PROGRAM and ABSTRACTS

of the

One Hundred Forty-Third Annual Meeting

AMERICAN OTOLOGICAL SOCIETY, INC.

May 1-2, 2010

Bally's
Gold Room

Paris/Bally's
Las Vegas, Nevada

OFFICERS
JULY 1, 2009—JUNE 30, 2010

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University of Iowa Hospitals & Clinics
Iowa City, IA

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Joseph B. Nadol, Jr, MD
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D. Bradley, Welling, MD, PhD

Accreditation Statement: The American Otological Society (AOS) is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

Credit Statement:
The American Otological Society designates this educational activity for a maximum of 8 *AMA PRA Category 1 Credit(s)*™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Certificate of Attendance will be issued at the close of the meeting upon completion of the questionnaire required by us for the certifying organizations.

AMERICAN OTOLOGICAL SOCIETY, INC.
MISSION STATEMENT

The mission of the American Otological Society, Inc., shall be

- to advance and promote medical and surgical otology/ neurotology and lateral skull base surgery in adult and pediatric patients including the rehabilitation of individuals with hearing and balance disorders.

- to encourage, promote, and sponsor research in otology/ neurotology and lateral skull base surgery and related disciplines.

- to conduct an annual meeting of the members for the presentation and discussion of scientific papers and the transaction of business affairs of the Society.

- to publish the peer reviewed papers and discussions presented during the scientific program and the proceedings of the business meetings.

CME 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 information presented regarding otologic and neurotologic disorders and scientific advances can be translated to improved quality of care as described by the ACGME and the Institute of Medicine.

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, audiologists, 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 supports 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 disorders of 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.

The following competency areas will be addressed through this CME activity/ scientific session

1. **Patient Care** that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health
2. **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
3. **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
4. **Interpersonal and Communication Skills** that result in effective information exchange and teaming with patients, their families, and other health professionals
5. **Professionalism** as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population
6. **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.

PRACTICE GAPS – 2010 AOS Annual Spring Meeting
Authors were asked to choose one or more of the practice gaps to go with their abstract. If the abstract did not fall under any of the gaps listed, it was the responsibility of the author to develop a practice gap.
MIDDLE EAR
1) Practice Gap - Inconsistent awareness or ability to implement strategies for improving conductive hearing loss.
Objective: Proper use of standard and novel strategies for improving conductive hearing losses.
SNHL
2) Practice Gap- Inconsistent or lack of awareness regarding the role of medical therapeutic guidelines in treating SNHL.
Objective: Describing the role of medical therapy in treating SNHL
VESTIBULAR
3) Practice Gap—Inconsistent diagnosis and implementation of medical therapeutic guidelines in treating vestibular disorders.
Objective: Outline or Discuss the role of medical therapy in treating vestibular diseases (medical and surgical therapy).
4) DIAGNOSTICS
Practice Gap- Under-utilization of recommended diagnostic strategies in cochlear and vestibular disease
Objective: Applying appropriate diagnostic strategies to inner ear (cochlear and vestibular) disease.
5) COCHLEAR IMPLANTS
Practice Gap- Lack of awareness/knowledge as to the expected results and
Objective: Outline the expected results and limitations of cochlear implants with respect to patient outcomes and
quality of life.
6) ACOUSTIC TUMORS
Practice Gap— Lack of knowledge of the current standards of care in the treatment of acoustic tumors.
Objective: Define the role of surgery and radiation therapy in treating acoustic tumors.
7) GENETICS
Practice Gap— Lack of or inconsistent knowledge of the genetic influence of inner ear disorders.
Objective: Apply the genetics of inner ear disorders to approaches and recommendations for assessment and treatment.
8) OTHER
Practice Gap—

Goals & Objectives

The overall goal of this course is to provide up-to-date information that focuses on the advancement of the scientific and clinical evidence that supports advances in otologic and neurotologic care to patients. The **target audiences** are physicians, otologists, residents, fellows, and researchers in the fields of otology and neurotology, as well as nurses, occupational and speech therapists, audiologists, and other healthcare professionals with specific interests in otologic and neurotologic disorders.

Learning Objectives:

Basic Science- The audience will understand some of the latest research results in the area of regeneration of the auditory system, the value of genetic testing in profoundly deaf individuals and newer methods to deliver drugs to the inner ear.

Cochlear Implant- The audience will appreciate the latest indications for considering a cochlear implant for auditory rehabilitation, the importance of preserving residual hearing, and the strategy for performing an MRI when a cochlear implant is in place.

Vestibular Schwannoma- The audience will be aware of the various outcomes of different treatment modalities for vestibular schwannoma, and the long-term outcome on word understanding following microsurgical excision.

Conductive Hearing Loss- The audience will learn the value of newer strategies to improve conductive hearing loss in chronic ear disease and otosclerosis.

Desired Results:

The audience will be informed of the latest research in auditory regeneration, genetic testing for hearing loss and state-of-the-art strategies for treatment of inner ear disorders.

Otologists will be able to determine the most current indications for using cochlear implants, reasons to preserve hearing while placing cochlear implants, and management of children with apparent cochlear nerve applasia.

Otologists and neurotologists will be able to make informed decisions on how to manage vestibular schwannomas in their practice.

Otologists will have a better perspective of the latest strategies to improve conductive hearing loss.

***** American Otological Society, Inc.*****

Any presentations, conversations, exhibits, or other meeting communications, including description of the use of drugs or devices, does not imply nor constitute endorsement of any company, product, application or use by the American Otological Society.

All Authors/Presenters signature on the following statements were required on all papers submitted to the American Otological Society. All authors/presenters were advised that the submitted paper becomes the property of ***Otology & Neurotology*** and cannot be reprinted without permission of the Journal.

FULL DISCLOSURE POLICY STATEMENT

In accordance with the ACCME Essential Areas and Policies, it is the policy of the American Otological Society to ensure balance, independence, objectivity and scientific rigor in all of its educational activities. **All authors, panelists, invited lecturers, program committee members, moderators, administrative staff and any other contributing individuals who may be in a position to control content of a CME activity** are responsible for disclosing any potential conflict of interest or any significant financial or other relationships with the manufacturer(s) of any commercial product(s) or provider(s) of any commercial service (s) discussed in an educational presentation. The purpose of this form is to identify and resolve all potential conflicts of interests that arise from financial relationships with any commercial or proprietary entity that produces healthcare-related products and/ or services relevant to the content you are planning, developing, or presenting for this activity. This includes any financial relationships within the last twelve months, as well as known financial relationships of your spouse or partner. Three weeks prior to the AOS meeting, the Council will review the manuscripts to identify a conflict of interest and make a decision if that individual should be the presenter or ask the primary author to select another person who does not have a conflict of interest to present the paper. If a conflict of interest is identified then one of the following mechanisms will be used to resolve it: Individuals may choose to discontinue their relationship, the individual can elect to alter the educational design or format of the presentation, and select someone else to present that portion of the content. The intent of this policy is not to discourage speakers who have relationships with commercial entities from presenting, but to identify these relationships to the listeners so that they may form their own judgments. **Failure to disclose this information on submission forms, or failure to return this disclosure form will result in exclusion from this activity and from future CME activities for up to two years.** The American Otological Society is committed to the non-promotional advancement of knowledge and science and to a free exchange of medical education in otology and neurotology.

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 including another COSM society. 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)

FACULTY DISCLOSURES

American Otological Society Council

Bruce J. Gantz, MD – Cochlear Corp - Consultant, Cochlear Implants
Advanced Bionics - Consultant, Cochlear Implants
Anspach- Consultant, Otologic Surgery

Joseph B. Nadol, Jr., MD – Boston Medical Product Loyalty, Otology
Olympus - Product Loyalty, Otology

Clough Shelton, MD – Cochlear Corp - Grant/Research Support

Herman A. Jenkins, MD – Otologics - Medical Advisor
(Grant for Research - No financial relationships)
Paul R. Lambert, MD – No Disclosures
C. Phillip Daspit, MD – No Disclosures
John W. House, MD – No Disclosures
D. Bradley Wellling, MD, PhD – No Disclosures
Debara L. Tucci, MD – No Disclosures

Administrators:
Shirley Gossard –No Disclosures
Kristen Bordignon –No Disclosures

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Carol A. Bauer, MD –No Disclosures

Craig A. Buchman, MD – Cochlear Corp - Consultant; Advanced Bionics - Consultant; Med El Corp - Consultant
Anspach Corp - Consultant

Rick A. Friedman, MD, PhD – Alcon Lab - Speaker

Marlan Hansen, MD – No Disclosures

David S. Haynes, MD – Cochlear Corp - Advisory Board; Anspach Corp - Advisory Board; Med El Corp - Research Support

Sean O. McMenomey, MD – Cochlear Corp - Advisory Board, Cochlear Implants; Advanced Bionics - Advisory Board, Cochlear Implants

Cliff Megerian, MD – Anspach Corp - Advisory Committee, Drills: Grace Med - Advisory Committee, PORPS

John K. Niparko, MD –Advanced Bionics Corp -Consultant w/o remuneration; Cochlear Corp -Consultant w/o remuneration

Myles Pensak, MD – No Disclosures

Jay T. Rubinstein, MD – Advance Bionics - Consultant, Research Funding, Inner Ear Implants; Cochlear - Consultant, Research Funding, Inner Ear Implants

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

Peter C. Weber, MD – Cochlear Americas - Surgical Advisory Board, Cochlear Implants; Advanced Bionics - Surgical Advisory Board, Cochlear Implants

D. Bradley Welling, MD, PhD – No Disclosures

***Disclosures—Oral Presentations ***

Saturday May 1, 2010 Scientific Session

Oral Pressentations: Authors/Presenters/Panel Participants Disclosures (listed in order of presentation)

1:10 pm Guest of Honor Presentation
Edwin W. Rubel, PhD No Disclosures

Basic Science Presentations

1:45 pm
Kaibao Nie, PhD—No Disclosures
Steven M. Bierer, PhD—No Disclosures
Leo Ling, PhD—No Disclosures
Trey Oxford, BA, No Disclosures
James O. Phillips, PhD—No Disclosures
Jay T. Rubinstein, MD, PhD - Advanced Bionics Corp Consultant, research funding;
Cochlear Ltd - Consultant, research funding

1:53 pm
Xiaobo Wang, MD—Otonomy, Inc. - Full Time Employee
Rayne Fernandez, BSc -Otonomy, Inc. - F/T Employee
Anne Harrop, BSc—Otonomy, Inc. - F/T Employee
Luis Dellamary—Otonomy, Inc. - F/T Employee
Qiang Ye, PhD—Otonomy, Inc. - F/T Employee
Elizabeth M. Keithley, PhD—Otonomy, Inc. - Consultant
Jeffrey P. Harris, MD—Otonomy, Inc. - Consultant
Jay Lichter, PhD—Otonomy, Inc. - F/T Employee
Carl LeBel, PhD—Otonomy, Inc. - F/T Employee
Fabrice Piu, PhD—Otonomy, Inc. - F/T Employee

