An emerging goal in cochlear implant recipients is preservation of residual hearing allowing for combined electric and acoustic stimulation (EAS). Residual hearing is at least partially lost in most patients as a result of cochlear implantation. A gerbil model was used to examine changes to acoustically evoked cochlear potentials during simulated cochlear implantation.

Methods: Gerbils were partially deafened by noise exposure to mimic human cochlear implant candidates. After one month, round window (RW) recordings of the cochlear microphonic (CM) and compound action potential (CAP) were made to tone burst stimuli. A flexible electrode, similar to a human implant electrode, was then advanced through the RW and the CM and CAP were re-measured in 100 μm steps. Subsequently, the cochleae were histologically examined for signs of mechanical damage as well as noise damage.

Results: The CM and CAP typically remained steady as the electrode traversed scala tympani through the basal turn. Near the end of the basal turn the response magnitudes decreased, indicating trauma as the electrode impacted cochlear structures. Unlike similar experiments in normal hearing animals, these reductions were usually not reversible with electrode retraction. Mechanical damage to the basilar membrane was present in most cases.

Conclusions: Recording patterns can shed light onto electrode position relative to intracochlear structures and surviving hair cells. Ultimately, we plan to provide real-time physiologic feedback during cochlear implantation.

Define Professional Practice Gap and Educational Need: Lack of current knowledge as to the etiology of damage to residual hearing in cochlear implant recipients.

Learning Objective: To gain insight into factors that may contribute to damage to residual hearing in a cochlear implant recipient.

Desired Result: Attendees will be able to better counsel future cochlear implant candidates as to factors that could result in damage to their residual hearing as well and recognize that electrode insertion technique could contribute to cochlear implant outcomes.

Received IACUC approval

8:56 am

Cochlear Implantation in Older Adults: Long-term Analysis of Complications and Device Survival in a Consecutive Series

David S. Chen, BS; Danisa M. Clarrett, MS
Lingsheng Li, MHS; Steve P. Bowditch, MS
John K. Niparko, MD; Frank R. Lin, MD, PhD

Objectives: To analyze the postoperative complications associated with cochlear implant (CI) surgery in a large consecutive case series of older adults (≥ 60 years)

Study Design: Retrospective case review

Setting: Tertiary referral center

Patients: 445 individuals ≥60 who received a first CI between 1999-2011

Interventions: Cochlear implantation

Main Outcome Measure(s): Postoperative complications classified as major (meningitis, immediate postoperative facial weakness, device failure, flap dehiscence, surgical removal) and minor (surgical site infection, balance problems, delayed postoperative facial weakness, facial nerve stimulation)

Results: The mean age at implantation was 72.7 years (60-94.9) and the median duration of follow-up was 4.8 years (0.1-12.5). There were 42 minor complications in 41 patients (9.2%) and 36 major complications in 21 patients (4.7%). Seventeen patients (3.8%) required surgical device removal, 15 of whom underwent reimplantation. A Kaplan-Meier analysis of rates of device explantation demonstrated that at 5 and 10 years after CI, respectively, 95.4% and 93.1% of patients retained their original CI. When comparing complications between patients aged 60-74 years and those aged 75 years and older, there was a higher prevalence of balance problems lasting more than 1 month in the older group (9.5% vs. 4.9%, $p = .05$).

Conclusions: Our results indicate that the safety profile of cochlear implantation in an older population is comparable to that of younger adults and children. We suggest that concerns for increased postoperative complications in patients of advanced age do not need to be a primary consideration when determining CI candidacy.

Define Professional Practice Gap and Educational Need: Lack of knowledge on postoperative complication rate of cochlear implantation in older adults as compared to the general cochlear implant population

Learning Objective: Investigate the safety of cochlear implantation in older adults

Desired Result: Our results suggest that concerns for increased postoperative complications in patients of advanced age do not need to be a primary consideration when determining CI candidacy.

Received IRB Approval

9:04 am

The Medium Term Results of Hearing Preservation Surgery for Cochlear Implantation

Peter Luke Santa Maria, MBBS, PhD
Chloe Domville-Lewis, MBBS
Marcus David Atlas, MBBS

Objective: To study the medium term benefits of hearing preservation surgery in cochlear implantation.

Study Design: A retrospective cohort study.

Setting: Performed at a single academic institution between 2008 and 2010

Patients: 13 patients (1 bilateral), 43% male and 57% female. Mean age at surgery was 51 years (range from 32 to 72 years). Average duration of deafness was 25 years (range from five to 62 years).

Intervention: Hearing preservation cochlear implantation surgery performed with the Med-El Flex EAS electrode

Main Outcome Measures: Pure tone thresholds, speech in quiet and noise measures and quality of life (Abbreviated Profile of Hearing Aid Benefit (APHAB) and Glasgow Hearing Aid Benefit (GHAB) Scales) up to and including two years after surgery.

Results: At the first postoperative audiogram the hearing preservation rate was 100% (Complete (42.9%), partial (50%) and minimal (7.1%)). After 24 months the breakdown was complete (25%), partial (12.5%), minimal (37.5%) and complete loss (12.5%). There was a trend in improvement in all areas of APHAB with significant improvements in the background noise and reverberation categories as well as the global scores. The GHAB scores showed high levels of use, benefit and low levels of residual disease.

Conclusion: Hearing preservation can be achieved in the short term but deteriorates with time over the medium term at a rate greater than that can be expected with the natural progression of the disease. Patients show benefits in speech outcomes and quality of life regardless of whether hearing preservation was achieved in the medium term.

Define Professional Practice Gap and Educational Need: 1) Many physicians and implant audiologists are unaware of the outcomes of hearing preservation cochlear implant surgery beyond the short term. 2) Some implant surgeons do not measure or report their hearing outcomes in patients undergoing hearing preservation cochlear implant surgery beyond the short term.

Learning Objective: 1) for the physician to be aware of the medium term outcomes of hearing preservation cochlear implantation surgery. 2) To encourage implant surgeons to continue to follow up their patients with speech testing in the medium and long term.

Desired Result: 1) That physicians and implant audiologists will be able to better counsel patients about the short and medium results of hearing preservation surgery in cochlear implantation
2) That centres will adopt speech testing in followup of these patients.

Received IRB Approval

9:12 am

Analysis of Inter-Subject Variations in Promontory and Intracochlear Anatomy for Cochlear Implantation

Stanley Pelosi, MD; Jack H. Noble, PhD
Benoit M. Dawant, PhD; Robert F. Labadie, MD, PhD

Hypothesis: We hypothesize that middle ear surface landmarks typically used to guide electrode placement during cochlear implantation (CI) exhibit substantial variability with respect to intracochlear anatomy.

Background: Recent publications suggest that both atraumatic electrode insertion and electrode location within the scala tympani can affect auditory performance after CI. However, current technique for electrode insertion relies on surface landmarks alone for navigation, without actual visualization of intracochlear structures other than what can be seen through a surgically-created cochleostomy. In this study we quantify how well the position of intracochlear anatomy is predicted by traditional landmarks.

Methods: Surfaces representing promontory and intracochlear anatomy were reconstructed in microCT scans of 9 temporal bone specimens. These surfaces were then re-oriented into a normalized coordinate system to facilitate measurement of inter-subject anatomical shape variations.

Results: Only minor inter-subject variations were detected for intracochlear anatomy (maximum deviation from average = 1 mm, standard deviation = 0.2 mm), with the largest differences existing in the basal turn. However, larger inter-subject variations in intracochlear structures were detected when considered relative to the promontory (maximum deviation from average = 2 mm, standard deviation = 0.5 mm).

Conclusions: The cochlea and its scala exhibit considerable variability in relation to promontory landmarks. While support for more precise, atraumatic CI electrode insertion techniques is growing in the otologic community, landmark guided insertion techniques have limited precision. Refining the CI insertion process may require the development of image-guidance systems for use in otologic surgery.

Define Professional Practice Gap and Educational Need: Current cochlear implant insertion techniques rely upon surface anatomic landmarks of the middle ear space to determine the optimal location for electrode insertion into the scala tympani. However, it is not clear as to whether the anatomic relationship of promontory landmarks to intracochlear structures is consistent between patients, potentially limiting precision in electrode placement.

Learning Objective: 1) We wish to demonstrate that surface landmarks of the middle ear exhibit considerable variation in their anatomic relationship to intracochlear structures. 2) We suggest a potential utility for image-guidance systems to improve precision in electrode placement during cochlear implantation.

Desired Result: We aim to improve understanding amongst cochlear implant surgeons of the variations in promontory and intracochlear anatomy that may limit precision in electrode placement when using middle ear surface landmarks alone to guide optimal insertion location.

Received IRB Exemption

9:20 am

Cochlear Implantation in Meniere's Disease Patients

Theodore R. McRackan, MD; Rene H. Gifford, PhD
Robert F. Labadie, MD, PhD; George B. Wanna, MD
David S. Haynes, MD; Marc L. Bennett, MD

Objective: A significant portion of the Meniere's disease (MD) population will ultimately have severe to profound hearing loss in their affected ear. When this occurs bilaterally or when a patient has poor hearing in the contralateral ear, these patients' may meet criteria for cochlear implantation (CI). Here we describe our institution's CI outcomes in MD patients.

Study Design: Retrospective chart and literature review.
Setting: Tertiary referral center.
Patients: Twenty-one patients with either bilateral MD or unilateral MD who underwent CI in their affected ear.
Intervention(s): Postoperative speech perception scores and clinical data retrieval.
Main Outcome Measure(s): postoperative speech perception.

Results: Post implantation hearing outcomes were not statistically significant between the MD group and published normative post-CI CNC results* (43.24 vs. 60.98, p=0.65). There were no statistically significant differences in post-CI hearing outcomes based on prior treatment of MD with medical management only, endolymphatic sac surgery, intratympanic gentamycin, or intratympanic steroids (all p>0.05). Although the sample size was low, two patients who underwent labrynthectomies on the implanted side did have better CNC scores than other prior treatment regimens (81.0% vs. 43.24%, p=0.03). Six patients had persistent vertiginous symptoms of MD prior to CI. After CI, two had complete resolution of vertigo, two had subjective improvement in their symptoms, and two noticed no change. No patient had worsening of vertiginous symptoms.

Conclusion: Despite prior treatment course, MD patients' hearing outcomes appear to be no different than the general CI population. In those patient's with active MD, post-operative subjective vertigo results vary, but do not worsen.
*By the time of the meeting we will have completed a CI database from our institution with our own normative CNC data for comparison.

Define Professional Practice Gap and Educational Need: 1) Lack of awareness in cochlear implant outcomes in patients with Meniere's disease 2) Lack of knowledge of how Meniere's treatment may ultimately influence cochlear implant outcomes 3) Lack of understanding of effect of cochlear implantation on vestibular symptoms in Meniere's disease patients
Learning Objective: Attendees will better understand the hearing and vestibular outcomes in Meniere's disease patients after cochlear implantation. They will also better know how the different Meniere's disease treatments may influence cochlear implant outcomes.
Desired Result: Attendees will be better able to know expected cochlear implant outcomes in Meniere's disease patients as well as be better able to counsel their patients.

Received IRB Approval

9:28 am

Cochlear Implantation in Patients with Autism Spectrum Disorder

Adrien A. Eshraghi, MD; Ronen Nazarian, MD
Fred F. Telischi, MD; Thomas J. Balkany, MD
Annelle Hodges, PhD; Alina Gomez; Lochet Domitille

Objective: To investigate changes in receptive or expressive language development and quality of life after cochlear implantation (CI) in children with autism spectrum disorder (ASD).

Study design: Retrospective case review

Setting: Academic medical center

Patients: Children with ASD who had a Cochlear implant, I with a mean follow-up of 7 years (ranging from 2 to 19 years).

Intervention(s): Cochlear implantation and specific rehabilitations in children with ASD

Main outcome measure(s): A novel adjusted receptive and expressive language scale. A quality of life questionnaire for kids and their parents

Results: There is improved receptive and expressive speech, behavior and quality of life after CI. They like their implant and are using them even if some do not develop advanced language skills.

Conclusions: Hearing impaired children with ASD made significant progress through CI. Counseling parents in appropriate expectations and facilitating development through collaboration with behavioral therapist is recommended.

Define Professional Practice Gap and Educational Need: 1) Lack of awareness of possible benefit of implantation in kids with autism. 2) Inconsistencies in the result of previous studies focusing on language development post implantation in kids with autism. 3) Lack of study evaluation the quality of life of kids and their family after cochlear implantation.

Learning Objective: 1) Benefits that may result for kids and their family post cochlear implantation.
2) Understanding of various degree of language development post implantation, in kids with autism

Desired Result: 1) The expectation from cochlear implantation in kids with autism is different than kids without any disability. 2) Developemnet of specific rehabilitation techniques after implantation to help kids with autism to develop receptive/expressive language at their maximal potential.

Received IRB Approval

10:15 am

Outcomes Following Stapedectomy for Congenital Stapes Footplate Fixation and Juvenile Otosclerosis

Matthew L. Carlson, MD; Kathryn M. Van Abel, MD
Stanley Pelosi, MD; Charles W. Beatty, MD
David S. Haynes, MD; George B. Wanna, MD
Colin L.W. Driscoll, MD

Objective: To compare outcomes among pediatric patients undergoing primary stapedectomy for congenital stapes footplate fixation (CSFF) and juvenile otosclerosis (JO).
Study Design: Retrospective review
Setting: Combined experience from two tertiary academic referral centers
Patients: Pediatric patients with CSFF or JO
Intervention: Primary stapedectomy
Main outcome measure(s): 1) Preoperative and postoperative audiometric data using the 1995 AAO-HNS reporting guidelines; 2) Notable operative findings, and postoperative complications.

Results: Forty-four pediatric ears met inclusion criteria (27 CSFF, 17 JO). The mean duration of audiometric follow-up was 27 months. Patients with CSFF presented with a more significant hearing loss (mean PTA 52 dB vs. 42 dB; P=0.04), underwent surgery at a younger age (12.3 years vs. 16.3 years; P<0.001), and more commonly had concurrent ossicular malformations (37% vs. 0%; P=0.004) compared to subjects with JO. Patients with JO demonstrated a smaller postoperative ABG (mean 8.8 dB vs. 17.2 dB; P=0.04), although both groups experienced a statistically significant improvement following surgery. Mean bone conduction thresholds remained stable for both groups. There were no instances of severe sensorineural hearing loss, perilymph gusher, facial nerve paresis, or tympanic membrane perforation.
Conclusions: When performed by an experienced surgeon, stapedectomy is safe and effective in carefully selected pediatric patients with CSFF and JO. CSFF presents earlier, is associated with a more severe hearing loss and more commonly demonstrates concurrent ossicular abnormalities. Both groups experience substantial benefit from stapedectomy however ABG closure rates are superior in patients with JO. These data may be helpful in preoperative assessment and patient counseling.

Define Professional Practice Gap and Educational Need: There currently exists a lack of contemporary knowledge concerning differences in clinical presentation and outcomes following stapedectomy for congenital stapes footplate fixation and juvenile otosclerosis.
Learning Objective: The learning objective of this talk is to describe primary stapedectomy outcomes with respect to surgical morbidity and audiometric benefit among pediatric patients with congenital stapes footplate fixation and juvenile otosclerosis.
Desired Result: The desired result is that based on a more complete understanding of the efficacy and safety of stapedectomy in pediatric patients with congenital footplate fixation and juvenile otosclerosis, clinicians will apply this information to make informed decisions when determining surgical candidacy and be able to convey accurate expectations and risks of surgery during preoperative counseling.

Received IRB approval

10:23 am

Extension of Indications for Transcanal Endoscopic Ear Surgery using an Ultrasonic Bone Curette

Seiji Kakehata, MD; Tomoo Watanabe, MD
Tsukasa Ito, MD; Toshinori Kubota, MD
Takatoshi Furukawa, MD

Objective: One-handed procedure in a small operation field limits the indications for transcanal endoscopic ear surgery (TEES) in cholesteatoma surgery. The advantages and feasibility of an ultrasonic bone curette (UBC) containing a suction-irrigation system in a one-handed piece in TEES were examined.

Study design: A prospective case series.

Setting: Tertiary referral center

Patients: TEES was performed on 38 cases of cholesteatoma between September 2011 and September 2012, including 10 cases extending to the antrum.

Intervention: 0-, 30- or 70-degree angled rigid endoscopes, 2.7 mm in the outer diameter (Karl Storz), with a high-definition video system were used. In order to drill the bony tissue, we used a Sonopet UBC (Stryker). The non-rotational motion of the Sonopet prevents damage to the tympanomeatal flap or other soft tissue such as a microdrill may cause. Transcanal endoscopic retrograde mastoidectomy on demand was performed to access the pathologies in the attic and antrum.

Result(s): A minimum atticoantrotomy, removing only the bony tissues necessary to visualize the pathology, was performed using the Sonopet. The cholesteatoma was completely removed from the antral mucosa under clear endoscopic visualization in 9 out of 10 cases. After removal of the cholesteatoma, the canal wall is reconstructed using the thin sliced cartilage from tragus. This procedure facilitates more mastoid preservation.

Conclusion(s): The transcanal endoscopic approach to the antrum using the powered instruments proved to be less invasive and more functional. The Sonopet, a one-handed device containing a suction-irrigation system, is an appropriate drilling tool that enables the extension of indications for TEES.

Define Professional Practice Gap and Educational Need: One-handed procedure in a small operation field limits the indications for transcanal endoscopic ear surgery in cholesteatoma surgery.

Learning Objective: To learn advantages and feasibility of an ultrasonic bone curette in transcanal endoscopic ear surgery.

Desired Result: The transcanal endoscopic approach to the antrum using the powered instruments proved to be less invasive and more functional. The ultrasonic bone curette, a one-handed device containing a suction-irrigation system, is an appropriate drilling tool that enables the extension of indications for TEES.

Received IRB Approval

10:31 am

Vascularized Reconstruction of Partial External Auditory Canal Wall Defects

Michael B. Gluth, MD

Objective: To review indications and surgical outcomes for vascularized reconstruction of various partial canal wall defects utilizing the middle temporal artery (MTA) rotational flap.

Study Design: Retrospective review, clinical case series

Setting: Academic tertiary referral center

Patients: Consecutive adults that underwent attempted reconstruction of various partial canal wall defects with the MTA rotational flap by a single surgeon.
Intervention(s): Review of demographic data, underlying pathology prompting surgery, nature of canal wall defect, operative technique, and time/success of canal wall healing.

Main Outcome Measure(s): Rate of complete canal wall healing/ epithelialization by 6 weeks post-op.

Results: 18 consecutive cases were reviewed. Underlying canal wall pathology included: cholesteatoma, iatrogenic (intentional and unintentional), osteonecrosis, and canal-mastoid fistula. Canal wall defects most commonly involved the medial canal wall at the posterior-superior aspect; however, defects of the posterior wall, inferior wall, and bone-cartilage junction were also treated. In all cases, the canal wall was completely healed and epithelialized by 6 weeks post-op. In a 2 cases, the MTA was violated by previous surgery; however, a smaller vascularized flap based on remnant blood supply was successfully utilized in each case.

Conclusions: The MTA flap is useful as a thin-pliable flap that can be applied as vascularized reconstruction material for various partial canal wall defects, affording rapid healing and epithelialization. This technique may be particularly useful in the settings of osteonecrosis and chronic infection where introduction of a vascularized canal wall lining is particularly desirable.

Define Professional Practice Gap and Educational Need: 1. Lack of awareness regarding the potential application of the middle temporal artery rotational flap in otologic surgery 2. Lack of contemporary knowledge regarding techniques to introduce vascularized soft tissue into the ear when canal wall osteonecrosis, bone erosion, or infection are present.

Learning Objective: To describe the technique and associated outcomes of vascularized reconstruction of various canal wall defects utilizing the rotational middle temporal artery flap--in particular when osteonecrosis or infection are present.

Desired Result: Attendees will utilize knowledge regarding vascularized reconstruction of partial canal wall defects to augment their surgical outlook as a potential reconstructive option in otologic surgery.

Received IRB Approval

10:39 am

Regenerative Treatment for the Soft Tissue Defect of External Auditory Meatus

Shin-ichi Kanemaru, MD, PhD; Hiroo Umeda, MD, PhD
Rie Kanai, MD; Takuya Tsuji, MD
Fumiko Kuboshima, MD; Misaki Yamamoto, MD

Objectives/Hypothesis: To establish regenerative treatment for the soft tissue defect of external auditory meatus (EAM) without conventional surgical therapy.

Study Design: Clinical pilot study with control

Materials and method: 63 patients with new/old EAM defect without active inflammation were randomly selected. Their ages ranged from 12 to 86, with the average age of 58. Materials for EAM defect repair were gelatin sponge with basic fibroblast growth factor (b-FGF), fibrin glue and medical cellophane. They were divided into 2 groups with(n=53)/without(n=10) b-FGF.
After creating a mechanical disruption of the EAM defect edge under the microscope, a gelatin sponge immersed in b-FGF was placed over the defect. It was covered by fibrin glue. In case with almost entire EAM defect, EAM was filled with a gelatin sponge immersed in b-FGF and auricle was wrapped in medical cellophane. At 3 weeks later, crust over the defect was removed.
In case complete closure of the EAM defect was not achieved, the above same treatment was performed repeatedly. The final estimation was performed 3 months after the treatment.

Results: Complete closure of the EAM defect was achieved in 94.3%(50/53)/20%(2/10) patients of with/witout b-FGF within 3 time treatments, respectively. No inflammation/infection and severe sequela were observed in all patients.

Conclusions: The study demonstrated that the combination of a gelatin sponge, b-FGF and fibrin glue was effective for regeneration of the EAM defect. This is the innovative regenerative therapy: easy, simple, cost-effective and minimum-invasive method for the patients with EAM defect.

Define Professional Practice Gap and Educational Need: At the conclusion of this presentation, the participants should be able to know how to regenerate the external auditory meatus defect without conventional surgical therapy.

Learning Objective: This new tissue engineered treatment will change the former concept of the oto-surgery.

Desired Result: The study demonstrated that the combination of a gelatin sponge, b-FGF and fibrin glue was effective for regeneration of the EAM defect. This is the innovative regenerative therapy: easy, simple, cost-effective and minimum-invasive method for the patients with EAM defect.

Received IRB approval

10:47 am

Split Thickness Skin Grafting in Canal Wall Down Tympanomastoidectomy

Stephen J. Wetmore, MD, MBA
Hope A. Bueller, MD; Jamey L. Cost, MD

Objective: To characterize the effects of a split thickness skin graft (STSG) on the healing of the mastoid cavity in patients undergoing canal wall down (CWD) procedures.

Study Design: A prospective randomized study.
Setting: Tertiary referral center.
Patients: Twenty-four patients, ages 21-82, with a diagnosis of cholesteatoma, undergoing CWD tympanomastoidectomy for the first time.

Intervention: Placement of a STSG to line the mastoid cavity at the time of surgery.

Main Outcome Measures: The primary outcome was the amount of time required for epithelialization of the mastoid cavity. Secondary outcomes included post-operative complications, specifically, presence of otorrhea, granulation tissue, meatal stenosis, or tympanic membrane perforation.

Results: Twenty-four patients met inclusion criteria. Thirteen patients were randomized to the study group and eleven patients to the control group. Data was collected at follow-up appointments scheduled at post-operative weeks three, six, nine and twelve as well as every six months thereafter. Average time for successful epithelialization of the cavity in the STSG group was 3.2 weeks. Average time for successful epithelialization of the control group was 6.6 weeks. Using a one-sided two sample t-test, this was found to be statistically significant with a p-value of 0.000137. There was no significant difference in complications rates between the two groups.

Conclusion: Placement of a STSG is a technique available to the otologist to facilitate rapid healing and epithelialization in patients undergoing CWD tympanomastoidectomy.