2:01 pm
Dylan K. Chan, MD, PhD—No Disclosures
Iris Schrijver, MD—No Disclosures
Kay W. Chang, MD—No Disclosures

2:09 pm
Richard J. H. Smith, MD—No Disclosures

Vestibular Schwannoma Presentations

3:10 pm
P. Ashley Wackym, MD—No Disclosures
Christina L. Runge-Samuelson, PhD—No Disclosures
John J. Nash, MD—No Disclosures
Maureen Hannley, PhD—No Disclosures
David M. Poetker, MD—No Disclosures
Katherine Albano, MS—No Disclosures
Joseph Bovi, MD—No Disclosures
Michelle A Michel, MD—No Disclosures
David R. Friedland, MD, PhD—No Disclosures
Yong-Ran Zhu, MD—No Disclosures

Disclosures—Oral Presentations

Saturday May 1, 2010 Scientific Session (Cont)

3:18 pm

Yuri Agrawal, MD—No Disclosures
Charles J. Limb, MD—No Disclosures
John K. Niparko, MD—No Disclosures
Howard W. Francis, MD—No Disclosures

3:26 pm

Stéphane Tringali, MD-Otologics LLC Boulder, CO-USA - Educational Grant
Chantal Ferber-Viart, MD, PhD-Otologics LLC Boulder, CO-USA - Educational Grant
Carine Fuchsmann, MD-Otologics LLC Boulder, CO-USA - Educational Grant
Sandra Zaouche, MD-Otologics LLC Boulder, CO-USA - Educational Grant
Christian Dubreuil, MD-Otologics LLC Boulder, CO-USA - Educational Grant

3:34 pm

Olivier Sterkers MD, PhD—No Disclosures
Michel Kalamarides, MD, PhD—No Disclosures
Alexis Bozorg Grayeli, MD, PhD—No Disclosures
Mustapha Smail, MD—No Disclosures
Daniele Bernardeschi, MD, PhD—No Disclosures
Evelyne Ferrary, MD, PhD—No Disclosures

3:42 pm

David J. Phillips, BA—No Disclosures
Erik J. Kobylarz, MD, PhD—No Disclosures
Edgar T. De Peralta, MD—No Disclosures
Philip E. Stieg MD, PhD—Leise-Consultant
Samuel H. Selesnick, MD—Medtronic ENT/Royalty Agreement

3:50 pm

Erika A. Woodson, MD—No Disclosures
Ryan D. Dempewolf, MD—No Disclosures
Samuel P. Gubbels, MD—No Disclosures
Marlan R. Hansen, MD—No Disclosures
Bruce J. Gantz, MD—No Disclosures

Clinical Trials and Clinical Research Presentations

4:03 pm

Jack J. Wazen MD—Neuromonics - Grant Recipient
Julie A. Daugherty NP-C—No Disclosures

4:11 pm

Agnes Oplatek, MD—No Disclosures
D. Bradley Welling, MD, PhD—No Disclosures
Edward E. Dodson, MD—No Disclosures
Claudia Dome, AuD—No Disclosures
Kelly Wolfe, BA—No Disclosures
Abraham A. Jacob, MD—No Disclosures

Disclosures—Oral Presentations

Saturday May 1, 2010 Scientific Session (Cont)

4:19 pm
Christopher E. Lee, MD—No Disclosures
John L. Dornhoffer, MD—No Disclosures
Gresham T. Richter, MD—No Disclosures
Lisa V. Christensen, AuD—No Disclosures

4:27 pm
Jeffrey T. Vrabec, MD—No Disclosures
Jerry W. Lin, MD—No Disclosures

4:35 pm
Eric R. Oliver, MD—No Disclosures
David C. Shonka, MD—No Disclosures
Brian B. Hughley, MD—No Disclosures
Bradley W. Kesser, MD—No Disclosures

4:43 pm
Gi Soo Lee, MD—No Disclosures
Guangwei Zhou, MD, ScD—No Disclosures
Dennis Poe, MD—No Disclosures
Margaret Kenna, MD—No Disclosures
Manali Amin, MD—No Disclosures
Laurie Ohlms, MD—No Disclosures
Quinton Gopen, MD—No Disclosures

Sunday, May 2, 2010, Scientific Session

*****Oral Pressentations: Authors/Presenters/Panel Participants Disclosures (listed in order of presentation)**

7:30 am
Christopher W. Hilton, MD—No Disclosures
Frank G. Ondrey MD, PhD—No Disclosures
Beverly R. Wuertz, BA—No Disclosures
Samuel C. Levine, MD—No Disclosures

7:38 am
Ashley E Balaker, MD—No Disclosures
Mia M Miller, MD—No Disclosures
Gail Ishiyama, MD—No Disclosures
Ivan A Lopez, PhD—No Disclosures
Akira Ishiyama, MD—No Disclosures

7:46 am
Yvonne L. Richardson, MD —No Disclosures
Kourosh Parham, MD, PhD—No Disclosures
Jonathan J. Romak, BA—No Disclosures
Marc D. Eisen, MD—No Disclosures
Michael S. Aronow, MD—No Disclosures
Gloria A. Gronowicz, PhD—No Disclosures

7:54 am
Prof. Dr. Ralf Siegert - Otomag, Germany - Ownership Interest

8:02 am
Richard T. Penninger—No Disclosures
John P. Carey, MD—No Disclosures
Tanya S. Tavassolie—No Disclosures

8:15 am
Andrei Danilchenko, BS—No Disclosures
Jenna L. Toennies, MS—No Disclosures
Ramya Balachandran, PhD—Intuitive Surgical, Inc. - Licensee of a Patent of mine; Abdominal Laparoscopy
Stephan Baron, PhD—No Disclosures
Benjamin Munske, BS—No Disclosures
Robert J. Webster III, PhD—Intuitive Surgical, Inc. - Licensee of a Patent of mine; Abdominal Laparoscopy
Robert F. Labadie, MD, PhD—No Disclosures

8:23 am
Stella Lee, MD—No Disclosures
Alexander Vortmeyer, MD, PhD—No Disclosures
Elias Michaelides, MD—No Disclosures

8:31 am
David D. Pothier MBChB, MSc, FRCS—No Disclosures
Samuel A. Mac Keith MBChB, MRCS—No Disclosures

8:39 am
Richard L. Goode, MD—Olympus (Gyrus) Royalties
Hiroyuki Yamada, MD—No Disclosures

8:47 am
Peter C. Weber, MD—Cochlear America - Surgeons Advisory Board -Cochlear Implants and BAHA Implants

Otosclerosis and Conductive Hearing Loss

9:03 am
Yu-Lan Mary Ying, MD—No Disclosures
Todd A. Hillman, MD—No Disclosures
Douglas A. Chen, MD—No Disclosures

9:11 am
Charles A. Mangham, Jr., MD, MS—No Disclosures

9:19 am
Sebastien Lagleyre, MD—No Disclosures
Mathieu Marx, MD—No Disclosures
Young-Je Shin, MD—No Disclosures
Bernard Escudé, MD—No Disclosures
Olivier Deguine, MD—No Disclosures
Bernard Fraysse, MD—No Disclosures

9:27 am
Samuel D. Turner MD—No Disclosures
David P. Mullin MD—No Disclosures
Xianxi Ge MD—No Disclosures
Travis J. Pfannenstiel MD—No Disclosures
Ronald L. Jackson PhD—No Disclosures
Jianzhong Liu MD—No Disclosures
Ben J. Balough MD—No Disclosures

9:35 am
Kanthaiah Koka, PhD—Otologics LLC Boulder, CO-USA - Educational Grant
Arnaud Devèze, MD—Otologics LLC Boulder, CO-USA - Educational Grant
Stéphane Tringali, MD—Otologics LLC Boulder, CO-USA - Educational Grant
Herman A. Jenkins, MD—Otologics LLC Boulder, CO-USA - Educational Grant
Daniel J. Tollin, PhD—Otologics LLC Boulder, CO-USA - Educational Grant

Clinical Implant Clinical Reseearch
10:15 am
Benjamin T. Crane, MD, PhD—No Disclosures
John K. Niparko, MD—Cochlear Corp - Volunteer Advisory Board Participant, Cochlear Implants; Advanced Bionics Corp - Volunteer Advisory Board Participant, Cochlear Implants

10:23 am
Bernard Fraysse, MD—No Disclosures
Matthieu Marx, MD—No Disclosures
Olivier Deguine, MD—No Disclosures
Marie-Laurence Laborde—No Disclosures
Chris James—No Disclosures

10:31 am
Thomas A. Suberman, BA—Med-EL Grant Recipient
Adam P. Campbell, BA—Med-EL Grant Recipient
Craig A. Buchman, MD—Med-EL- Consultant Advisory Board; Cochlear - Consultant Advisory Board; Advanced Bionics - Consultant Advisory Board
Oliver F. Adunka, MD—No Disclosures
Douglas C. Fitzpatrick, PhD—Med-EL Grant Recipient

10:39 am
Nancy M. Young, MD—Cochlear Americas/Medical Advisory Board; Advanced Bionics Corp - Medical Advisory Board
Francine Kim, MD—No Disclosures
Beth Tournis—Cochlear Americas - Audiology Advisory Board Member

Disclosures—Oral Presentations
Sunday, May 2, 2010, Scientific Session (Cont)

10:47 am

Frank M. Warren III, MD—No Disclosures
Richard H. Wiggins III, MD—Amirsys, Inc. - Consultant
H. Ric Harnsberger MD—No Disclosures
Clough Shelton, MD—Cochlear Corp - Grant/Research Support; Synthes Corp - Grants/Research Support

Panel: Cochlear Implant Candidacy in 2010
11:00 am

John K. Niparko, MD—Cochlear Corp & Advanced Bionics Corp - Volunteer Advisory Board Participant - Cochlear Implants
Craig Buchman, MD—Advanced Bionics Corp, Cochlear Corp, MedEL Corp - Advisory Board Member
J. Thomas Roland, Jr., MD—Cochlear Americas - Consultant; Advanced Bionics - Consultant
Peter S. Roland, MD—Cochlear Corp, MedEL - Advisory Board Consultant-Cochlear Implants
Jay T. Rubinstein, MD, PhD—Cochlear, Ltd; Advanced Bionics Corp - Consultant, research funding
Nancy M. Young, MD—Cochlear Americas & Advanced Bionics - Advisory Board

NOTES

Saturday, May 1, 2010

12:30 **Business Meeting** *(Restricted to Members)*
Room: Gold Room

Minutes of the Annual Meeting 2009

Introduction of New Members

Election of Nominating Committee

Report of the Secretary-Treasurer

Report of the Editor-Librarian

1:00 **Scientific Program**
(*Open to Registered Members & Non-Members*)
Room: Gold Room