Define Professional Practice Gap and Educational Need: Lack of awareness of options for surgical treatment for patients requiring canal wall down mastoid procedures

Learning Objective: Learn the advantages of using a split thickness skin graft to line the mastoid cavity when performing a canal wall down procedure.
Compare the complications of using a skin graft versus standard treatment of the mastoid cavity during canal wall down surgery for patients presenting with cholesteatoma.

Desired Result: The attendee will learn the pros and cons of use of a split thickness skin graft in the treatment of the patient who is undergoing canal wall down surgery for treatment of cholesteatoma. The presentation will enhance the surgeon's armamentarium in performing canal wall down mastoidectomy procedures.

Received IRB approval

NO. 2-069
Identification of COCH gene mutation in exon 5 of the LCCL Domain in Archived DFNA9 Temporal Bone

Joni K. Doherty, MD, PhD; Jamie Treadway
Jose N. Fayad, MD; Robert Gellibolian, PhD
Fred H. Linthicum, Jr., MD

Hypothesis: Correlation of genotype and otopathological phenotype is feasible.

Background: DFNA9 is an autosomal dominant nonsyndromic hereditary hearing loss due to heterozygous mutation in the COCH gene, encoding cochlin. Manifestations of DFNA9 include adult onset progressive sensorineural hearing loss and vestibular dysfunction. Our laboratory and others have described the histopathology of DFNA9, including cartilage deposits in the tympanic membrane, mucosa, and ossicular joints. However, patients usually progress to anacusis prior to developing a conductive or mixed hearing loss due to tympanic membrane stiffness or ossicular chain fixation.

Methods: Extraction of protein and genomic DNA from archived celloidin-embedded temporal bone was performed. Proteomic analysis identified an LCCL domain mutation in cochlin. DNA was amplified using PCR with primers designed to flank exon 5 of the LCCL domain, spanning the region corresponding to the predicted mutation. PCR products gel purified and sequenced.

Results: Sequencing of PCR products from the DFNA9 temporal bone revealed a heterozygous single nucleotide G→A transition at residue 6328 within exon 5, which was predicted to result in an A119T (Ala to Thr) amino acid change in the cochlin protein product.

Conclusions: We have verified a mutation in the COCH gene identified at the protein level via proteomic analysis from archived formalin fixed celloidin-embedded temporal bone. LCCL domain mutains in COCH have been shown to result in misfolding and oligomerization of cochlin, resulting in cytotoxicity. To our knowledge, this is the first report of an hereditary hearing loss mutation identified in archived temporal bone tissue.

Define Professional Practice Gap and Educational Need: Lack of contemporary knowledge of hereditary causes for sensorineural hearing loss.

Learning Objective: This presentation will educate the listeners on hereditary hearing impairment disorders and their manifestations.

Desired Result: Attendees will be able to cite the most common genetic mutations known to be associated with hereditary hearing impairment.

Received IRB approval

NO. 2-070
Social Media Effectively Increased the Awareness of Cochlear Implants as a Treatment for Severe to Profound Hearing Loss

Douglas D. Backous, MD; Dana Lewis

Hypothesis: Social media effectively increased the awareness of cochlear implants as a treatment for severe to profound hearing loss.

Background: The estimated market penetration for cochlear implants in the USA varies between 9-13% in spite of on-going local and national awareness campaigns by CI centers, citizen groups and manufacturers. Women and young adults are the main subscribers of social media and also represent the principal medical decision makers for children and the aging population.

Methods: We hosted a coordinated effort to increase CI awareness from 9/3- 10/10/12. Two public service videos were released weekly on YouTube. On 10/2/12 a CI surgery was live-Intagrammed in the form of still photos and narrations on Twitter. One week later the CI activation was live streamed followed by two live chat sessions hosted on Twitter. The entire program was archived for store-forward viewing with Storify. Respondents were surveyed live as to why they were following. Media placements, PR impressions and the number of directly engaged individuals was calculated. This was approved by corporate compliance and no CI manufacturer involvement was used.

Results: 1142 individuals (in over 10 countries) directly engaged with the live chats. To date, 118.2 million PR impressions, 7 local and national television stories, three syndicated radio spots, and placements in Forbes, Social Media Today, Mashable.com, The Wall Street Journal.com, USA Today / MSNBC, Yahoo News, Neatorama, Healthcare Communications, Northwest Primetime, and KING-5 TV (NBC) have been made.

Conclusions: Social media is an effective tool for increasing awareness for cochlear implants.

Define Professional Practice Gap and Educational Need: This presentation will address the practice gap in efficient and ethical distribution of medical knowledge in order to increase public awareness of medical interventions.

Learning Objective: Delegates will be able to apply social media methods in order to increase awareness of medical interventions germane to their clinical practices.

Desired Result: Delegates will feel comfortable using social media as a method to improve patient service and care.

Received IRB Exception- certified by Corporate Compliance for all activities.

NO. 2-071

Timing Discrepancies of Early Intervention Hearing Services in Urban and Rural Cochlear Implant Recipients

Matthew L. Bush, MD; Mary Burton, AuD
Ashley Loan; Jennifer B. Shinn, PhD

Objective: The purpose of this study was to examine the timing of early intervention diagnostic and therapeutic services in cochlear implant recipients from rural and urban areas.

Study design: Retrospective case series review

Setting: Tertiary referral center

Patients: Children with severe congenital sensorineural hearing loss who subsequently received cochlear implant as a part of their rehabilitation were examined. All children underwent diagnostic and therapeutic services at a single regional comprehensive hearing center.

Intervention(s): Diagnosis, amplification, and eventual cochlear implantation for all patients in the study

Main outcome measure(s): Timing of definitive diagnosis, amplification, and cochlear implantation for children from urban and rural regions were examined.

Results: Children with congenital hearing loss were diagnosed at a median age of 13 weeks after birth. Children from rural regions obtained amplification at a median age of 36.8 weeks after birth, while children from an urban area were amplified at 21.6 weeks after birth. Cochlear implantation was performed at a median age of 156 weeks after birth in those from rural areas and at 104 weeks after birth in urban-dwelling patients.

Conclusions: Children that fail newborn hearing screening in rural regions can be diagnosed in a timely manner; however, utilization of rehabilitative services and treatments are frequently delayed compared with those patients that reside in urban areas that are closer to tertiary medical and hearing centers of excellence.

Define Professional Practice Gap and Educational Need: 1) Inconsistencies in the timing of early hearing intervention services in urban and rural regions, 2) Lack of awareness of delayed diagnosis and treatment of pediatric congenital hearing loss in rural regions

Learning Objective: 1) Define the timing of diagnosis and treatment of pediatric congenital hearing loss in rural and urban regions. 2) Discuss characteristics of cochlear implant recipients from rural and urban regions

Desired Result: Attendees will utilize this knowledge to pursue timely diagnosis and treatment for patients with pediatric congenital hearing loss from rural regions

Received IRB approval

NO. 2-072
Contemporary Surgical Management of Cholesteatoma in the Only Hearing Ear

Matthew L. Carlson, MD; Richard F. Latuska Jr, BS
Alejandro Rivas, MD; Marc L. Bennett, MD
George B. Wanna, MD; Michael E. Glasscock, III, MD
David S. Haynes, MD

Objective: To describe the evolution in surgical management of cholesteatoma in the only hearing ear

Study design: Retrospective case series spanning the last 30 years
Setting: Single tertiary referral center
Patients: All patients that underwent cholesteatoma surgery with profound hearing loss in the contralateral ear
Intervention(s): Cholesteatoma surgery
Main outcome measure(s): Surgical strategy, postoperative audiometric outcomes, short and long-term complications, recidivism

Results: Thirty patients met inclusion criteria and the mean duration of postoperative audiometric follow-up was 48 months. Patients undergoing surgery in the latter half of the study period underwent intact canal wall mastoidectomy (CWUM) 5 times more frequently (P=0.01) despite having similar severities of disease. All patients with inner ear fistulae underwent a canal wall down mastoidectomy (CWDM). Immediate postoperative and most recent audiometric performance was stable or improved in 90% and 83% of subjects respectively. Three patients acquired delayed profound mixed hearing loss despite undergoing CWDM without recurrence. None of the patients with CWUM experienced worsening sensorineural hearing loss while 1 subject recurred.

Conclusions: The surgical management of cholesteatoma in the only hearing ear remains controversial. Over the last 30 years, the authors have modified their approach favoring CWUM in the absence of inner ear fistulae. This strategy has been influenced by advancements in preoperative imaging, intraoperative endoscopy, postoperative imaging surveillance options and the potential for cochlear implant "salvage" in the rare case of profound hearing loss. Based on the current series, this approach appears safe when performed by an experienced surgeon and long-term patient follow-up is maintained.

Define Professional Practice Gap and Educational Need: There currently exists a lack of knowledge concerning the contemporary surgical management of cholesteatoma in the only hearing ear.

Learning Objective: The learning objective of this talk is to describe the evolution in surgical strategy and a modern approach to managing cholesteatoma in the only hearing ear.

Desired Result: The desired result is that based on a more complete understanding of the efficacy and safety of cholesteatoma surgery in the only hearing ear, clinicians will apply this information to make informed decisions when determining surgical strategy and be able to convey accurate expectations and risks of surgery during preoperative counseling.

Received IRB approval

NO. 2-073
Melanin - An Inflammatory Marker in Chronic Middle Ear Disease?

Mark A. Fritz, MD; Pamela C. Roehm, MD, PhD
Michael A. Bannan, MD; Anil K. Lalwani, MD

Objective: Melanin is a pigmented polymer with a putative role in dermal solar protection. In vertebrates, melanogenesis has been reported in leukocyte population suggesting a potential role in innate immunity. In this study, we report the novel finding of melanin associated with chronic inflammation and speculate on its potential role in the middle ear and mastoid.

Study Design: Retrospective review of case series

Methods: Medical records of 6 patients who demonstrated melanin in the ear were reviewed.

Results: Six patients were identified with extracellular melanin within middle ear and/or mastoid air cells at time of surgery. The age of the patients were 1 to 63 years. Two pediatric patients had chronic OM noted at time of cochlear implantation; remaining 4 adult patients had cholesteatoma (n=2), chronic suppurative OM (n=2) and coalescent mastoiditis (n=1). Histologically, extracellular melanin was identified by Fontana-Masson stain; absence of melanocytes was confirmed by the absence of Melan-A and Prussian Blue stain. One patient had a positive stain for CD163 for the presence of macrophages.

Conclusion: This case series is the first demonstration of extracellular melanin within middle ear mucosa not associated with melanocytes or metastatic melanocytic lesions. The presence of melanin is either a variant of normal anatomy, a pathway of cholesteatoma formation, or a marker of the inflammatory immune response. Melanin's presence in the setting of inflammation suggests that there may be a heretofore unreported link between the pigmentary and immune systems.

Define Professional Practice Gap and Educational Need: 1) Lack of evidence in the literature regarding the presence of melanin without melanocytes in chronic middle ear diseased mucosa

Learning Objective: to present a retrospective case series that identifies patients that have melanin within their chronically diseased mastoids and middle ear spaces without melanocytes or melanocytic lesions; to present a current review of literature; and to hypothesize the cause for its presence.

Desired Result: attendees will hopefully listen to the presentation and then be driven to ascertain why melanin is present in diseased mastoids and ponder its role in the pathogenesis of chronic middle ear disease and immunogenesis in general.

Received IRB exemption

NO. 2-074
Management of Endolymphatic Sac Tumor: Sporadic Cases and Von Hippel-Lindau Disease

Jerome Nevoux, MD; Catherine Nowak, MD
Christine Lepajolec, MD; Olivier Sterkers, MD, PhD
Stéphane Richard, MD, PhD; Serge Bobin, MD

Objective: Analyze difference between endolymphatic sac tumor (ELST) in sporadic cases and in von Hippel-Lindau (VHL) disease.

Study design: Retrospective case review in a tertiary referral center.

Patients and Methods: Thirteen cases of ELST were reviewed since 1995. We analyzed: initial symptoms, characteristics of the tumor, treatment, sequella and follow-up for each group.

Results: The mean age at first time surgery was 26 years [12-41]. All patients but 2 present a unilateral tumor. Initial symptoms were vertigo (n=5), hearing loss (n=8) and/or tinnitus (n=2). Preoperative embolization was performed for 3 patients. The size of the tumor was significantly more important in sporadic case (30mm) than in VHL disease (19.4mm). The surgeons found two types of tumor: infiltration inside bone with moderate bleeding but invading the surrounding structure (durra-mater or jugular bulb) arising especially in sporadic cases and cystic tumor with massive bleeding in VHL disease.
Two patients were not operated but follow up for 6 years without growing of the small lesion. They died of metastasis from gastric and kidney cancer. Four recurrences occurred during the 4 years of follow-up. We observed one malignant transformation of a tumor after two recurrences and radiotherapy. Four facial palsies and five profound deafness were encountered postoperatively.

Conclusion: Complete surgical resection should be the aim of treatment. Preoperative angiography is recommended with embolization when possible. Sporadic tumor seems to be more aggressive than in VHL disease. Postoperative radiotherapy must be avoid to prevent malignant transformation.

Define Professional Practice Gap and Educational Need: Lack of awareness in this rare tumor with delay in diagnosis and treatment. Lack of important series and general.

Learning Objective: made the diagnosis earlier. performed the right treatment for each case.

Received IRB approval

NO. 2-075
Auditory and Vestibular Phenotypes Associated with GATA3 Mutation

Wade Chien, MD; Jennifer W. Leiding, MD; Amy P. Hsu, BA
Chris Zalewski, MA; Kelly King, AuD, PhD
Steven M. Holland, MD; Carmen Brewer, PhD

Objective: To report the auditory and vestibular phenotypes of patients with GATA3 mutation.

Study design: Case series of 6 patients

Setting: Tertiary referral center

Patients: All patients had the classic triad of GATA3 deficiency: hypoparathyroidism, renal disease, and deafness. Patients (29-60 years old, mean age 42.5 years, 3M/3F) were confirmed to have heterozygous mutations involving the GATA3 gene by genetic analysis.

Interventions: Audiometry, distortion product otoacoustic emission (DPOAE) and auditory brainstem responses (ABR) were used to assess hearing. Rotational vestibular testing was used to assess vestibular function.

Results: Patients with GATA3 mutation presented with hearing loss during childhood. The mean pure tone average was 67 dB (range 50-83 dB, SD 9.3). The average speech discrimination score was 73% (range 36-100%, SD 15.9). DPOAEs were absent in all patients. ABRs were remarkably robust and provided no evidence of retrocochlear dysfunction. Some patients complained of dizziness, but rotary chair testing testing was normal.

Conclusions: Patients with GATA3 mutation present with early onset sensorineural hearing loss. DPOAEs were absent in all patients, indicating outer hair cell dysfunction. Some patients complained of dizziness, but vestibular testing was normal.

Define Professional Practice Gap and Educational Need: Lack of awareness, lack of comtemporary knowledge

Learning Objective: To understand the auditory and vestibular phenotypes of patients with GATA3 mutation

Desired Result: To recognize the auditory and vestibular phenotypes of patients with GATA3 mutation

Received IRB approval

NO. 2-076
High-resolution CT Scan in Superior Canal Dehiscence Diagnosis: a Correlation Between Coronal and Multiplanar Reformatted Images

Lina Zahra Benamira; Musaed Alzahrani MD
Manon Bélair MD; Issam Saliba MD

Objective: To determine the correlation between the number of slices on a coronal CTscan and a multiplanar reformatted images for diagnosis of superior canal dehiscence(SCD).

Study design: Retrospective case review

Setting: Tertiary referral center

Patients: Patients who underwent high resolution (HR) temporal bone CT scan

Intervention(s): 0.6mm slices of a HRCT scan

Main outcome measure(s): number of coronal slices and the size of SCD on multiplanar reformatted images

Results: 3428 temporal bones were selected from our radiologic data base. 216 have been found dehiscent on coronal images with a number of slices ranging from 1 to 14. A real dehiscence was visible in only 104 after a multiplanar reconstruction. These results involve a number of true positive of 48.1%. Receiver operating characteristic (ROC) analysis for the number of coronal slices showed a sensitivity of 75.9% (CI 95% [74.3%; 88.8%]) and specificity of 82.7% (CI 95% [67.2%; 82.9%]) when 4 and more coronal slices displayed a SCD. Lowering the number of slices to at least 3 increases the sensitivity to 87.5% but decreases the specificity to 56.7%. Finally we found a statistically significant association between the number of coronal slices showing SCD and the size of the dehiscence ($p<0.001$).

Conclusions: There is an association between the number of coronal slices showing SCD and the presence of a dehiscence and its size on a multiplanar reconstruction which is directly proportional. Because real dehiscence was present on 5 cases with a 1 positive slice on a coronal view, multiplanar reconstruction of images is always mandatory.

Define Professional Practice Gap and Educational Need: Incomplete management of superior canal dehiscence when coronal CTscan shows the dehiscence only on one slice especially when multiplanar reconstruction is not available.

Learning Objective: 1) To estimate the probability of a true dehiscence when multiplanar reconstruction is not available. 2) To recognize the importance of Multiplanar reconstruction even with only one slice shows SCD on coronal plan.

Desired Result: To be able to assess the size of a dehiscence when multiplanar reconstruction is not available

Received IRB Approval

NO. 2-077

Reversible Cochlear Function with ANCA-associated Vasculitis Initially Diagnosed by Otologic Symptoms

Naohiro Yoshida, MD, PhD; Mariko Hara, MD
Masayo Hasegawa, MD; Akihiro Shinnabe, MD
Hiromi Kanazawa, MD; Yukiko Iino, MD, PhD

Objective: To present eight cases with hearing loss as an initial symptom of anti-neural cytoplasmic antibodies (ANCA)-associated vasculitis, involving granulomatosis with polyangiitis (GPA), and to discuss the treatment and mechanisms of hearing outcome after immunosuppressive therapy.
Study design: Retrospective case review.
Setting: Tertiary referral center.
Patients: Eight patients were referred to our university hospital between 2004 and 2012 for intractable otitis media with acute progressive mixed (conductive and sensorineural) hearing loss and facial palsy.
Intervention(s): Diagnostics and treatment.
Main outcome measures: Otologic symptoms as initial manifestations of ANCA-associated otitis media and cochlear function after treatment.
Results: Eight cases (six females, two males; age from 54 to 73 years; six MPO (myeloperoxidase)-ANCA positive, two PR3 (proteinase 3)-ANCA positive cases) were included in this study. Progressive hearing loss (100%) and hemi/bilateral facial palsy (62.5%) were present in the patients for 6.75±4.3 months before diagnosis. Patients with hearing levels better than 95 dB were improved with good speech discrimination and otoacoustic emission (OAE) after immunosuppressive therapy, but the completely deaf could not be recovered. All patients have been successfully controlled for 1 to 8 years without any systemic disorders.
Conclusions: This study showed the difficulty of diagnosing localized GPA and the effectiveness of immunosuppressive therapy for hearing loss at an early stage. Based on these results, early-stage ANCA-associated vasculitis would be limited at stria vascularis which generates endocochlear potentials. ANCA-associated otitis media is a new entity among the causes of intractable otitis media and progressive hearing loss.
Define Professional Practice Gap and Educational Need: Lack of awareness of the aberrant expression of a protein commonly used as an internal control when investigating proteins differentialy expressed in sporadic vestibular schwannomas Anti-neural cytoplasmic antibodies (ANCA)-associated vasculitis (AVV), involving granulomatosis with polyangiitis (GPA) is potentially lethal because of its systemic disorders. Hearing loss in the clinical course of AVV had been reported, however hearing loss as the initial symptom of AVV is rare and the mechanism of reversible cochlear function of AVV had not been reported.
Learning Objective: 1) AVV patients with hearing levels better than 95 dB were improved with good speech discrimination and otoacoustic emission (OAE) after immunosuppressive therapy, but the completely deaf could not be recovered. 2) This effectiveness of immunosuppressive therapy for hearing loss at an early stage indicates AVV would be limited at stria vascularis which generates endocochlear potentials. 3) All patients diagnosed by the initial otologic symptoms have been successfully controlled for 1 to 8 years without any systemic disorders.
Desired Result: Some patients present the otologic symptom as initial symptom of AVV. This presentation shows that cochlear function of AVV at early stage is reversible. However, once the hearing level reaches to the completely deaf, the cochlear function is not recovered. The role of otologist is important for early detection of this disease. ANCA-associated otitis media is a new entity among the causes of intractable otitis media and progressive hearing loss.

Received IRB Approval

NO. 2-078
Advantages and Feasibility of Transcanal Endoscopic Myringoplasty

Takatoshi Furukawa, MD; Tomoo Watanagbe, MD
Tsukasa Ito, MD; Toshinori Kubota, MD
Seiji Kakehata, MD

Objective: When performing transcanal myringoplasty under a microscope, it is sometime difficult to confirm the total circumference of the perforation in cases where the external ear canal is narrow and/or protruded. In such cases, an approach using retroauricular incision is usually selected. The advantages and feasibility of transcanal endoscopic myringoplasty were examined.

Study design: A prospective case series.

Setting: Tertiary referral center.

Patients: Transcanal endoscopic myringoplasty was performed on 22 ears in 20 patients with chronic otitis media between September 2011 and September 2012.

Intervention: 0-, 30- or 70-degree angled rigid endoscopes, 2.7 mm in the outer diameter (Karl Storz), were used with a high-definition video system. Comparison of the two fields of view provided by a microscope or an endoscope was performed in 10 ears, to examine the merits and demerits of each.

Result(s): Endoscopic views provided a whole image of the tympanic membrane in one field and clear visualization of the perforation edges even when the ear canal was curved. This facilitated reliable refreshing of the perforation edges and grafting. The anterior edge of the perforation was not visible under microscopy in 3 out of 10 ears. Under an endoscopic wide view, the tympanic cavity was observable through the perforation, and especially with large perforations, the orifice of tube, ossicular chain and tympanic isthmus were detected.

Conclusion(s): As opposed to conventional microscopic methods, transcanal endoscopic myringoplasty does not require surgical exposure such as retroauricular skin incision to get an anterior view, and has superior visualization and operability.

Define Professional Practice Gap and Educational Need: When performing transcanal myringoplasty under a microscope, it is sometime difficult to confirm the total circumference of the perforation in cases where the external ear canal is narrow and/or protruded. In such cases, an approach using retroauricular incision is usually selected.

Learning Objective: The advantages and feasibility of transcanal endoscopic myringoplasty were examined.

Desired Result: As opposed to conventional microscopic methods, transcanal endoscopic myringoplasty does not require surgical exposure such as retroauricular skin incision to get an anterior view, and has superior visualization and operability.

Received IRB Approval

NO. 2-079
Complicated Otitis Media – a Modern Reappraisal

William R. Schmitt, MD; Brian A. Neff, MD
Alexander P. Marston, MD

Objective: Most literature regarding acute complications of otitis media (OM) draws upon data collected in the pre-antibiotic era or from developing nations. We aim to better understand the nature of complicated OM presenting in the modern health care environment.

Study Design: Retrospective chart review.

Setting: Tertiary academic institution.

Patients: 33 patients presenting with intracranial and intratemporal complications of OM (excluding coalescent mastoiditis) between 1996 and 2012 were evaluated.

Interventions: All patients were treated with intravenous antibiotics and tympanostomy tube placement. When indicated, additional surgery was usually performed transmastoid.

Main outcome measures: Symptomatic and imaging presentation.

Results: 19/33 (58%) of patients were male. The average age at presentation was 48 years (range 1-93). There were 8 cases of bacterial meningitis, 2 of otitic hydrocephalus, 1 of parenchymal brain abscess, 3 of acute petrositis, 9 of facial palsy, 9 of labyrinthitis, and 1 of dural venous sinus thrombophlebitis. We did not observe any cases of subdural or epidural abscess.

Conclusions: The modern presentation of complicated OM discloses intracranial disease in 1/3 of patients. Among patients with intracranial suppuration, bacterial meningitis is much more common than abscess. This finding varies significantly from reports produced in developing nations, in which brain abscess is the commonest intracranial complication.