Moderators: *Bruce J. Gantz, MD*
Paul R. Lambert, MD

1:00 **Remarks by the President**
Bruce J. Gantz, MD

Presidential Citation
Thomas J. Balkany, MD
Derald E. Brackmann, MD
Noel L. Cohen, MD
Sam E. Kinney, MD
Charles M. Luetje, MD
Richard T. Miyamoto, MD

1:10 **Introduction of Guest of Honor**
Edwin W. Rubel, PhD

1:15 **Guest of Honor Presentation**
Toward a New Era of Hearing Habilitation
Edwin W. Rubel, PhD

1:40 **Discussion**

Basic Science

1:45 **Characterization of the Electrically-Evoked Compound Action Potential of the Vestibular Nerve**
Kaibao Nie, PhD
Steven M. Bierer, PhD
Leo Ling, PhD
Trey Oxford, BA
James O. Phillips, PhD
Jay T. Rubinstein, MD, PhD

1:53 **Pharmacokinetic and Toxicity Profile of the Clinical Candidate OTO-104: a Sustained Release Dexamethasone Hydrogel for Inner Ear Delivery**
Xiaobo Wang, MD
Rayne Fernandez, BSc
Anne Harrop, BSc
Luis Dellamary, BSc
Qiang Ye, PhD
Elizabeth M. Keithley, PhD
Jeffrey P. Harris, MD
Jay Lichter, PhD
Carl LeBel, PhD
Fabrice Piu, PhD

2:01 **Connexin 26-Associated Deafness: Association of a Single Common Allele with Progressive Hearing Loss**
Dylan K. Chan, MD, PhD
Iris Schrijver, MD
Kay W. Chang, MD

2:09 **Basic Science Lecture**
Genetic Testing for Deafness – How It Will Impact Your Management of Deaf and Hard of Hearing Persons
Richard J. H. Smith, MD

2:35 **Discussion**

2:40 **Break with Exhibitors**

Vestibular Schwannoma

3:10 **Gamma Knife Surgery of Vestibular Schwannomas: Volumetric Dosimetry Correlations to Hearing Loss Suggest Stria Vascularis Devascularization as the Mechanism of Early Hearing Loss**
P. Ashley Wackym, MD
Christina L. Runge-Samuelson, PhD
John J. Nash, MD
Maureen Hannley, PhD
David M. Poetker, MD
Katherine Albano, MS
Joseph Bovi, MD
Michelle A. Michel, MD
David R. Friedland, MD, PhD
Yong-Ran Zhu, MD

3:18 **Predictors of Vestibular Schwannoma Growth and Clinical Implications**
Yuri Agrawal, MD
Charles J. Limb, MD
John K. Niparko, MD
Howard W. Francis, MD

3:26 **Hearing Preservation in Retrosigmoid Approach for Small Vestibular Schwannoma: Prognostic of Internal Auditory Canal Filling**
Stéphane Tringali, MD
Chantal Ferber-Viart, MD, PhD
Carine Fuchsmann, MD
Sandra Zaouche, MD
Christian Dubreuil, MD

3:34 **Management of Solitary Vestibular Schwannomas: Observation, Surgery or Irradiation?**
Olivier Sterkers, MD, PhD
Michel Kalamarides, MD, PhD
Alexis Bozorg Grayeli, MD, PhD
Mustapha Smail, MD
Daniele Bernardeschi, MD, PhD
Evelyne Ferrary, MD, PhD

3:42 **Predictive Factors of Hearing Preservation Following Surgical Resection of Small Vestibular Schwannoma**
David J. Phillips, BA
Erik J. Kobylarz, MD, PhD
Edgar T. De Peralta, MD
Philip E. Stieg, MD, PhD
Samuel H. Selesnick, MD

3:50 **Long-Term Hearing Preservation Following Microsurgical Excision of Vestibular Schwannoma**
Erika A. Woodson, MD
Ryan D. Dempewolf, MD
Samuel P. Gubbels, MD
Marlan R. Hansen ,MD
Bruce J. Gantz, MD

3:58 **Discussion**

Clinical Trials and Clinical Research

4:03 **Evaluation of a Customized Acoustical Stimulus System in the Treatment of Chronic Tinnitus**
Jack J. Wazen, MD
Julie A. Daugherty, NP-C

4:11 **Melatonin: Can It Stop the Ringing?**
Agnes Oplatek, MD
D. Bradley Welling, MD, PhD
Edward E. Dodson, MD
Claudia Dome, AuD
Kelly Wolfe, BA
Abraham A. Jacob, MD

NOTES

4:19 **Complications of Bone-Anchored Hearing Aids: the Arkansas Experience**
Christopher E. Lee, MD
John L. Dornhoffer, MD
Gresham T. Richter, MD
Lisa V. Christensen, AuD

4:27 **Inner Ear Anomalies in Congenital Aural Atresia**
Jeffrey T. Vrabec, MD
Jerry W. Lin, MD

4:35 **Revision Aural Atresia Surgery: Indications and Outcomes**
Eric R. Oliver, MD
David C. Shonka, MD,
Brian B. Hughley, MD
Bradley W. Kesser, MD

4:43 **Clinical Experience in Diagnosis and Management of Superior Semicircular Canal Dehiscence in Children**
Gi Soo Lee, MD
Guangwei Zhou, MD, ScD
Dennis Poe, MD
Margaret Kenna, MD
Manali Amin, MD
Laurie Ohlms, MD
Quinton Gopen, MD

4:51 **Discussion**

4:56 **Adjournment**

5:10 **AOS Group Photograph**
(Location to be announced)

6:30 **AOS President's Reception and Dinner/Dance**
Bally's Las Vegas—Skyview 1 and 2 (26th Floor)
(Members and Invited Guests Only-Tickets required for admission)

Sunday, May 2, 2010

7:00 **Business Meeting** *(Restricted to Members)*
Room: Gold Room

7:30 **Scientific Program**
(Open to Registered Members & Non-Members)
Room: Gold Room

Moderators: *Bruce J. Gantz, MD*
Paul R. Lambert, MD

7:30 **IL-8 Production in Response to TNF-alpha by Cholesteatoma Keratinocytes in Cell Culture**
Christopher W. Hilton, MD
Frank G. Ondrey, MD, PhD
Beverly R. Wuertz, BA
Samuel C. Levine, MD

7:38 **Immunocytochemistry of the Spiral Ganglia Obtained from Microdissected Human Temporal Bones**
Ashley E. Balaker, MD
Mia M. Miller, MD
Gail Ishiyama, MD
Ivan A. Lopez, PhD
Akira Ishiyama, MD

7:46 **Characteristics of Osteoblasts Cultured from Stapes of Patients with Otosclerosis after Exposure to Alendronate**
Yvonne L .Richardson, MD
Kourosh Parham, MD, PhD
Jonathan J. Romak, BA
Marc D. Eisen, MD
Michael S. Aronow, MD
Gloria A. Gronowicz, PhD

7:54 **Partially Implantable Bone Conducting Hearing Aids without a Percutaneous Abutment. Technique and Preliminary Clinical Results**
Prof. Dr. Ralf Siegert

8:02 **Applications of Cone Beam CT in the Temporal Bone**
Richard T. Penninger, MD
John P. Carey, MD
Tanya S. Tavassolie

8:10 **Discussion**

8:15 **Robotic Mastoidectomy**
Andrei Danilchenko, BS
Jenna L. Toennies, MS
Ramya Balachandran, PhD
Stephan Baron, PhD
Benjamin Munske, BS
Robert J. Webster III, PhD
Robert F. Labadie, MD, PhD

8:23 **The Effect of Ultrasonic Bone Removal on the Guinea Pig Facial Nerve**
Stella Lee, MD
Alexander Vortmeyer, MD, PhD
Elias Michaelides, MD

8:31 **Thermal Properties of Operative Otoendoscopes: An Ovine Model**
David D. Pothier, MBChB, MSc FRCS
Samuel A. Mac Keith, MBChB, MRCS

8:39 **A Self-adjusting Ossicular Prosthesis Containing Polyurethane Sponge**
Richard L. Goode, MD
Hiroyuki Yamada, MD

8:47 **Minimally Invasive BAHA Surgery**
Peter C. Weber, MD

8:55 **Discussion**

Otosclerosis and Conductive Hearing Loss

9:03 **Patterns of Failure in Heat-Activated-Crimping Prosthesis in Stapedectomy**
Yu-Lan Mary Ying, MD
Todd A. Hillman, MD
Douglas A. Chen, MD

9:11 **Nitinol Stapes Prosthesis Improves Low-Frequency Hearing Results in Otosclerosis Surgery**
Charles A. Mangham Jr., MD, MS

9:19 **Reliability of CT-Scan in the Prognosis of Otosclerosis**
Sebastien Lagleyre, MD
Mathieu Marx, MD
Young-Je Shin, MD
Bernard Escudé, MD
Olivier Deguine, MD
Bernard Fraysse, MD

9:27 **The Incus in Ossicular Chain Reconstruction: Take it or Leave it?**
Samuel D. Turner, MD
David P. Mullin, MD
Xianxi Ge, MD
Travis J. Pfannenstiel, MD
Ronald L. Jackson, PhD
Jianzhong Liu, MD
Ben J. Balough, MD

9:35 **Active Middle Ear Implant Application in Case of Stapes Fixation: A Temporal Bone Study**
Kanthaiah Koka, PhD
Arnaud Devèze, MD
Stéphane Tringali, MD.
Herman A. Jenkins, MD
Daniel J. Tollin, PhD

9:43 **Discussion**

9:48 **Intermission**

Cochlear Implant Clinical Research

10:15 **Magnetic Resonance Imaging after Cochlear Implantation Using 1.5 Tesla Magnet**
Benjamin T. Crane, MD, PhD
John K. Niparko, MD

10:23 **Binaural Speech Recognition in Noise by Cochlear Implanted Patients**
Bernard Fraysse, MD
Matthieu Marx, MD
Olivier Deguine, MD
Marie-Laurence Laborde
Chris James

10:31 **Residual Hearing Preservation during Cochlear Implantation in Gerbils with Noise Induced, High-Frequency Hearing Loss**
Thomas A. Suberman, BA
Adam P. Campbell, BA
Craig A. Buchman, MD
Oliver F. Adunka, MD
Douglas C. Fitzpatrick, PhD

10:39 **Pediatric Cochlear Implantation in Children with Eighth Nerve Hypoplasia**
Nancy M. Young, MD
Francine Kim, MD
Beth Tournis

10:47 **Apparent Cochlear Nerve Aplasia: To Implant or not to Implant?**
Frank M. Warren III, MD
Richard H. Wiggins III, MD
H. Ric Harnsberger, MD
Clough Shelton, MD

10:55 **Discussion**

11:00 **Panel: Cochlear Implant Candidacy in 2010**
Moderator: *John K. Niparko, MD*
Panelists: *Craig A. Buchman, MD*
J. Thomas Roland, Jr., MD
Peter S. Roland, MD
Jay T. Rubinstein, MD, PhD
Nancy M. Young, MD

11:50 **Discussion**

12:00 **Introduction of Incoming AOS President**
C. Phillip Daspit, MD

12:00 **Adjournment**

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144th AOS Annual Spring Meeting
April 30 & May 1, 2011
Sheraton Chicago Hotel & Towers
Chicago, IL

Abstract Deadline: October 15, 2010
Abstract Instructions and submission form will be available on website after July 1, 2010
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
The journal of ***OTOLOGY & NEUROTOLOGY*** no longer accepts paper manuscripts. All manuscripts must be submitted online **three weeks** prior to the annual meeting, via the journal's website: https://www.editorialmanager.com/on/. Instructions for registering, submitting a manuscript, and the author guidelines can all be found on the Editorial Manager site: https://www.editorialmanager.com/on/.
One copy of the manuscript (.pdf format) is to be submitted electronically to the AOS Administrative Office **a minimum of three weeks** prior to the Annual Meeting for content and conflict of interest review and resolution.