Define Professional Practice Gap and Educational Need: Our understanding of the acute complications of otitis media is perhaps irrelevant to modern American otologic practice, as most series describing these infections were published in developing nations and in the pre-antibiotic era. This study seeks to modernize the conceptualization of complicated otitis.

Learning Objective: To better understand the clinical features of patients presenting with complicated otitis media over the past 20 years in a demographic with access to modern health care.

Desired Result: Heightened awareness of the modern complications of otitis media will hone the participant's ability to identify patients requiring hospital admission, IV antibiotics, and possibly surgery.

Received IRB Approval

NO. 2-080
Irradiated Rib Cartilage Tympanoplasty - Does it Last?

William R. Schmitt, MD; Brian A. Neff, MD

Objective: To examine the durability of cadaveric irradiated rib cartilage in chronic otitis media.

Study Design: Retrospective chart review.

Setting: Tertiary academic institution.

Patients: 133 ears in 107 patients operated between 1994 and 2002 were evaluated, so our data is limited to subjects with a possible decade of follow-up data.

Interventions: Irradiated rib cartilage was sculpted to augment fascia tympanoplasty and to support ossicular prostheses.

Main outcome measures: Prosthesis extrusion/dislocation and recurrence of cholesteatoma or perforation.

Results: Convalescent data was available for 98 ears. The mean duration of follow-up was 7.4 years. 20/133 (15%) ears required re-operation, 9 (7%) for cholesteatoma, 1 (1%) for perforation, and 6 (5%) for prosthesis extrusion/dislocation. The remaining 4 reoperations were for sequelae unrelated to the cartilage tympanoplasty. We observed no case of disease transmission attributable to use of allograft.

Conclusions: Our data indicate that irradiated rib cartilage affords durable middle ear reconstruction for chronic otitis media in 85% of patients operated in a tertiary setting. Furthermore, its use appears to be safe. This offers another option in the otologist's armamentarium, especially for patients who have a paucity of autogenous cartilage for the defect to be reconstructed.

Define Professional Practice Gap and Educational Need: Autogenous cartilage in tympanomastoid surgery is sometimes unavailable or insufficient to fulfill the reconstructive demands. We have used cadaveric irradiated rib cartilage in tympanic reconstruction over the past 20 years and have previously reported on the short-term outcomes. Concern for resorption and subsequent complications has prompted the current study, which examines long-term outcomes of cartilage tympanoplasty.

Learning Objective: Participants will better understand the durability of allograft cartilage in middle ear reconstruction against the forces of chronic otitis media.

Desired Result: We demonstrate the favorable performance characteristics of irradiated rib cartilage, with comparable cholesteatoma recurrence rates and prosthesis extrusion rates over an average 7.5 years of follow-up. This data helps to increase the otologic surgeon's armamentarium, especially when faced with challenging and resource-limited tympanic reconstruction.

Received IRB Approval

NO. 2-081
Traumatic Superior Semicircular Canal Dehiscence: Case Series and Review of the Literature

Sameer Ahmed, MD; Isaac Yang, MD
Quinton Gopen, MD

Objective: To examine the clinical and radiographic features of superior semicircular canal dehiscence in the setting of temporal bone fractures and general head trauma.

Study: Case series and literature review.
Setting: Tertiary referral center, level 1 trauma center.
Patient: Two trauma patients, ages 47 and 27 years old.

Intervention(s): The patients were identified by history, physical examination, and high-resolution computed tomography. Serial audiologic examinations—including air and bone audiometry, tympanometry, and acoustic reflexes —were performed after the trauma.

Results: After the head trauma, both patients complained of varying degrees of dizziness and disequilibrium along with hyperacusis and pulsatile tinnitus. Audiology revealed a mixed hearing loss in both cases, confirmed on serial audiologic examinations. High resolution CT images showed temporal bone fractures into the superior semicircular canal. In both cases, middle ear explorations were performed and were negative for perilymphatic fistula.

Conclusion: Superior semicircular canal dehiscence represents a third window lesion, which can lead to variable amounts of auditory and vestibular dysfunction. In both of our trauma cases, this included a mixed hearing loss, vestibulopathy, and pulsatile tinnitus. To our knowledge, this is the first case series of temporal bone fractures causing superior semicircular canal deshiscence. A review of the literature yields a discussion about other etiologic factors commonly seen in superior semicircular canal dehiscence.

Define Professional Practice Gap and Educational Need: The current research on superior semicircular canal dehiscence identifies trauma as an etiologic factor. However, there is a lack of contemporary knowledge on the severity of head trauma that is required to produce such a dehiscence.

Learning Objective: We aim to educate the scientific community about patients who had temporal bone fractures that resulted in superior semicircular canal dehiscence. In addition, our literature review will analyze previous cases that cited head trauma as an inciting factor in the development of superior semicircular canal dehiscence.

Desired Result: This will raise awareness about the prospect of temporal bone fractures causing superior semicircular canal dehiscence, and thus enabling clinicians to decrease the chance of a missed diagnosis of a trauma induced semicircular canal dehiscence.Utilize a more appropriate and stable internal control such as glyceraldehyde 3-phosphate dehydrogenase when establishing differential expression of proteins in vestibular schwannomas

Received IRB Exemption

NO. 2-082
Beta-actin Upregulated in Sporadic Vestibular Schwannomas

Sonam Dilwali, BS; Martijn Briet, BS
Konstantina Stankovic, MD, PhD

Hypothesis: Beta-actin (B-actin) is aberrantly expressed in sporadic vestibular schwannomas.

Background: Vestibular schwannomas (VS), the most common tumors of the cerebellopontine angle, are known to comprise of schwann cells with a disorganized cytoskeleton. B-actin, a ubiquitous cytoskeletal protein known to be important in cell migration and proliferation, is usually present in the polymeric filamentous-actin (F-actin) form that can degrade into monomeric globular-actin form depending on cellular requirements. B-actin expression has not been studied in sporadic VS (sVS), and the protein is commonly utilized as a control when investigating proteins differentialy expressed in sVS.

Methods: To identify key modulators within the interactome leading to sVS growth, a bioinformatic network analysis was conducted through Ingenuity Pathway Analysis. Expression of the key modulator, as identified by the central node of the highest scoring network, was quantified through western blot analysis of freshly harvested sVS and healthy great auricular nerves (GAN).

Results: The central node of the most significant network ($p=10^{-38}$) controlling sVS growth was the F-actin form of the actin family, comprising of B-actin, alpha skeletal muscle actin 1, alpha skeletal muscle actin 2, alpha cardiac muscle actin, gamma-1 actin and gamma -2 smooth muscle actin. Immunoblot analysis validated the bioinformatic finding as B-actin expression was 3-fold higher in sVS (n=4) than in GAN (n=4) when glyceraldehyde 3-phosphate dehydrogenase was utilized as a protein-loading control ($p=0.008$).

Conclusion: B-actin is expressed at significantly higher levels in sVS than in healthy nerves, indicating that B-actin should not be used as a protein loading control in sVS studies.

Define Professional Practice Gap and Educational Need: Lack of awareness of the aberrant expression of a protein commonly used as an internal control when investigating proteins differentialy expressed in sporadic vestibular schwannomas

Learning Objective: To understand the aberrant expression of beta-actin in sporadic vestibular schwannomas

Desired Result: Utilize a more appropriate and stable internal control such as glyceraldehyde 3-phosphate dehydrogenase when establishing differential expression of proteins in vestibular schwannomas

Received IRB Approval

NO. 2-083
Where Do Middle Ear Implants Fit in the Rehabilitation of Patients With Sensorineural Hearing Loss?

Michael E. Glasscock, III, MD; Matthew L. Carlson, MD

Objective: To determine where middle ear implants fit in the rehabilitation of patients with sensorineural hearing loss.

Data Sources: Eligible studies were identified through searches of electronic databases Ovid MEDLINE and PubMed.

Study Selection: Review of clinical studies of the three FDA approved middle ear implants (MEIs) currently for use in the rehabilitation of patients with sensorineural hearing loss.

Data Extraction: Data extracted included classification of sensorineural hearing loss in the U.S., functional gains, word recognition and patient surveys of hearing aids and MEIs.

Results: The clinical studies included in this review show that, for patients with moderate to severe sensorineural hear loss, MEI's provide improved functional gain of 7.0 - 12 dB and improved audibility and word recognition scores of 12 – 21% over the patients' own best fit hearing aids. Patients in all studies reported a strong preference for MEIs over their hearing aids for sound quality, lack of occlusion, less feedback and overall satisfaction.

Conclusions: Hearing aids use acoustic energy and a column of air to drive the tympanic membrane and ossicular chain. The use of an acoustic speaker produces occlusion, distortion and acoustic feedback. MEIs eliminate these issues. MEIs use electromechanical energy to drive the stapes directly which produces sharper, clearer sound. Lack of acoustic feedback allows for more functional gain in the high frequencies which increases audibility and word recognition.

Define Professional Practice Gap and Educational Need: Lack of awareness.

Learning Objective: Familiarize attendees with the advantages of middle ear implants in the treatment of moderate severe to severe sensorineural hearing loss.

Desired Result: Attendees will have the knowledge to recommend middle ear implants to their patients with sensorineural hearing loss when appropriate.

Key Word: Acoustic Feedback, Distortion, Occlusion, Functional Gain

IRB Approval not required for this type of study

NO. 2-084
Intraoperative Measurement of Skull Bone Vibration during Mastoidectomy Using an Ultrasonic Bone Curette

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Takatoshi Furukawa, MD, PhD; Takuji Koike, PhD
Seiji Kakehata, MD, PhD

Hypothesis: Mastoidectomy using an ultrasonic bone curette (UBC) is as safe for the inner ear as a high-speed drill.

Background: In transcanal endoscopic ear surgery (EES), a minimally invasive, secure and functional technique, we use a UBC instead of a high-speed drill. This device delivers bone cutting, irrigation and aspiration simultaneously, hence the UBC is suitable for one-handed EES. To estimate the effects of UBC on the inner ear, we measured skull vibration caused by the UBC.

Methods: Five patients with cholesteatoma underwent mastoidectomy using a UBC (Sonopet UST-2001, Stryker) and two kinds of high-speed drills. For measurement of skull vibration, Poly Vinylidene DiFluoride (PVDF) film was attached to the forehead. PVDF is a piezoelectric material useful for vibration sensors. The recorded data were transformed to the power spectrum in the frequency domain by Fast Fourier Transform. The average and the peak value of vibration were analyzed in four frequency bands, 1) 200-500 Hz, 2) 500-2000 Hz, 3) 2000-8000 Hz, and 4) 8000-20k Hz.

Results: Between 500 and 8000 Hz, the average value of skull vibration caused by the UBC was smaller than that caused by the high-speed drills and the peak value was significantly smaller than that caused by one kind of high-speed drill ($p < 0.05$). There was no significant difference among the three devices below 500 Hz or above 8000 Hz.

Conclusions: Skull bone vibration caused by the UBC seemed to be at a safe enough level for the inner ear as that caused by high-speed drills.

Define Professional Practice Gap and Educational Need: Lack of contemporary knowledge about the effects of ultrasonic bone curette on the inner ear

Learning Objective: To evaluate the skull bone vibration during mastoidectomy using a ultrasonic bone curette and estimate the safety of ultrasonic bone curette for the inner ear

Desired Result: Transcanal endoscopic ear surgery using a ultrasonic bone curette, a minimally invasive, secure and functional technique, will be widely indicated for cholesteatoma patients.

Received IRB Approval

NO. 2-085
Microbial Flora of Cochlear Implants by Gene Pyrosequencing

Patrick J. Antonelli, MD; Carolyn P. Ojano-Dirain, PhD
Scot E. Dowd, PhD

Objective: To describe the microbial flora associated with cochlear implants (CIs) removed for infectious and non-infectious indications.

Study Design: Prospective, controlled

Setting: Academic, tertiary medical center

Patients: All patients undergoing CI removal

Intervention: CIs were removed with aseptic technique and processed for total deoxribonucleic acid (DNA) isolation.

Main Outcome Measure: 16s DNA 454-pyrosequencing was performed on all CI explant specimens.

Results: All CIs had evidence of microbes. Propionibacterium acnes and Acidovorax facilis were more common on non-infected CIs ($p = 0.005$ & 0.031). Staphylococcus aureus was more common on infected CIs ($p = 0.003$). The microbial profiles associated with CI infection were different from, but overlapped with those of non-infected CIs.

Conclusions: Microbes are present on all CIs, both with and without evidence of clinical infection, but the profiles differ with clinical status. This information may provide the basis for novel strategies to avoid CI loss due to clinical infection.

Define Professional Practice Gap and Educational Need: Lack of contemporary knowledge of microbiology associated with cochlear implants

Learning Objective To better understand the microbial flora associated with cochlear implants in the presence and absence of clinical infection.

Desired Result: Information will be applied to the perioperative management of patients receiving cochlear implants

Received IRB Approval

NO. 2-086
EAR MAPS a New Classification for Congenital Microtia/Atresia Based on the Evaluation of 742 Patients

Joseph B. Roberson, Jr., MD; Hernan Goldsztein, MD
Ashley Balaker, MD; John F. Reinisch, MD

Objective: Describe anatomical and radiological findings in 742 patients evaluated for congenital atresia/microtia by a multidisciplinary team. Describe a new classification method for multidisciplinary communication for patients with congenital microtia and atresia.

Study Design: Retrospective chart review with descriptive analysis of findings.
Setting: Multidisciplinary tertiary referral center
Patients: Patients with congenital atresia/microtia evaluated between the years of 2008 and 2012.
Intervention: Data analysis and description of new classification method for congenital atresia and microtia.

Results: We have developed a new method based on the acronym EAR MAPS (Ear [microtia], Atresia grade, Remnant earlobe, Mandible development, Asymmetry of soft tissue, Paralysis of the face and Syndromes). The acronym has been used to evaluate 742 patients between 2008 and January of 2012. Grade 3 microtia was the most common external ear malformation (75%). Pre-Operative Jahrsdoerfer –Scale was 9 (19%), 8 (39%), 7 (19%), 6 or less (15%). Ten percent of children had varying degrees of hypoplasia of the mandible. Less than 5% of children had an associated syndrome.

Conclusion: Patients with atresia and microtia often require the intervention of audiology, otology, plastic surgery, and maxillofacial surgery to achieve optimal functional and aesthetic reconstruction. Good communication between these different providers is essential for coordination of care. We propose a new classification that efficiently describes the physical and radiologic findings in microtia / atresia patients to improve communication amongst care providers.

Define Professional Practice Gap and Educational Need: Patients with atresia and microtia often require the intervention of multidisciplinary team to achieve optimal functional and aesthetic reconstruction. Good communication between these different providers is essential for coordination of care and current classifications are specific to each specialty but provide an incomplete and partial picture of the patient.\

Learning Objective: - Describe anatomical and radiological findings in 742 patients evaluated for congenital atresia/microtia by a multidisciplinary team. - Describe a new classification method for multidisciplinary communication for patients with congenital microtia and atresia.

Desired Result: Improve communication amongst otologic surgeons, plastic surgeons, and maxillofacial surgeons to achieve optimal functional and aesthetic reconstruction..

Received IRB Exemption

NO. 2-087
Histological Study of Cochleostomy and Titanium Microactuator Implanted in Lateral Wall of Cat Scala Tympani

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Anthony J. Skowronek, DVM, PhD; Oscar A Bermeo Blanco, DVM
Gregory L. Koskowich, PhD; Brenda L. Farmer-Fedor, PhD
Karen E. Elsass, BS

Hypothesis: Implantation of the fully implantable hearing system (FIHS) anchor and non-functioning microactuator showed minor histological effects on inner ear integrity.

Background: A unique implantable hearing system that stimulates perilymph directly in scala tympani requires: 1) surgical cochleostomy without damage to the membranous inner ear or hearing, 2) minimal histological response to the implant, and 3) secure sealing of the device to prevent perilymph leak and infection.

Methods: Eight male cats were surgically implanted. Pre- and post-operative ABRs were performed to evaluate the cat's hearing (reported in a separate paper). At one, two and three months post-op, some of the animals were terminated, temporal bones removed and decalcified, implants removed, bones sectioned and stained with H&E. The eighth bone was suspended in a plastic resin (araldite) with the Ti implant in place, ground down and stained with toluidine blue. All specimens were examined microscopically to assess the histological responses of the cochlea.

Results: The cat cochleae demonstrated fibrous connective tissue, minimal to mild chronic inflammation and slight new bone growth, primarily limited to scala tympani near the implant site. There was no foreign body reaction to the Ti implant. Fibrous tissue and some bone growth sealed the implant in the cochleostomy.

Conclusion: Results of this histological study (combined with ABR data) confirm that with proper surgical technique, the lateral wall of scala tympani can be fenestrated without damage to the cochlea or to hearing. A titanium microactuator implant is well-tolerated by the cochlea.e and habitual sniffing were risk factors for cholesteatoma recurrence after the canal wall up procedure.

Define Professional Practice Gap and Educational Need: New data is available from animal studies for the development of the next generation of implantable hearing devices.

Learning Objective: To describe the histologic results of cochleostomy and implantation of a titanium microactuator in the basal coil scala tympani.

Desired Result: Data supports the safety of properly performed cochleostomy and lack of foreign body response to titanium microactuator in cat cochlea.

Received IRB Approval

NO. 2-088

Improved Sound Localization Following Cochlear Implantation For Single-Sided Deafness: A Case Comparison

Jessica J. Kepchar, DO; Joshua G.W. Berstein, PhD
Arnaldo Rivera, MD

Objective: To determine if cochlear implantation for single-sided deafness, alone or in conjunction with bone-anchored hearing aid, provides improved sound localization. To describe the surgical challenges and placement of a cochlear implant on a patient who has previously received a bone-anchored hearing aid.

Study design: Case Report

Setting: Tertiary Referral Center

Patients: Two male patients with single-sided deafness

Intervention: Cochlear implantation after bone-anchored hearing aid failure compared to cochlear implantation used in conjunction with a bone-anchored hearing aid

Main Outcomes: Subjective patient perception of hearing and objective measurements of sound localization in a free-field spatial-hearing test facility

Results: Subjective reports of improved sound-localization performance with a cochlear implant were confirmed in objective tests

Conclusions: A cochlear implantation alone or in conjunction with a pre-existing bone-anchored hearing aid may yield improved sound-localization ability for patients with single-sided deafness relative to the bone-anchored hearing aid alone.

Define Professional Practice Gap and Educational Need: Little data to support cochlear implantation alone or in conjunction with bone-anchored hearing aid in patients with single-sided deafness

Learning Objective: Sound localization in patients with single-sided deafness following cochlear implantation alone or in conjunction with bone-anchored hearing aid

Desired Result: Consider the use of cochlear implant for single-sided deafness in the event of failure of bone-anchored hearing aid or in conjunction with bone-anchored hearing aid

IRB: Exempt

NO. 2-089
Access to Cadaveric Temporal Bone Dissection Improves Resident Performance on a Standardized Skill Assessment Instrument

Sarah E. Mowry, MD; Marlan R. Hansen, MD

Hypothesis: Increasing numbers of cadaveric temporal bone (CTB) dissection translates to improved scores on a timed microdissection of a CTB.

Background: Recent literature regarding resident education has focused on virtual learning. However advocates for virtual temporal bone drilling admit that there is not yet a substitute for drilling a CTB.

Methods: Retrospective review of resident performance on a standardized instrument during a timed microdisscetion of CTBs. Resident performance on the graded dissection was compared to the number of CTBs drilled during the year. Graded performance was also compared to the total number of CTBs dissected over 4 years of residency. Faculty assessed intraoperative skill of the senior residents. These rankings were compared to the number of CTBs drilled. Comparisons were made using Pearson's and Spearman's correlations.

Results: Comparison of test scores from the most recent resident year to the number of CTBs drilled during the corresponding year correlated well ($r = 0.41$, $p=0.002$). The correlation between the score during the highest year of training and the cumulative number of CTB drilled during residency was even stronger ($r=0.604$, $p=0.005$). Faculty rankings correlated well comparing general surgical skills to TB surgical skills ($r=0.655$, $p=0.008$). Comparing faculty rankings of TB surgical skill to the number of CTB drilled during the final year of residency yielded a negative correlation ($r=-0.8$) but was not significant ($p=0.1$).

Conclusions: Greater exposure to CTB dissection correlates with improved scoring on a standardized instrument. Residents who struggle with temporal bone surgery use CTB dissection more than those who are more facile.

Define Professional Practice Gap and Educational Need: Assess the ongoing need for access to a scarce resource (cadaveric temporal bones)

Learning Objective: Resident education continues to require access to these resources even as other learning modalities become available.

Desired Result: Incorporate and continue to provide access to cadaveric temporal bones into educational opportunities for both residents and practicing clinicians.

Received IRB Approval

NO. 2-090
Reevaluation of Eustachian Tube Function and Habitual Sniffing in Middle Ear Cholesteatoma

Masafumi Sakagami, MD, PhD; Shigeto Ohta, MD
Hirokazu Katsura, MD, PhD; Yasuo Mishiro, MD

Objective: To investigate (1) the function of the Eustachian tube (ET) and the incidence of habitual sniffing and (2) relationship between these two factors and postoperative retraction of the ear drum in middle ear cholesteatoma

Study design: Prospective study

Setting: University hospital

Patients: Between 2007 and 2011, 663 patients underwent primary surgery. They were 217 cases of acquired cholesteatoma, 381 cases of chronic otitis media (COM), and 65 cases of otosclerosis.

Interventions: A questionnaire was conducted regarding the symptoms of patulous tube and habitual sniffing to alleviate ear symptoms. Eustachian tube function was examined by sonotubometry.

Main outcome measures: Relationship among ET function, habitual sniffing and cholesteatoma

Results: ET function of cholesteatoma showed the patulous type in 73/213 (34.3%), stenotic type in 89/213 (41.8%), and normal type in 51/213 (23.9%). The incidence of the patulous type was significantly higher in cholesteatoma than in COM (39/381, 10.2%) ($p<0.01$) and in otosclerosis (2/65, 3.1%) ($p<0.001$). Habitual sniffing was found to be significantly higher in cholestetatoma (62/213, 29.1%) than in COM (26/381, 6.8%) ($p<0.001$) and in otosclerosis (4/65, 6.2%) ($p<0.001$). After the canal wall up procedure (n=156), cholesteatoma recurrence was found to be significantly higher in the group with habitual sniffing continuing after surgery (8/24, 33.3%) than in the group with habitual sniffing stopping after surgery (1/26, 3.8%) ($p<0.05$) or in the group without habitual sniffing (6/106, 5.7%) ($p<0.001$).

Conclusion: Patulous tube and habitual sniffing were risk factors for cholesteatoma recurrence after the canal wall up procedure.

Define Professional Practice Gap and Educational Need: Lack of awareness of (1) Eustachian tube function and habitual sniffing before middle ear surgery, (2) the relationship between these two factors and (3) their effect on outcomes of middle ear surgery

Learning Objective: (1)To learn how much population shows patulous type, stenotic type and normal type among patients with middle ear cholesteatoma, (2)To examine the relationship between patulous type and habitual sniffing, and (3)To clarify the effect of habitual sniffing on the postoperative retraction of the ear canal.

Desired Result: Attendees will be able to pay attention to Eustachian tube function and habitual sniffing before tympanoplasty and apply them for informed consent to the patient.

Received IRB Approval

AOS Clinician-Scientist Award Progress Report
Project: Influence of vestibular dysfunction on fall risk in older individuals
PI: Yuri Agrawal, MD

The aims of this study were: 1) to characterize the vestibular physiologic changes associated with the aging process, 2) to determine the association between specific vestibular physiologic deficits and fall risk in older individuals, and 3) to develop a valid, reliable measure of fall risk that is sensitive to changes in vestibular function in older individuals. With respect to Aim 1, in a prior study of 50 older individuals age 70 and older, we observed a much higher prevalence of semicircular canal dysfunction compared to otolith dysfunction. Our first goal has been to confirm these findings using scleral search coils, which are considered the gold standard test of semicircular canal function, and also to extend these findings by evaluating the new technique of eye movement recording with 3-D video-oculography (VOG) goggles as a measure of canal function in older individuals.