Administrative Office Address
American Otological Society, Inc.
Shirley Gossard, Administrator
3096 Riverdale Road
The Villages, Florida 32162
Ph: 352-751-0932
Fax: 352-751-0696
Email: segossard@aol.com
Website: www.americanotologicalsociety.org

Kristen Bordignon, Administrative Assistant
315 North Iris Drive
Auburn, IL 62615
Email: neurotology65@yahoo.com

Yuri Agrawal, MD
Dept. of Otolaryngology-HNS
The Johns Hopkins University
Baltimore, MD 21287

Ashley E. Balaker, MD
10833 Le Conte Avenue
Los Angeles, CA 90095

Dylan K. Chan, MD
Department of Otolaryngology
Stanford University
Stanford, CA 94301

Benjamin T. Crane, MD, PhD
Dept. of Otolaryngology
Rochester, NY 14642

Andrei Danilchenko, BS
7209 Medical Center East
Nashville, TN 37232

Richard L. Goode, MD
801 Welch Road
Stanford, CA

Christopher W. Hilton, MD
University of Minnesota
Dept. of Otolaryngology
Minneapolis, MN 55455

Kanthaiah Koka, PhD
University of Colorado Denver
Department of Physiology and Biophysics
Aurora, CO 80045

Sebastien Lagleyre, MD
Service d'ORL et
Otoneurologie, CHU
Purpan, Place du
Docteur Baylac
31059 Toulouse Cedex
France

Christopher E. Lee, MD
University of Arkansas for Medical Sciences
Department of Otolaryngology
Little Rock, AR 72205

Gi Soo Lee, MD
Children's Hospital Boston
Boston, MA 02115

Stella Lee, MD
Department of Otolaryngology
Yale School of Medicine
New Haven, Connecticut
06520-8041

Charles A. Mangham Jr., MD
Seattle Ear Clinic
801 Broadway Ste 830
Seattle, WA 98122-4328

Agnes Oplatek, MD
The Ohio State University
Eye and Ear Institute
Columbus, OH 43212

Eric R. Oliver, MD
University of Virginia
Department of Otolaryngology
Charlottesville, VA 22908

Richard T. Penninger, MD
Ross Research Building 833
The Johns Hopkins Med Inst.
Baltimore, MD 21205

Fabrice Piu, PhD
Otonomy Inc.
San Diego, CA 92121

David D. Pothier, MBChB
Department of Otolaryngology
Toronto General Hospital
Toronto, Canada M5G 2C4

Yvonne Richardson, MD
University of Connecticut
Farmington, CT 06030-6228

Jay T. Rubinstein, MD, PhD
Virginia Merrill Bloedel
Hearing Research Ctr
Seattle, WA 98195-7923

Samuel H. Selesnick, MD
1305 York Ave., 5th Floor
New York, NY 10021

Prof. Dr. Ralf Siegert
Muehlenstrasse 27
D-45659 Recklinghausen
Germany

Olivier Sterkers, MD, PhD
Service ORL Hôpital Beaujon
92110 Clichy
France

Thomas A. Suberman, BA
101 Mason Farm Rd,
CB# 7546
Chapel Hill, NC

Stéphane Tringali, MD
Lyon Sud
Department of Otology
F- 69495 Pierre-Bénite, France

Samuel D. Turner, MD
Naval Medical Center San
Diego—ENT DEPT
San Diego, CA 92134

Jeffrey T. Vrabec, MD
Department of Otolaryngology
Baylor College of Medicine
Houston, Texas 77030

P. Ashley Wackym, MD
Ear and Skull Base Institute
Portland, OR 97232

Frank M. Warren, MD
University of Utah
Division of Otolaryngology
Salt Lake City, UT 84132

Jack J. Wazen, MD
1901 Floyd St.
Sarasota, FL 34239

Erika A. Woodson, MD
University of Iowa Hospitals
and Clinics
Iowa City, IA 52242

Peter C. Weber, MD
Cleveland Clinic
Dept. of Otolaryngology
Cleveland, OH 44195

Yu-Lan Mary Ying, MD
Pittsburgh Ear Associates
Pittsburgh, PA 15212

Nancy M. Young, MD
Section of Otology &
Neurotology
Children's Memorial Hospital
Chicago, Illinois

1:45 pm

Characterization of the Electrically-Evoked Compound Action Potential of the Vestibular Nerve

Kaibao Nie, PhD; Steven M. Bierer, PhD
Leo Ling, PhD; Trey Oxford, BA
James O. Phillips, PhD; Jay T. Rubinstein, MD, PhD

Hypothesis: It is possible to record electrically-evoked compound action potentials (ECAPs) in Rhesus monkeys implanted with a vestibular implant and such measures will correlate with the generation of nystagmus induced by electrical stimulation of the implanted semicircular canal.

Background: A number of vestibular disorders could potentially be treated with a vestibular implant. Surgical placement of implant electrodes may potentially be guided by electrophysiological measures.

Methods: Four Rhesus monkeys were implanted with a vestibular implant modified from the Nucleus Freedom™. ECAP recordings were obtained during surgery or at various intervals post-surgery. Eye movements during electrical stimulation of individual canals were recorded with a scleral coil system in the same animals.

Results: Measurable vestibular ECAPs were observed intra-operatively or postoperatively in three implanted animals. ECAP waveforms were monitored during surgery for two animals. Robust ECAPs were collected in two monkeys at the test intervals of 0, 7 or >100 days post surgery. Electrical stimulation in monkeys with normal vestibular ECAPs also produced measurable eye movements in a direction consistent with the VOR from the implanted semicircular canal. Electrically-evoked eye movements could not be measured in two of four canals without distinct vestibular ECAPs.

Conclusions: Monkey vestibular ECAPs exhibit similar morphology and growth to cochlear ECAPs from human cochlear implant patients. The ECAP measure is well correlated with the functional activation of eye movements by electrical stimulation postoperatively. The intra-operative ECAP recording technique provides a reliable and efficient tool to guide the placement of electrode leads to the proximity of vestibular neurons.

Supported by NIDCD and the Wallace Coulter Foundation
IRB Approval: N/A

Define Professional Practice Gap: Vestibular
Educational Need: Knowledge
Learning Objective:
Desired Result:

1:53 pm

Pharmacokinetic and Toxicity Profile of the Clinical Candidate OTO-104 : a Sustained Release Dexamethasone Hydrogel for Inner Ear Delivery

Xiaobo Wang, MD; Rayne Fernandez, BSc
Anne Harrop, BSc; Luis Dellamary, BSc; Qiang Ye, PhD
Elizabeth M. Keithley, PhD; Jeffrey P. Harris, MD
Jay Lichter, PhD; Carl LeBel, PhD; Fabrice Piu, PhD

Hypothesis / Background: In recent years, intratympanic drug delivery has been investigated as a route of administration to treat various otic disorders. While constituting a significant improvement in safety and efficacy over traditional systemic approaches, several issues still remain to be addressed: large differences in dosing schedules / regimen, high variability in clinical outcomes and patient acceptance. These disparities are primarily the result of the nature of the current formulations, namely drug solutions with short residence time and rapid elimination from the middle and inner ear.

Methods: OTO-104, a poloxamer-based hydrogel containing micronized dexamethasone (DEX) was developed.Poloxamers are tri-block co-polymers with mucoadhesive and thermoreversible properties that behave as sustained release drug delivery vehicles. OTO-104 was administered to guinea pigs intratympanically and its pharmacokinetic and toxicity profile was examined.

Results: Following a single intratympanic injection, significant and prolonged exposure to dexamethasone in the inner ear was observed. Increasing the concentration of dexamethasone resulted in higher drug levels as well as a more prolonged duration of exposure. At the maximally deliverable drug concentration, therapeutic levels of dexamethasone could be sustained over 3-month. The toxicological evaluation included assessment of auditory function and histological analyses (cochlear paraffin sections, cytocochleograms). A small and transient shift in hearing threshold was observed, most probably of conductive nature. No significant histological changes in the middle or the inner ear tissues were noted.

Conclusions: OTO-104 appears to provide a well-tolerated and controllable delivery system to achieve prolonged sustained release of dexamethasone at multiple concentrations within the inner ear.

Define Professional Practice Gap: Treatment of inner ear disease - Meniere's disease
Educational Need: develop new treatment approaches
Knowledge Competence Performance
Learning Objective: Implement novel strategies to treat inner ear disorders
Desired Result: medical knowledge
Medical Knowledge
Practice-Based Learning

2:09 pm

Connexin 26-Associated Deafness: Association of a Single Common Allele with Progressive Hearing Loss

Dylan K. Chan, MD, PhD; Iris Schrijver, MD; Kay W. Chang, MD

Objective: To evaluate genotype-phenotype correlation over time among children with connexin 26 (GJB2)-associated autosomal recessive hearing loss.
Study design: Retrospective case review series
Setting: Outpatient tertiary referral center
Patients: Children with SNHL and pathologic mutations in GJB2
Intervention: Gene sequencing for mutations in GJB2 and longitudinal audiologic and otolaryngologic evaluation
Main outcome measure(s): Correlation of GJB2 genotype with severity and progression of hearing loss.
Results: Among 52 individuals with GJB2-associated deafness, hearing loss was most severe in those with two truncating mutations and mildest in those with two non-truncating mutations. Progressive hearing loss was noted by serial audiometry in 24% of all subjects, and 50% of patients passed a newborn hearing screen at least unilaterally. Among the 39 subjects with CT scans, only one abnormality was noted- an enlarged vestibular aqueduct. Carriers of the V37I allele, either in homozygosity or compound heterozygosity with a truncating allele, demonstrated a statistically significantly higher incidence of progressive hearing loss (39%) compared to subjects with non-V37I GJB2-associated hearing impairment (7%; $p < 0.05$). These children are primarily of Asian descent, have normal CT scans, and demonstrate mild, slowly progressive hearing loss.
Conclusions: Phenotype in GJB2-associated hearing loss is correlated with genotype. Progression of hearing loss is common, especially in association with the V37I allele, which has a carrier frequency of up to 10% of some East Asian populations. These results highlight the importance of thorough genotype analysis in GJB2-associated recessive hearing loss, and indicate that close audiometric follow-up is warranted for these patients.

IRB Approval: N/A

Define Professional Practice Gap: Genetics- Lack of or inconsistent knowledge of the genetic influence of inner ear disorders.

Educational Need: Apply the genetics of inner ear disorders to approaches and recommendations for assessment and treatment
Knowledge
Competence
Performance
Learning Objective: To inform clinicians of the diversity of phenotypes seen in hearing loss associated with Connexin 26, and most common form of genetic deafness. To emphasize the importance of genotype analysis and serial audiometry in the diagnosis and management of patients with Connexin 26-associated hearing impairment.

Desired Result: We hope that our study will influence the diagnostic paradigm and management of Connexin 26-associated hearing impairment in order to better serve and inform this patient population.

3:10 pm

Gamma Knife Surgery of Vestibular Schwannomas: Volumetric Dosimetry Correlations to Hearing Loss Suggest Stria Vascularis Devascularization as the Mechanism of Early Hearing Loss

P. Ashley Wackym, MD; Christina L. Runge-Samuelson, PhD
John J. Nash, MD; Maureen Hannley, PhD; David M. Poetker, MD
Katherine Albano, MS; Joseph Bovi, MD; Michelle A. Michel, MD
David R. Friedland, MD, PhD; Yong-Ran Zhu, MD

Objective: Determine which variables are correlated with the early hearing changes following gamma knife surgery of vestibular schwannomas (VSs).

Study Design: Prospective clinical study of hearing outcomes, radiation dosimetry, conformity and tumor size of all sporadic unilateral VS patients treated between June 2000 and July 2009.

Setting: Tertiary Referral Center.

Patients: 59 VS patients with at least six-months follow-up data were studied.

Interventions: Audiometry and imaging were performed to determine auditory thresholds, speech discrimination, and tumor size. Radiation doses to five volumes were measured.

Main Outcomes Measures: Pre- and post-treatment comparisons were performed with regard to: change in tumor size; radiation dose to specific volumes including the internal auditory canal, cochlea, basal turn of the cochlea, and modiolus; and comformity of the treatment.

Results: The mean follow-up was 63.76 months (± 29.02 months S.D., range 9 to 109 months). The median follow-up was 65.5 months. A statistically significant association between maximum radiation dose to the cochlea volume and three-frequency pure-tone average (PTA3) in patients starting with ≤ 50 dB PTA3 was demonstrated using linear regression analysis.

Conclusions: Longitudinal changes in hearing occur over time with the largest changes seen in the first 12 months after treatment. Based on our study outcomes, limiting the dose of radiation to the cochlea would likely reduce vascular injury to the stria vascularis and improve hearing outcomes. Shielding the cochlea during the treatment planning process would be one mechanism to accomplish this goal.

IRB Approval: Yes; HRRC# 186-04, FMLH# 04-092

Define Professional Practice Gap: Lack of knowledge of the current standards of care in the treatment of acoustic neuromas.
Educational Need: Define the role of radiation therapy in treating acoustic tumors and understand expected hearing outcomes.
Knowledge Patient Outcomes
Learning Objective: Gamma knife surgery of acoustic neuromas has unpredictable hearing outcomes and the use of practice-based learning can be used to understand the variables associated with hearing loss after treatment.
Desired Result: Practice-based learning after assessment of treatment outcomes will help shape treatment protocols to optimize hearing outcomes.

3:18 pm

Predictors of Vestibular Schwannoma Growth and Clinical Implications

Yuri Agrawal, MD; Charles J. Limb, MD; John K. Niparko, MD
Howard W. Francis, MD

Objective: Vestibular schwannomas exhibit variable and unpredictable patterns of growth. We evaluated the extent to which tumor growth influences the management of these benign tumors, and we explored symptom markers present at diagnosis that may be predictive of tumor growth.

Study design: Retrospective case review.

Setting: Tertiary care hospital center.

Patients: 180 patients with unilateral vestibular schwannomas diagnosed between 1997-2007 who were initially managed conservatively by serial observation.

Intervention(s): Serial observation versus eventual micro- or radio-surgical treatment.

Main outcome measure(s): Tumor growth, defined as a 1mm/year or greater increase in tumor size.

Results: We observed that tumor growth was the most important predictor of a change in treatment strategy from serial observation to micro- or radio-surgical treatment. We further noted in multivariate analyses that larger tumor size at diagnosis was associated with a higher odds of tumor growth, such that each 1mm increment in tumor size at presentation increased the odds of growth by 20%. We also found that the symptom marker of tinnitus at diagnosis significantly increased the odds of tumor growth nearly three-fold.

Conclusions: Tumor growth plays a significant role in guiding the management of vestibular schwannomas. Assessment of tumor size at diagnosis and for the presence of tinnitus may allow for the risk stratification of patients with newly-diagnosed vestibular schwannomas, and for a more rational application of the conservative management approach.

IRB Approval: This study was approved by the Johns Hopkins University Institutional Review Board.

Define Professional Practice Gap: Lack of knowledge of the current standards of care in the treatment of acoustic tumors.
Educational Need: Define the role of surgery and radiation therapy in treating acoustic tumors.
Knowledge
Patient Outcomes
Learning Objective: 1) To evaluate the extent to which tumor growth influences the management of vestibular schwannomas; and 2) to explore symptom markers present at diagnosis that may be predictive of tumor growth.
Desired Result: Allow for the risk stratification of patients with newly-diagnosed vestibular schwannomas, and for a more rational application of the conservative management approach.
Patient Care
Medical Knowledge:

3:26 pm

Hearing Preservation in Retrosigmoid Approach for Small Vestibular Schwannoma: Prognostic of Internal Auditory Canal Filling

Stéphane Tringali, MD; Chantal Ferber-Viart, MD, PhD
Carine Fuchsmann, MD; Sandra Zaouche, MD
Christian Dubreuil, MD

Objectives: To assess the contribution of preoperative radiologic appearance of the small vestibular schwannoma (VS) on the MRI in constructive interference in steady-state sequences (CISS) and demonstrated if the degree of the filling of the internal auditory canal (IAC) is correlated with hearing preservation.

Study Design: Between January 1993 to December 2007, 1000 patients with a unilateral, sporadic, VS were admitted in our department. The study involved 278 candidates for hearing preservation attempt with MRI in CISS sequences.

Mean Outcome Measures: We devised in 4 groups on the MRI depending on the percentage of IAC filling as Group IAC 1(IAC empty or full less than 25% and with free fundus), Group IAC 2 (IAC full than 25 to 50% with free fundus), Group IAC 3 (IAC full than 50 to 75% with free fundus) and Group IAC 4 (IAC full but some CSL was visible on the fundus).

Results: A good correlation was observed between the IAC classification and the rate of hearing preservation. There was a significant difference between the group IAC1, 2, 3 and the group 4 for the each stage in term of hearing preservation.

Conclusion: We provide an additional criterion to predict the rate of preserved hearing after vestibular schwannoma surgery and confirm the predictive value of factors, such as the aspect of the VS in the IAC on CISS sequences. In this case, surgery is the treatment of choice for patients with serviceable hearing and the desire to retain it.

Retrospective study. Acoustic tumors. To provide an additional criterion to predict the rate of preserved hearing after vestibular schwannoma surgery.

Patient Outcomes. To assess the contribution of preoperative radiologic appearance of the small vestibular schwannoma (VS) on the MRI in constructive interference in steady-state sequences (CISS) and demonstrated if the degree of the filling of the internal auditory canal (IAC) is correlated with hearing preservation. To provide an additional criterion to predict the rate of preserved hearing after vestibular schwannoma surgery.

Patient Care

3:34 pm

Management of Solitary Vestibular Schwannomas : Observation, Surgery or Irradiation?

Olivier Sterkers, MD, PhD; Michel Kalamarides, MD, PhD
Alexis Bozorg Grayeli, MD, PhD; Mustapha Smail, MD
Daniele Bernardeschi, MD, PhD; Evelyne Ferrary, MD, PhD

Objective : To evaluate the management of sporadic vestibular schwannomas (VS on a 4 year period in a tertiary referral center)

Study design: Retrospective chart review.

Setting: Tertiary referral center

Patients: Two hundred and four patients were included in this study, who were first seen in the department during the year 2005 for the management of VS: 70 were intracanalar VS, 77 small VS (stage 2, < 15 mm CPA), 42 middle sized VS (stage 3, >15 <30 mm in CPA), 15 large VS (>30 mm in CPA). Three therapeutic options (observation surgery and stereotactic radiotherapy) were proposed as a function of VS volume, hearing loss, age, general status, and willing of the informed patients. The patients were followed-up for 4 years period (2008).

Results: Initial treatment was observation in 121 VS (59,5%), surgery in 75 VS (37%), irradiation in 3 cases (1,5%). Five patients refused initial treatment (2%). In 2008, 48 VS (23,5%) were still observed (47% of stage 1 and 19,5% of stage 2), 107 VS operated on (52,5%), 17 VS irradiated (8,3 %) and 32 VS lost for follow-up (15,7%: 24% of stage I, 17% of stage 2, 5% of stage 3). Change of therapeutic management was induced by growing of VS in more than 90% of cases.

Conclusion: During the 4 years period of survey, 60% of VS were actively treated. Observation was recommended for the initial period for most of intracanalar or small VS although follow up should be difficult in such non aggressive tumors.

IRB Approval:

ACOUSTIC TUMORS
Practice Gaps— Lack of knowledge of the current standards of care in the treatment of acoustic tumors.

Better understanding of evolution of patients with vestibular schwannoma

Knowledge
Competence

Learning Objective: To show and analyze changement of therapeutic management during 4 years period.