We have completed a study in 7 older individuals who underwent simultaneous eye movement recording with a search coil and VOG during head impulse testing. We observed a significant correlation between angular vestibulo-ocular reflex (AVOR) gain measured using both techniques ($r=0.86$, $p=0.0002$). Moreover, we found that both the search coils and VOG captured specific features of eye movement responses, such as abrupt declines in eye velocity, and compensatory saccades (*manuscript in preparation*). This work will allow us to move forward with testing our cohort of older individuals using VOG to assess semicircular canal function.

Additionally, with respect to Aim 1, we have been developing a testing paradigm to assess age-related changes in high-frequency vs. low-frequency semicircular canal responses. We have tested 2 patients so far in whom we delivered horizontal head impulses in 2 different velocity categories: greater than 200 degrees/second to elicit high-frequency responses and less than 200 degrees/second to elicit low-frequency responses. This testing paradigm is based on prior work in patients with bilateral vestibulopathy (BV) of different etiologies, where we observed differences in AVOR responses to head impulses at these 2 categories of stimulation velocity based on etiology of BV. We observed in these 2 patients that reductions in AVOR gain (and associated compensatory saccade eye movements) are manifest more at the high head impulse velocities, consistent with greater loss of high-frequency semicircular canal responses.

With respect to Aim 2, our collection of prospective falls data is ongoing, and we will report progress on this Aim in the next report.

Finally, we have made progress on Aim 3, which is to evaluate laboratory measures of standing balance and gait as a valid proxy for fall risk. We have been validating the BalanSens (Biosensics, Cambridge, MA), a portable, body-worn device that measures trunk, ankle and center of mass (COM) sway during stance. We have performed a preliminary study in 13 young control subjects and 7 older individuals evaluating the BalanSens COM sway measurements against the gold standard of center of pressure (COP) measurement using force platform posturography. We tested subjects under eyes open and eyes closed conditions, and observed a significant correlation ($r=0.85$; $p<0.0001$) between COM and COP sway measures obtained from the BalanSens and force plate respectively. Validation of the BalanSens as an accurate measure of postural control could allow for the widespread clinical assessment of the postural sequelae of vestibular loss in older individuals.

Progress Report: Characterization of Hippo Signaling during Development and Regeneration of Inner Ear Sensory Hair Cells
PI: Matthew R. Barton, MD

Sensorineural hearing loss (SNHL) – which includes the loss of sensory hair cells (HCs) in the organ of Corti – is responsible for a significant proportion of all hearing impairment. HC regeneration was not considered a viable therapeutic option for SNHL until the early 1980s, when it was discovered that birds and other non-mammalian vertebrates can regenerate sensory HCs after loss due to injury. Unfortunately, mammals do not share this capacity for spontaneous regeneration. By coupling the study of non-mammalian HC regeneration with that of mammalian inner ear developmental mechanisms, we stand to learn key principles that can be applied in engineering HC regeneration in humans. In particular, characterization of the cell signaling mechanisms that regulate establishment of mitotic quiescence and differentiation of sensory progenitors can guide efforts to artificially induce cell cycle re-entry and hair cell differentiation of mature cochlear supporting cells for therapeutic benefit.

The Hippo signaling pathway constitutes an evolutionarily conserved kinase cascade involved in regulation of planar cell polarity, organ size, cell proliferation, and tissue regeneration. Hippo signaling was recently discovered in Drosophila as a potent mechanism that restricts tissue size by limiting cell proliferation and promoting apoptosis. At the core of this pathway is a kinase cascade composed of four tumor suppressors, including Hippo (Hpo), Warts (Wts), and their respective regulatory proteins Salvador (Sav) and Mats. This core set of Hippo signaling components is highly conserved in mammals, and orthologs of Hpo (MST1/2), Sav (SAV1), Wts (LATS1/2), and Yki (YAP1) exhibit similar biochemical properties. In mammals, the MST1/2-SAV1 complex phosphorylates and activates the LATS1/2-MOB1 complex, which in turn phosphorylates and inactivates the transcriptional coactivator and primary Hippo pathway effector YAP1. In its active state YAP1 is unphosphorylated and localized to the nucleus, where it facilitates transcription of target genes associated with cell proliferation, stem cell renewal, and growth. Phosphorylation of YAP1 prevents its nuclear translocation and facilitates its cytoplasmic sequestration and degradation resulting in overall negative regulation of growth. Interestingly, the tumor suppressor gene NF2/Merlin (mutation of which causes Neurofibromatosis type 2) has more recently been identified as part of the core Hippo signaling cascade, and has been shown to negatively regulate cell proliferation by promoting YAP1 phosphorylation.

Illumina RNA sequencing data from our laboratory has revealed that all core Hippo signaling components are robustly expressed in the sensory epithelia of both chickens and mice. In the chicken auditory organ (called the basilar papilla or BP), immunolocalization experiments have demonstrated that YAP1 is present strictly in phosphorylated form and localizes to the cytoplasm of supporting cells (which serve as HC progenitors/stem cells during regeneration) in the quiescent BP. Several other Hippo pathway constituents discretely localize to HCs or SCs. Most surprisingly, we have observed that in the undamaged BP, NF2 localizes to hair cells (not supporting cells), and is distinctly concentrated in both HC stereocilia and, to a lesser extent, HC nuclei. After exposure to streptomycin for eight hours *in vitro*, robust NF2 expression becomes restricted to supporting cell nuclei. RNAseq data obtained throughout the time course (120 hours) of chick sensory regeneration (after streptomycin-induced injury *in vitro*) revealed that YAP1 target genes involved in proliferation and tissue regeneration (i.e. MYC, DIAPH1, E2F1, CCNE2, TP53BP2, others) are upregulated during the acute phase (first 48 hours) of regeneration, while genes involved in cell cycle inhibition are downregulated (i.e. TP63, TP73, others).

(CONT)

In the mouse, experiments have also revealed intriguing patterns of Hippo pathway protein expression during organ of Corti development that suggest possible roles for Hippo signaling in the regulation of both cell cycle exit (YAP1) and hair cell differentiation (SAV1, NF2). Between E12 and E14, YAP1 protein is downregulated within the developing sensory epithelium. Marked by an apex-to-base gradient of YAP1 protein downregulation, this YAP1-negative domain appears to correspond to the well-characterized domain of p27kip1 expression that is not only the hallmark of permanent progenitor cell cycle exit, but also appears in an apex-to-base gradient beginning at approximately E12. In contrast to p27kip1, whose expression becomes restricted to SC nuclei as HC differentiation proceeds, YAP1 protein appears in the cytoplasm of supporting cells and other non-sensory cells of the cochlear epithelium but is distinctly absent from hair cells alone by P0.

Developmental profiling of additional Hippo pathway proteins has also revealed possible roles for SAV1 and NF2 in HC differentiation. SAV1 is expressed broadly throughout the developing sensory epithelium at E13.5, and localizes to discrete domains within developing intercellular contacts at this stage. By E14.5, SAV1-positive cellular contacts begin to accumulate at the medial-most border of the p27kip1-expressing zone of non-proliferating cells. This pattern is present in a base-to-apex gradient, corresponding to the developing inner hair cell region that expresses ATOH1 (but not Myosin VIIa) at this stage. Between E15.5 and E16.5, the SAV1 expression domain gradually becomes restricted to developing hair cells and follows the classic base-to-apex gradient of hair cell differentiation. Interestingly, although SAV1 localization to developing hair cells follows a base-to-apex gradient that is similar to that of Myosin VIIa, it's expression pattern is more mosaic in nature than Myosin VIIa and, cell for cell, does not strictly coincide with the stereotypical pattern of Myosin VIIa expression at this stage. Curiously, by approximately E18 SAV1 protein becomes almost entirely absent from HCs of the organ of Corti.

Similar to the SAV1 developmental gradient described, NF2 appears to follow a base-to-apex gradient that is typical of processes involved in HC differentiation. Despite our observation that NF2 localizes to HCs in the mature basilar papilla, we expected that NF2 protein would localize to supporting cells or other non-sensory cells within the organ of Corti and spiral ganglion given their well-described glial nature. Instead, we again found that NF2 protein, broadly expressed throughout the developing epithelium until around E16.5, became restricted to developing hair cells as the gradient of HC differentiation progressed. By P4, NF2 is present only in HCs along the full length of the organ of Corti. It remains to be seen whether NF2 might play a role in the downregulation of YAP1 within HCs that is so distinct by P0.

In summary, our work represents the first in depth characterization of Hippo signaling in the context of inner ear development and HC regeneration. In mouse and chick, our findings suggest important roles for Hippo signaling in sensory epithelial cell cycle regulation and hair cell differentiation. Future work will focus on further *in vitro* characterization of Hippo signaling proteins after aminoglycoside induced HC damage in both chickens and mice. Using RNAi techniques previously described in our laboratory, we plan to determine whether Hippo signaling is required for proliferative HC regeneration in the BP. In the mouse, we will continue to probe the function of individual Hippo pathway components using Adenoviral gene delivery, which facilitates supporting cell-specific delivery of gene constructs. Specifically, we will first determine whether supporting cell-restricted overexpression of a mutant YAP1 construct that produces constitutively active YAP1 protein is sufficient to drive postnatal supporting cell proliferation and subsequent hair cell regeneration *in vitro*. Finally, we plan to determine whether Hippo signaling is active within mouse inner ear stem cells, and whether Hippo proteins are functionally involved in regulating their self-renewal.

Research Fund of the American Otological Society Inc.
Progress Report: Toward Pathophysiologic Standards for Gentamicin Pharmacotherapy
PI: LF Hoffman

Intratympanic gentamicin has become a widely used treatment for Meniere's disease. Though numerous studies have attempted to establish correlates between tests of vestibular function and treatment efficacy, standards for the relationship between the extent of neuroepithelial lesion and functional output, which will critically ameliorate objective tests of vestibular function, do not exist. Such standards will enable rigorous objective evaluation of the intended vestibular paresis and the efficacy of intratympanic gentamicin treatment for eliminating the symptoms of Ménière's disease.

The histopathology associated with gentamicin administration has historically focused upon hair cell loss. However, data from previous studies of intratympanic gentamicin therapy indicates that gentamicin may also induce *partial* dysfunction that may not involve rampant destruction of hair cells, and there is ample evidence indicating that Scarpa's ganglion neurons and associated dendrites are also targets. In fact, recent evidence from our laboratory suggests that retraction of afferent calyces is more widespread than hair cell loss (Sultemeier and Hoffman, submitted). Furthermore, there is additional evidence to suggest that gentamicin may induce subcellular changes that may not manifest in morphologic anomalies, but may compromise mitochondrial function and induce oxidation of specific proteins. Therefore, the development of pathophysiologic standards should include evaluation of key proteins that may explain functional compromise that may not have a specific morphologic correlate.

The specific aim of this research is to induce partial lesions in the vestibular neuroepithelia through intraperilymphatic gentamicin administration, and to determine the relationship between histologic characterization of the lesions, discharge characteristics among afferent neurons, and the expression of key markers in hair cells and primary afferents.

Results We are conducting experiments to establish the relationship between gentamicin dose and the vestibular histopathology. Our previous studies (Sultemeier and Hoffman, submitted; Hoffman and Sultemeier, in preparation) demonstrated that 1μg (approximately 130μM) intraperilymphatic gentamicin resulted in complete loss of afferent calyces and only modest (≤30%) hair cell loss. However, this level of lesion resulted in complete paralysis of the epithelia to natural stimuli. Consequently, the pathophysiologic extent of these lesions resulting from this gentamicin dose does not mimic clinical findings, and suggests that a smaller dose that produces hypofunction is necessary. We are exploring gentamicin doses of 0.5 – 0.75μg (65 – 100μM) to produce such model lesions. These data are currently under analysis, and will be presented in preliminary form at the 2013 Midwinter Meeting of the Association for Research in Otolaryngology.

A summary of this presentation is appended below.

Background: Clinical investigations of Meniere's disease treatments have demonstrated that partial physiologic dysfunction may be induced by transtympanic gentamicin therapy. However, comparable animals studies have yet to be conducted which would illuminate the cellular correlates of such partial lesions. The goals of the present study were to induce partial lesions of the vestibular epithelia through intraperilympatic gentamicin administration and document the physiologic deficits, and to investigate the associated alterations in key cellular markers within hair cells and afferents.

Methods: Adult male chinchillas underwent a surgical procedure under isoflurane anesthesia to administer 2.5µl of gentamicin solutions through an implanted stainless steel cannula providing direct perilymphatic access at the superior semicircular canal. The concentration of this solution was adjusted so that the final quantity administered was 0.5 or 0.75 µg. After 4 weeks animals were reanesthetized (sodium pentobarbital) for recording spontaneous and evoked discharge from individual afferent neurons projecting in the superior vestibular nerve. At the conclusion of the recording session, vestibular epithelia were harvested for immunohistochemical analysis.

Results: Administration of 0.75µg gentamicin resulted in partial lesions represented by calyx retraction in the central zones of all cristae, and in the utricular striola, while intermediate- and peripheral -zone and extrastriolar calyces exhibited intact morphologies. To date, afferents recorded from these specimens that projected to the horizontal crista exhibited greater CVs for a given spontaneous discharge rate. Coupled with what appear to be low sensitivities and coherence measures in response to stimulus frequencies $\geq$ 1.6Hz, these data suggest lower signal:noise ratios among responding afferents. The phase measures of these responses suggest they may project from remnant dimorphic afferents projecting from the crista central zone. We observed no evidence of induced lesions subsequent to 0.5µg gentamicin, in which the cristae and utriculi exhibited normal distributions of anti-calretinin and anti-KCNQ4 immunoreactive calyces. Afferent discharge characteristics in these specimens could not be distinguished from untreated specimens. Further analyses to reveal hair cell densities and additional cellular markers are ongoing.

Conclusion: These results demonstrate that partial lesions of the vestibular epithelia may be induced by quantities of gentamicin as low as 0.75µg, though the dosage window for producing lesions compatible for detailed study is surprisingly narrow. Calyces projecting to the crista central zones are most severely affected, yet recorded responses indicate that central zone hair cells are functional.

Supported by the Research Fund of the American Otological Society Inc.

Progress Report: AOS Research Grant: Objective Measure of Low-Frequency Auditory Thresholds: A Translational Study
PI: Jeffery T. Lichtenhan, PhD

Patients with Ménière's disease may exhibit low-frequency sensorineural hearing loss. At present, there is no clinically-available objective measure of low-frequency auditory thresholds. The goal of this work is to translate to humans a newly developed electrophysiologic technique for low-frequency auditory thresholds.

During our first six months of funding, the main focus of the project has been on equipment setup and programming. We initially planned to use a commercially available "turnkey" data acquisition system, but found a custom system offering greater flexibility. We have setup a custom system based on National Instruments hardware and the LabVIEW software development environment. While this customizable system requires an initial time-consuming programming and debugging effort, we expect the system to be both efficient and cost-effective for proposed and future protocols that will be implemented towards our long term goal of developing diagnostic and treatment-monitoring techniques for Ménière's disease.

We have begun data collection in humans and have already required changes to the data acquisition protocol. Recording the physiologic signals of interest from humans has proven to be as difficult as we anticipated it might be. Low frequency stimuli were found to produce prolonged oscillations, so that inter-stimulus periods for time averaging cannot be as brief as used for responses to higher frequencies. Some elements of the collection protocol are being evaluated in a parallel project that uses animals, prior to their use in humans. This will allow a better interpretation of results guided by comparing near-field and far-field measures from the putative generators in the same ears. When the collection protocol is fully optimized we will proceed with the human data collection addressing the proposed Aims.

Progress Report: AOS Research Grant: Epigenetic Regulation of Hair Cell Regeneration in Zebrafish Lateral Line
PI: Felipe Santos, MD

Our goal is to investigate the epigenetic mechanism regulating hair cell regeneration in the zebrafish lateral line. Epigenetic mechanisms are the heritable changes, including histone modifications, that regulate transcription independent of changes in the genome. Atoh1 is a transcription factor that is necessary for the specification of hair cells in mammals and zebrafish. We are 1.) using a drug screen approach to assess if pharmacological epigenetic inhibitors can affect hair cell regeneration, 2.) examining the interaction of transcription factors pax2 and sox2, through histone modifications, to induce expression of atoh1 during regeneration, and 3.) will determine if there is a change in the chromatin state at the atoh1 site during regeneration to a euchromatin state.

To investigate the effect of chemical epigenetic modification on hair cell regeneration we have used both histone deacetylase (HDAC) and histone methylase (HMTase) inhibitors as drug treatments during lateral line hair cell regeneration. A neuromast hair cell toxicity screen has been performed for the HDAC inhibitors Valproic acid and Trichostatin A and the methyl transferase inhibitors RG108, Bix-01294 and EZH2. Both Trichostatin and Bix were identified to be toxic to hair cells at all doses tested. Valproic Acid, RG108 and EZH2 were not ototoxic at the doses examined. Using a gamma secretase inhibitor as a positive control known to induce supernumerary proliferation of hair cells during regeneration, valproic acid was not found to affect hair cell regeneration. RG108 was found to decrease the number of hair cells regenerating and the results of the effects of EZH2 are pending.

All experimentation with fish was interrupted for several weeks by mechanical failure of our pump system and subsequent outbreak of velvet disease. The parasite infection was treated though subsequently there was a notable decline in the fecundity of the wildtype adult fish that were replaced. These new adult wildtype fish have been removed from quarantine and have resumed a normal breeding schedule. Immunohistochemical localization of sox2 to a subset of neuromast cells has been performed and we are currently in the process of trying alternate polyclonal antibodies for localizing pax2 expression.

When our transgenic fish with gfp labeled neuromast cells begin breeding, DNA from age matched control neuromasts and neomycin treated neuromasts during the period of regeneration will be isolated using a commercially available chromatin analysis kit (Bio-Rad, Hercules, CA.)Chromatin will be digested in situ with a nuclease. Using real time quantitative PCR we will quantify the level of he accessibility of the entire atoh 1 gene. The HBB gene will be used as a referenced epigenetically silencedcontrol and GAPDH as a constituitively expressed control. By comparing the Cq delay we will determine the epigenetic state of chromatin at the Atoh1 site in regenerating and non-regenerating neuromasts. In the closed chromatin state, atoh1 will not be affected by the nuclease digestion so there will be no quantification delay (Cq delay) during real time PCR. In the euchromatin state we expect to see a Cq delay

Research Fund of the American Otological Society Inc.
Progress Report—Magnetohydrodynamic effects on the Murine Vestibular System
PI: Bryan K. Ward, MD

Recent work by our group demonstrated that static magnetic fields induce nystagmus in humans by peripheral vestibular stimulation and that this effect may be mediated by a magnetohydrodynamic (MHD) force (1). This hypothesis can be tested by changing head orientation within static magnetic fields, but MRI magnet bore dimensions limit the ability to do this with humans. A mouse model of this effect would allow greater flexibility in assessing multiple head orientations. This project's aim is to demonstrate magnetic field-induced nystagmus in mice and assess the influence of otoconia on the MHD response.

We have assessed eye movements in wild-type C57BL/6J mice exposed to a 4.7T Earth-horizontal magnetic field. When placed in the bore nose-first, all mice demonstrated robust left-beating nystagmus lasting approximately 20 seconds on first entry. Mean peak SPV of six mice was 282°/s and the time constant of the decay was 3.62 s (SD 0.39) over the initial interval within the bore. When placed in the bore tail-first, nystagmus direction reversed. When placed in the bore left-ear-first or right-ear-first, few eye movements were observed. Beats of nystagmus direction reversal were seen on a few trials after exiting the bore.

These early findings show that mice exposed to high-strength magnetic fields demonstrate robust magnetic field-induced nystagmus, that similar to humans, is dependent on magnetic field orientation. These findings also further support the hypothesis that static magnetic fields induce peripheral vestibular stimulation through a Lorentz (MHD) force. The peak SPV and decay are both faster than in human subjects and may in part reflect poor velocity storage and relatively weak velocity-to-position integrator in the mouse.

We have developed a colony of Nox3 knockout mice, which lack otoconia, and have made key collaborations with a developmental biology laboratory with expertise in mouse mutations. We intend to model the eye movement response of mice to account for differences between the species and to assess the role of otolith organ function in this response in mice with a targeted deficiency in otoconia development.

Roberts DC, Marcelli V, Gillen JSet al. MRI Magnetic Field Stimulates Rotational Sensors of the Brain. Curr Biol 2011.

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1995	Richard R. Gacek, MD
1996	James L. Sheehy, MD
1997	Mansfield F.W. Smith, MD
1998	Robert A. Jahrsdoerfer, MD
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2006	Richard A. Chole, MD, PhD
2007	Fred H. Linthicum, Jr., MD
2008	H. Ric Harnsberger, MD
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2010	Edwin Rubel, PhD
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1925 - 1927	D. Harold Walker, MD
1927 - 1940	Thomas J. Harris, MD
1940 - 1945	Isidore S. Friesner, MD
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1950 - 1955	John R. Lindsay, MD
1955 - 1960	Lawrence R. Boies, MD
1960 - 1965	James A. Moore, MD
1965 - 1972	Wesley H. Bradley, MD
1972 - 1977	G. Dekle Taylor, MD
1977 - 1982	Cary N. Moon, Jr., MD
1982 - 1987	D. Thane Cody, MD
1987 - 1992	Robert I. Kohut, MD
1992 - 1997	Gregory J. Matz, MD
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1990	H.A. Ted Bailey, Jr., MD
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1992	Michael Glasscock, III, MD
1993	Mansfield F.W. Smith, MD
1994	Robert I. Kohut, MD
1995	Robert A. Jahrsdoerfer, MD
1996	Derald E. Brackmann, MD
1997	Joseph C. Farmer, Jr., MD
1998	Charles M. Luetje, MD
1999	Gregory J. Matz, MD
2000	C. Gary Jackson, MD
2001	A. Julianna Gulya, MD
2002	Richard A. Chole, MD PhD
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2006	John K. Niparko, MD
2007	Antonio De La Cruz, MD
2008	Clough Shelton, MD
2009	Joseph B. Nadol, Jr., MD
2010	Bruce J. Gantz, MD
2011	C. Phillip Daspit, MD
2012	Herman A. Jenkins, MD

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Tampa, FL

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Watertown, MA

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Dallas, TX

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Sarasota, FL

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Hinrich Staecker, MD, PhD (Active 2013)
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Wilmette, IL

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Thomas P.U. Wustrow, MD (Corresponding 2000)
Munchen, Germany

HONORARY MEMBERS
Pedro Albernaz (Honorary 1993)
Miami, FL

Aziz Belal, MD (Honorary 1993)
Alexandria, Egypt

Edgar L. Chiossone, MD (Honorary 1993)
Miami, FL

Graeme M. Clark, PhD (Honorary 2003)
Australia

Ugo Fisch, MD (Honorary 1985)
Erlenbach, Switzerland

Jerome C. Goldstein, MD (Honorary 1992)
Lake Worth, FL

William E. Hitselberger, MD (Honorary 1997)
Pasadena, CA

L.B.W. Jongkees (Honorary 1968)
The Netherlands

Yasuya Nomura (Honorary 1992)
Tokyo, Japan

Michel Portmann (Honorary 1983)
Bordeaux, France

Naoaki Yanagihara, MD (Honorary 2008)
Matsyama, Japan

IN MEMORIUM *(in alphabetical order)*

The AOS Administrative office was notified of the following members death since the last Spring meeting.

Please take a moment of silence to remember this outstanding group of colleagues & friends.

F. Owen Black, MD – Member since 1983
Wesley H. Bradley, MD – Member since 1961
Vijay S. Dayal, MD – Member since 1975
Jack V.D. Hough, MD – Member since 1960
William F. House, MD – Member since 1964
Saumil N. Merchant, MD – Member since 2000