Desired Result: to choose the best therapeutic option in patient with vestibular schwannoma

Patient Care, Medical Knowledge, Practice-Based Learning

3:42 pm

Predictive Factors of Hearing Preservation Following Surgical Resection of Small Vestibular Schwannoma

David J. Phillips, BA; Erik J. Kobylarz, MD, PhD
Edgar T. De Peralta, MD; Philip E. Stieg, MD, PhD
Samuel H. Selesnick, MD

Objective: To identify factors predictive of hearing preservation in patients undergoing resection of vestibular schwannoma.
Study Design: Retrospective chart review.
Setting: Tertiary-care medical center.
Patients: 41 patients with serviceable hearing pre-operatively who underwent a potentially hearing sparing procedure for resection of small vestibular schwannoma (extending 1 cm or less into the cerebellopontine angle).
Intervention: All patients underwent resection of vestibular schwannoma via the middle fossa (subtemporal) or retrosigmoid (suboccipital) approach.
Main Outcome Measures: Hearing was assessed pre- and post-operatively and classified according to the criteria of the American Academy of Otolaryngology-Head and Neck Surgery. Post-operatively, audiograms were unavailable for 8 patients without subjective hearing in the affected ear. These patients are included in the group without hearing preservation. Potential predictive factors of hearing preservation were tumor size, laterality, depth of penetration into the internal auditory canal (IAC), surgical approach, pre-operative hearing status, and intraoperative brainstem auditory evoked response (BAER) monitoring.
Results: Serviceable hearing was preserved in 23 patients (56%). Tumor size, laterality, depth of penetration into the IAC, surgical approach, pre-operative hearing status, wave V latency, and wave V amplitude were not predictive of hearing preservation. The presence of wave V on intraoperative BAER was the only significant predictor of hearing preservation ($p=0.013$). Serviceable hearing was preserved in 77.7% of patients with wave V present. Of note, serviceable hearing was also preserved in 39.1% of patients without a measurable wave V.
Conclusions: Presence of wave V on intraoperative BAER is a significant predictor of hearing preservation. Additionally, absence of wave V does not preclude preservation of serviceable hearing.
IRB Approval: 0907010508
Define Professional Practice Gap: There currently exists a lack of awareness of the factors predictive of hearing preservation following surgical resection of small vestibular schwannoma. In addition, the reliability, or lack thereof, of key brainstem auditory evoked response (BAER) data is not well appreciated.
Educational Need: Predictive factors of hearing preservation are important tools for clinicians in the counseling and treatment of patients.
Knowledge Competence Performance Patient Outcomes
Learning Objective: 1. To describe the significant predictors of hearing preservation following surgical resection of small vestibular schwannomas. 2. To describe the reliability of intraoperative brainstem auditory evoked response (BAER) monitoring as a predictor of hearing preservation.
Desired Result: The desired result is that based on a more complete understanding of the factors that predict hearing preservation following surgical resection of small vestibular schwannoma, clinicians will make more informed decisions when counseling patients on prognosis and recommended treatment modalities. Additionally, a more complete understanding of the utility of brainstem auditory evoked response (BAER) will allow clinicians to make more informed decisions intraoperatively to improve patient outcomes.
Patient Care
Medical Knowledge

3:50 pm

Long-Term Hearing Preservation following Microsurgical Excision of Vestibular Schwannoma

Erika A Woodson, MD; Ryan D. Dempewolf, MD
Samuel P. Gubbels, MD; Marlan R. Hansen, MD; Bruce J. Gantz, MD

Objective: To examine long-term hearing outcomes following microsurgical excision of vestibular schwannoma (VS).

Study design: Retrospective case review.

Setting: Tertiary referral center.

Patients: Forty-six subjects at a single institution who had undergone microsurgical excision of VS via middle fossa craniotomy between 1994 and 2007 with immediate post-operative hearing preservation and for whom long-term audiograms were available.

Intervention(s): Diagnostic.

Main outcome measure(s): Word Recognition Score (WRS) as defined by speech discrimination (SD via W-22 recorded word lists) scores of > 70 % (Grade I), 50-70 % (Grade II), < 50% (Grade III), and 0% (Grade IV).

Results: In subjects with greater than five years of follow-up (range 5-14 yrs), 23 (82%) maintained the same WRS as one month post-operative. Three subjects experienced a > 20% decline in WRS. One of these subjects lost significant hearing in the contralateral ear as well. For subjects with 2-5 years of follow-up, 15/18 (83%) maintained the same WRS as immediately post-operative. One subject experienced a one-grade decline in WRS. For this individual, his latest SD was 68% bilaterally and therefore likely represented a symmetric, progressive sensorineural hearing loss (SNHL).

Conclusions: Most subjects maintain their initial post-operative SD after microsurgical VS removal, and therefore initial post-operative WRS are predictive of long-term hearing in most patients. Post-surgical changes do not alter the natural rate or pattern of progressive bilateral SNHL in individual subjects.

IRB Approval: 200908784

Define Professional Practice Gap:
ACOUSTIC TUMORS
Practice Gaps— Lack of knowledge of the current standards of care in the treatment of acoustic tumors.

Educational Need: Define the role of surgery in treating acoustic tumors.

Patient Outcomes
Learning Objective: Evaluate long-term hearing outcomes after microsurgery for vestibular schwannoma removal.

Desired Result: Retained hearing with no degradation over time.

Practice-Based Learning

4:03 pm

Evaluation of a Customized Acoustical Stimulus System in the Treatment of Chronic Tinnitus

Jack J. Wazen, MD; Julie A. Daugherty, NP-C

Objective: The purpose of this study is to evaluate the efficacy of a customized acoustical stimulus (Neuromonics) system in the treatment of chronic tinnitus.

Study Design: Multi-institutional prospective

Setting: Nine US Tertiary Otological referral centers; ambulatory

Patients: Fifty-one (51) adults suffering from chronic tinnitus for a minimum of 6 months, with poor or no response to previous treatments, and on no concomitant therapies were enrolled to participate in the study.

Interventions(s): Following diagnostic measures and signing the IRB approved informed consent, patients were enrolled in the study. Treatment was delivered in 2 phases: phase 1 consisted of stimulation with patient customized musical tracks and white noise masking of the tinnitus for 2 months, 2-4 hours a day. Phase 2 consisted of listening to the same tracks, with no tinnitus masking for 4 months. Both phases included education, cognitive therapy and periodic follow up.

Main outcome measures: The response to treatment was measured through validated psychometric testing: the Tinnitus Reaction Questionnaire (TRQ) and the Tinnitus Handicap Inventory (THI). Other measures included the Hospital Anxiety Depression Scale (HADS), tinnitus awareness and disturbance scores and Loudness Discomfort Levels (LDL).

Results: Patients responses were recorded at 2,4,6,12 and 24 months after initiation of treatment. The TRQ was significantly reduced in 80% of patients at 6 months. The THI was reduced in 61% of patients as opposed to 42% in tinnitus retraining therapy and 21% in masking alone as reported in other studies. Scores continued to improve over time. Results at 12 and 24 months will be presented on patients who completed those measures.

Conclusion: The customized acoustical stimulus system offers a safe and effective means of tinnitus management as shown in this study and previously published clinical trials.

IRB Approval: Western IRB

Define Professional Practice Gap: Lack of definitive treatment for tinnitus
Educational Need: Present a novel treatment for the control of chronic tinnitus
Knowledge
Competence
Performance
Patient Outcomes
Learning Objective: Describe the theory and results of a novel treatment for chronic tinnitus
Desired Result: Apply new technology in the treatment of chronic tinnitus

4:11 pm

Melatonin: Can It Stop the Ringing?

Agnes Oplatek, MD; D. Bradley Welling, MD, PhD
Edward E. Dodson, MD; Claudia Dome, AuD
Kelly Wolfe, BA; Abraham A. Jacob, MD

Objective: To report the effectiveness of melatonin on chronic tinnitus and to determine if there is a subset of tinnitus patients that will benefit from melatonin therapy.

Study Design: Prospective, randomized, double-blind, crossover clinical trial.

Setting: Ambulatory setting in a tertiary referral center.

Patients: Adults with chronic tinnitus greater than 6 months in duration.

Intervention: Study subjects were randomized to 3 mg melatonin or placebo pills nightly for 30 days followed by a 1-month washout period. Each group then crossed into the opposite treatment arm for 30 days. Tinnitus Matching (TM), Tinnitus Severity Index (TSI), Self Rated Tinnitus (SRT), Pittsburgh Sleep Quality Index (PSQI), and Beck Depression Inventory (BDI) were administered every 30 days to assess the effects of each intervention.

Main outcome measures: Subjective and objective impact of melatonin on chronic tinnitus severity. Establish whether patient specific factors correlate with melatonin response.

Results: A total of 53 patients were enrolled. Following treatment with melatonin there was a significant decrease in TM, TSI, SRT, and PSQI scores ($p<0.05$). Placebo was associated with a significant decrease in TSI scores. The change in TM and SRT were statistically different between melatonin and placebo. Male gender, bilateral tinnitus, and absence of depression or anxiety were predictors of a positive response to melatonin. Patients with TSI scores ≥ 28, SRT ≥ 6, and PSQI ≥ 5 were more likely to have improvement in both tinnitus and sleep with melatonin ($p=<0.05$).

Conclusions: Melatonin is associated with a decrease in tinnitus intensity and improved sleep quality in patients with chronic tinnitus. Melatonin's greatest effect is seen in patients who are males, who have no history of depression or anxiety, have more severe bilateral tinnitus, and are poor sleepers.

IRB Approval: 2006H0263

Define Professional Practice Gap: Currently there are no definitive treatment options for tinnitus, a common problem effecting over 40 million people in the United States.
Educational Need: To report the effectiveness of one modality for the management of chronic tinnitus and to determine which patients may benefit from it.
Knowledge
Patient Outcomes
Learning Objective: 1. To understand the effectiveness of melatonin on chronic tinnitus. 2. To learn which subset of patients with chronic tinnitus may benefit from melatonin therapy.
Desired Result: Improve understanding of management options for chronic tinnitus.

4:19 pm

Complications of Bone-Anchored Hearing Aids: The Arkansas Experience

Christopher E. Lee, MD; John L. Dornhoffer, MD
Gresham T. Richter, MD; Lisa V. Christensen, AuD

Objective: The aim of this study was to determine what factors increase the likelihood of complications, specifically osseointegration failure and implant extrusion, with the use of bone-anchored hearing aids in children.

Study Design: This was a retrospective case review of 60 patients (42 pediatric and 18 adult patients).

Setting: Tertiary referral center; procedure performed as hospital outpatient surgery.

Patients: All children ≤ 19 years of age and all adults 34–69 years of age who received an osseointegrated implant for a bone-anchored hearing aid at Arkansas Children's Hospital from October 2003 to May 2009 or at the University of Arkansas for Medical Sciences from November 2005 to May 2009, respectively.

Intervention: Bone-anchored hearing aid placement.

Main Outcome Measures: Age, postoperative complications (osseointegration failure and adverse skin reactions), single versus two-stage procedures, medical history, skull thickness, and size of implant used.

Results: Fifty-seven loaded fixtures were placed in the pediatric population, and 20 were placed in the adults. We had a 21% pediatric and 0% adult osseointegration failure rate and a 16.67% pediatric and 5% adult adverse skin reaction rate.

Conclusions: Young age, syndromic status, and failure to penetrate the inner table of the skull increased the risk of osseointegration failures in children. Bicortical placement of the implanted screw may decrease the extrusion rate. Fixtures that were 3 mm through and through skull had a decreased extrusion rate compared to 3-mm fixtures that were surrounded by bone. Fixtures measuring 3-mm and 4-mm had similar outcomes overall.

IRB Approval: yes 110362
Practice Gap: Lack of knowledge and inconsistent awareness of complications related to the use of bone-anchored hearing aids.
Educational Need:
Understanding of individual patient factors that contribute to complications seen with the use bone-anchored hearing aids, specifically osseointegration failures in the pediatric population.
Knowledge
Patient Outcomes
Learning Objective: To understand and identify individual patient factors that contribute to complications of bone-anchored hearing aids specifically osseointegration failures.
Desired Result:
(1)Improved knowledge about modifiable factors that contribute to osseointegration failures in bone-anchored hearing aids.
(2)To minimize postoperative complications with the use of bone-anchored hearing aids.
Patient Care, Medical Knowledge, Practice-Based Learning

4:27 pm

Inner Ear Anomalies in Congenital Aural Atresia

Jeffrey T. Vrabec, MD; Jerry W. Lin, MD

Objectives: To define the prevalence of inner ear anomalies in aural atresia patients. To recognize patterns of developmental anomalies in aural atresia patients.

Setting: Retrospective review in an academic medical center.

Patients: Pediatric patients with aural atresia.

Main outcome measure: Prevalence of inner ear anomalies and coexisting facial paralysis or sensorineural hearing loss.
Results: In this series of 119 patients with aural atresia, associated facial palsy was seen in 12% while inner ear anomalies were present in 21%, including all patients with facial palsy. Interestingly, the inner ear anomalies often did not display a significant sensorineural hearing loss. Bilateral inner ear anomalies were frequently encountered despite unilateral atresia. A novel anomaly, the dilated posterior semicircular canal, is described in this series.

Conclusion: Inner ear anomalies are common in the presence of aural atresia, especially when there is concurrent congenital facial palsy. The presence of inner ear anomalies should be recognized as a common feature of craniofacial microsomia.

IRB Approval: Yes

Define Professional Practice Gap: Inconsistent awareness of the prevalence of inner ear anomlaies in patients with aural atresia.

Educational Need: Apply approriate diagnositic strategies for identification of inner ear anomalies. Recognize the adverse effect of an inner ear anomaly on hearing outcomes in atresia surgery.
Knowledge
Patient Outcomes

Learning Objective: To define the prevalence of inner ear anomalies in aural atresia patients.
Desired Result: Awareness of the prevalence of inner ear anomalies in patients with aural atresia and their impact on surgical management.

Patient Care
Medical Knowledge
Practice-Based Learning

4:35 pm

Revision Aural Atresia Surgery: Indications and Outcomes

Eric R. Oliver, MD; David C. Shonka, MD; Brian B. Hughley, MD
Bradley W. Kesser, MD

OBJECTIVE: To determine the most common indications for revision atresia surgery and the postoperative healing and hearing outcomes.

STUDY DESIGN: Retrospective case review.

SETTING: Tertiary care academic otologic practice

PATIENTS: Patients undergoing revision surgery for congenital aural atresia.

INTERVENTION: Revision surgery for congenital aural atresia.

MAIN OUTCOME MEASURES: Indications for revision surgery; postoperative ear canal patency, incidence of infection/drainage, and speech reception thresholds.

RESULTS: 74 patients underwent 106 revision operations for aural atresia as follows: 47% for stenosis/new bone growth, 22% for infection/drainage, and 31% for hearing loss alone. Fifty-four patients (73%) required a single revision.
Twenty patients (27%) required two or more revisions, including bilateral patients. With follow-up greater than 3 months, 63% achieved a patent canal (7 patients required more than one revision), and 76% achieved a dry canal (6 required more than one revision). The average postoperative SRT of 25 dB HL was a significant improvement from the average preoperative SRT of 33 dB HL ($p < 0.01$, paired t-test).

CONCLUSIONS: Revision aural atresia surgery is most commonly indicated for stenosis of the external auditory canal. Despite the challenges of revision surgery, significant improvement in canal patency, epithelialization, and hearing outcomes can be achieved.

IRB Approval: University of Virginia IRB #13090

Practice Gaps-- Inconsistent awareness or ability to implement strategies for improving conductive hearing loss in patients with congenital aural atresia.
Educational Need: 1) Proper use of standard and novel strategies for improving conductive hearing losses. 2) Understanding and refining techniques to improve overall outcomes for patients with congenital aural atresia
Knowledge
Patient Outcomes
Learning Objective:Participants will be able to identify the most common indications for revision surgery for aural atresia and understand surgical outcomes with respect to canal patency and hearing improvement.
Desired Result: Improvement in healing and hearing outcomes in patients with aural atresia.
Patient Care
Practice-Based Learning

4:43 pm

Clinical Experience in Diagnosis and Management of Superior Semicircular Canal Dehiscence in Children

Gi Soo Lee, MD; Guangwei Zhou, MD, ScD; Dennis Poe, MD
Margaret Kenna, MD; Manali Amin, MD; Laurie Ohlms, MD
Quinton Gopen, MD

Objective: To identify clinical characteristics of pediatric superior semicircular canal dehiscence (SSCD) and explore suitable options for medical management.

Study Design: Retrospective case review.

Setting: Tertiary referral center.

Patients: Ten pediatric patients with definitive symptomatic SSCD.

Interventions: Pediatric patients with suspicious audiologic or vestibular complaints were evaluated using high-resolution temporal bone CT scan. Those suspected with SSCD underwent electrophysiological evaluation, i.e., vestibular evoked myogenic potential (VEMP) testing, for confirmation, in addition to routine audiologic tests.

Results: All ten patients had some degree of either auditory or vestibular impairment, or both. Auditory symptoms included autophony, tinnitus, and hearing loss. The hearing loss was either conductive or mixed. Bone conduction responses were occasionally seen better than 0dB HL. Vestibular dysfunction included attacks of vertigo and chronic dysequilibrium. One patient underwent surgical repair for disabling vestibular symptoms and had dramatic improvement in both her auditory and vestibular symptoms after the surgery.

Conclusion: Different from adult patients, children with SSCD usually present with auditory symptoms first, such as hearing loss and autophony, although they share some similarities with adults in clinical manifestations of SSCD. Our study has shown that SSCD syndrome (Minor's syndrome), a well accepted clinical entity, does exist in the pediatric population. Conservative approach is preferred in managing children with SSCD, with surgical plugging of the dehiscent superior semicircular canal reserved for patients with disabling vestibular or auditory symptoms. To date, this is the first clinical case series of symptomatic pediatric patients with SSCD.

IRB Approval: Yes

Define Professional Practice Gap: Vestibular Diagnostics
Educational Need: To report on a case series of symptomatic patients with superior canal dehiscence which has not yet been presented in the pediatric population (To date has only been presented within adult patients).
Knowledge
Competence
Performance
Patient Outcomes
Learning Objective:
Education about pediatric superior canal dehiscence
Desired Result:
Better understanding of the condition

7:30 am

IL-8 Production in Response to TNF-alpha by Cholesteatoma Keratinocytes in Cell Culture

Christopher W. Hilton, MD; Frank G. Ondrey, MD, PhD
Beverly R. Wuertz, BA; Samuel C. Levine, MD

Hypothesis: Keratinocytes harvested from acquired cholesteatoma and grown in cell culture will demonstrate increased IL-8 production in response to TNF-alpha compared to a control keratinocyte cell line.

Background: Immunohistochemical studies have identified IL-8 and TNF-alpha, mediators of bony destruction, in tissue samples of cholesteatoma. TNF-alpha stimulates IL-8 production in healthy epidermal keratinocyte cell lines. It is not known whether TNF-alpha stimulates IL-8 production in cultured cholesteatoma keratinocytes (CK).

Methods: Tissue samples of acquired cholesteatoma were dissociated into a single cell suspension and grown in keratinocyte serum-free media for eight weeks. CK and a control cell line of skin epidermal keratinocytes (SEK) were treated with 0 pg/ml, 2 pg/ml, and 20 pg/ml of TNF-alpha. Conditioned media was harvested after 24 hours. Production of IL-8 was measured by ELISA and cell counts were performed.

Results: At a zero concentration of TNF-alpha, mean production of IL-8 by CK was 39,809 pg/ml/24hr/1x10^6 cells verses 1907 pg/ml/24hr/1x10^6 cells from SEK cells, a statistically significant difference (p value <.05). The CK showed a 2.1-fold increase in response to 2 pg/ml of TNF and a 2.44-fold increase in response to 20 pg/ml of TNF alpha. The SEK cell line demonstrated a 1.07 and 1.13-fold increase to respective concentrations of TNF alpha.

Conclusions: CK appear to retain cell signaling characteristics in vitro that distinguish them from SEK. This may indicate that CK undergo a change in behavior in vivo that is preserved after the cells are removed from the inflammatory environment of the middle ear.

IRB Approval: University of Minnesota IRB#: 0810E51942, approval 11/08

Define Professional Practice Gap: Basic Science: Cholesteatoma pathogenesis
Educational Need: Pathogenesis of cholesteatoma
Knowledge
Learning Objective: 1)Understand factors that influence the destructive behavior of cholesteatoma 2) Learn about behaviors of cholesteatoma keratinocytes in cell culture which distinguish them from a healthy epidermal keratinocyte cell line.
Desired Result: 1) Improved knowledge of cholesteatoma pathogenesis. 2) Improved understanding of the cholesteatoma keratinocyte as a unique phenotype.
Medical Knowledge

7:38 am

Immunocytochemistry of the Spiral Ganglia Obtained from Microdissected Human Temporal Bones

Ashley E. Balaker, MD; Mia M. Miller, MD; Gail Ishiyama, MD
Ivan A. Lopez, PhD; Akira Ishiyama, MD

Hypothesis: To describe the immunolocalization of specific neuronal markers in order to identify human spiral ganglia neurons and fibers in microdissected vestibular end organs.

Background: The use of microdissected specimens has several advantages over the traditional celloidin embedded archival human temporal bone specimens. First, each vestibular nerve can be properly oriented and thin cross sections of the microdissected vestibular nerve can be made. Secondly, immunohistochemistry can be successfully applied to the microdissected specimens.

Methods: Frozen sections were used from vestibular end organs microdissected from human temporal bones. Tissue sections were incubated with antibodies against pan-neurofilaments, peripherin and superoxide dismutase-2, synaptophysin, and myelin basic protein. This allowed us to visualize the axoplasm of nerve fibers using antibodies against neurofilaments.

Results: These antibodies specifically identified neuronal somata and nerve terminals. Type I and type II spiral ganglia neurons were also identified.

Conclusions:
The present combination of microdissection and immunohistochemistry can be used to investigate the total number and size of nerve fibers in vestibular end organs in a range of clinical conditions, including. aging, gentamicin ototoxicity, Meniere's disease or other auditory and vestibular disorders. These techniques, once only possible in animal models, have the potential to open up a new field for future human temporal bone research.

Supported by NIH/NIDCD grants DC005028; 5U24 DC008635; DC05187I

Practice Gaps- Under-utilization of recommended diagnostic strategies in cochlear and vestibular diseaseApplying appropriate diagnostic strategies to inner ear (cochlear and vestibular) disease.

KnowledgeTo understand the immunolocalization of specific neuronal markers in order to identify human spiral ganglia neurons and fibers in microdissected vestibular end organs.To use the combination of microdissection and immunohistochemistry to investigate the total number and size of nerve fibers in vestibular end organs in a range of clinical conditions, including. aging, gentamicin ototoxicity, Meniere's disease or other auditory and vestibular disorders

Medical Knowledge

7:46 am

Characteristics of Osteoblasts Cultured from Stapes of Patients with Otosclerosis after Exposure to Alendronate

Yvonne L. Richardson, MD; Kourosh Parham, MD, PhD
Jonathan J. Romak, BA; Marc D. Eisen, MD
Michael S. Aronow, MD; Gloria A. Gronowicz, PhD

Hypothesis: Bisphosphonates alter the characteristics of cultured otosclerotic osteoblasts.
Background: The mechanisms by which bisphosphonates help in treatment of otosclerosis are unknown. In this study we assessed how the characteristics of in vitro osteoblast cultures grown from stapes removed during stapedectomies are altered with exposure to alendronate.
Methods: Cell cultures from stapes of four patients with otosclerosis were compared to cell cultures from healthy human peripheral bone fragments harvested during four orthopedic procedures of patients matched for age and sex. Specimens were cultured in DMEM-F-12 with 15% FBS and antibiotics. Once cells reached confluence, 10,000 cells/cm2 were replated, and adhesion and proliferation assays were performed.
Results: For adhesion studies, cells were treated with and without alendronate (10-10 - 10-8M) for 1 week, then trypsinized andreplated at the same density. Cells were assayed after 4 hours of culture. Significantly more stapes osteoblasts (SO) (mean±SEM 22616±2455) attached to the plates than normal human osteoblasts (NHO) (12651±90; $p < 0.005$). SO counts decreased in the presence of aldendronate (e.g., at 10-8 M 12630±1874). For proliferation studies cells were treated with and without alendronate (10-10 - 10-8 M) for 2 days. At 72 hours of culture, tritiated thymidine uptake for the SO was lower than NHOs (2884±391 vs. 3935±513 dpm; $p < 0.05$) but in the presence of alendronate, SO uptake increased (e.g., at 10-8 M 4061±701).
Conclusions: Alendronate has a "normalizing" effect on otosclerotic osteoblasts. These present in vitro findings support a role for the bisphosphonates in the treatment of otosclerosis.

IRB Approval: Yes-Exempt

Define Professional Practice Gap: MIDDLE EAR
Practice Gaps-- Inconsistent awareness or ability to implement strategies for improving conductive hearing loss.

Educational Need: Pathogenesis of otosclerosis and effects of bisphosphonates in otosclerotic osteoblasts.

Knowledge

Learning Objective: 1. Understand potential role of osteoblasts in pathogenesis of otosclerosis. 2. Understand potential role bisphosphonates in treatment of otosclerosis.

Desired Result: 1. Increased knowledge in otosclerosis and a potential future treatment.

Medical Knowledge

7:54 am

Partially Implantable Bone Conducting Hearing Aids without a Percutaneous Abutment. Technique and Preliminary Clinical Results

Prof. Dr. Ralf Siegert

Introduction: We have developed new partially implantable BCHA (Bone Conduction Hearing Aids) without a percutaneous abutment and have been using them clinically for four years. The principle of these BCHA is a magnetic coupling and acoustic transmission between implanted and external magnets. The goal of this study was to evaluate clinical and audiological results.

Methods: Magnets are implanted into shallow bone beds in a one step procedure. The skin above the magnets is also reduced to a thickness of 4-5 mm, which reduces the attenuation to less than 10 dB compared to direct bone stimulation.
Patients: Eighty-four patients have been implanted in the last 4 years. Their average age was 22 yrs (6 – 63), sensorineural hearing deficit 16 ± 10 dB (5 – 43 dB) and air-bone-gap 54 ± 12 dB (18 – 75 dB).
Results: Except for temporary pressure marks in 4%, which healed after careful shimming of the external base-plate, there were no other complications. The magnetic force chosen by the patients was 2.0 ± 0.5 N. The average hearing gain was 38 ± 8 dB and the suprathreshold word-recognition tests "(Freiburger") increased significantly from 2% without to 77% with the BCHA at 65 dB.

Discussion: The holding strength of the external components is equivalent to partially implantable hearing aids and Cochlea implants and the hearing improvement is similar to other bone conducting hearing aids. We have found the comfort and safety of this system is significantly improved compared to conventional or percutaneous bone conducting hearing aids.

IRB Approval:
MIDDLE EAR
Practice Gaps-- Inconsistent awareness or ability to implement strategies for improving conductive hearing loss.

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Educational Need:
Educational Objective 1) Proper use of standard and novel strategies for improving conductive hearing losses.

Knowledge
Competence
Performance
Patient Outcomes
Learning Objective: Learn about the new technique

Desired Result: Understand the technique and its indication
Patient Care
Medical Knowledge
Practice-Based Learning

8:02 am

Applications of Cone Beam CT in the Temporal Bone

Richard T. Penninger, MD; John P. Carey, MD; Tanya S. Tavassolie

Objective: To determine if cone-beam CT can better estimate the size of superior canal dehiscences (SCD) than multislice CT.
Study design: Retrospective review of CT and surgical data; Comparisons of multislice and cone-beam CTs on cadaveric specimens
Setting: Academic medical center
Patients: Patients with SCDS, aged 46.3 ±11.22
Interventions: diagnostic CT scans
Main outcome measure, Result and Conclusion:The gold standard for diagnosis of superior canal dehiscence (SCD) has been multi-slice CT. However, partial volume averaging and filtering may confound the ability to detect thin bone next to low-radiodensity brain and inner ear fluids. We correlated radiographic and surgical findings in SCD to determine if multi-slice CT overestimated the size of SCD and if a threshold radiodensity could be defined, below which actual dehiscence could be predicted. Dehiscence length and width measured from multi-slice CT were compared to measurements made at microsurgery. Differences between radiographic and actual length and width were both >0 ($p < 0.001$, one-sample t-test), indicating that CT tends to overestimate the size of SCD. Receiver operating characteristic analysis found that a threshold of -375 Hounsfield units predicted actual dehiscence. Cone Beam Volumetric Tomography (CBVT) has a smaller radiation dose (e.g., 5mA and120kV) than multislice CT (MSCT, 250mA and 135kV), which allows CBVT to be deployed directly to outpatient offices. There is potentially better spatial resolution compared to MSCT when inherent tissue contrast is high. Data from cadaveric temporal bones scanned with CBVT and MSCT are compared. Results demonstrate better spatial resolution of CBVT for some structures.

This study qualified for exemption from an IRB protocol based on DHHS Criteria 45 CFR 46.101(b) (15). The determination that the study was exempt from a protocol requirement was made by the Joint Committee on Clinical Investigation of the Johns Hopkins University School of Medicine.

Practice Gaps- Under-utilization of recommended diagnostic strategies in cochlear and vestibular disease.

Applying appropriate diagnostic strategies to inner ear (cochlear and vestibular) disease. Specifically, understandingthe role of novel cone -beam CT technology in diagnosing inner ear disease.

Knowledge
Competence
Performance
Patient Outcomes

Comparison between Multi Slice CT and Cone Beam CT
Getting an non biased overview of the new CT devices on the market.

8:15 am

Robotic Mastoidectomy

Andrei Danilchenko, BS; Jenna L. Toennies, MS
Ramya Balachandran, PhD; Stephan Baron, PhD
Benjamin Munske, BS; Robert J. Webster III, PhD
Robert F. Labadie, MD, PhD

Hypothesis: Using image-guided surgical techniques, we propose that an industrial robot can be programmed to safely, effectively, and efficiently perform a mastoidectomy.

Background: While a mature field with surgical applications in urologic, cardiothoracic and head and neck oncologic surgery, robots have yet to be clinically utilized in otologic surgery despite significant advantages including reliability and precise-repeatability.

Methods: We designed a robotic system that incorporates custom software to an industrial robot Mitsubishi RV-3S (Mitsubishi Electric & Electronics USA, Inc., Cyprus, CA) to allow complex path implementation. The software controls the movements of the robot based on real-time feedback from commercially-available Spectra optical tracking system (NDI, Waterloo, Ontario) via the reference markers. We custom-built an end effector to hold a surgical drill. The desired path of the drill was contoured on clinically-applicable temporal bone CT scan using planning software and then exported to the robotic system. Bone-implanted fiducial markers were used to provide registration between CT and physical space.

Results: On 3 phantoms, we drilled the mastoid cavity before moving on to implementation on cadaveric skulls. 5mm fluted ball bits were used for drilling. Drilling was subjectively accurate without violation of any major landmarks (i.e. tegemen, external auditory canal, sigmoid sinus). Video of the robotic drilling will be presented.

Conclusions: To the best of our knowledge, this is the first time that a robot has been used to perform a mastoidectomy. While significant hurdles remain to translate this to clinical use, we have shown that it is feasible.

Acknowledgement: Funded by NIH/NIBIB-R21EB006044-01A1
IRB Approval: N/A

Define Professional Practice Gap: Knowledge about robots
Educational Need: Knowledge about robots
Knowledge

Learning Objective: Feasibility of perfoming robotic mastoidectomy
Desired Result: Robot perfoming mastoidectomy

Medical Knowledge

8:23 am

The Effect of Ultrasonic Bone Removal on the Guinea Pig Facial Nerve

Stella Lee, MD; Alexander Vortmeyer, MD, PhD
Elias Michaelides, MD

Hypothesis: Ultrasonic bone dissection over the facial nerve can provide a safe alternative than the otologic drill based on functional and histological parameters.

Background: High-speed drills in otologic surgery may injure nerve structures through direct contact and production of high temperatures. Ultrasonic dissection may be able to provide a safer means of bone removal around the facial nerve due its emulsification of bone eliminating torque, skipping, and bone dust.

Methods: Phase I comprised the feasibility study on a cadaveric temporal bone model in which a complete mastoidectomy and facial nerve decompression was performed on 6 temporal bones using either the ultrasonic device or the drill. Average time required to perform the procedure was measured and signs of damage to critical structures evaluated. Phase II comprised the in-vivo study in which facial nerve decompression was performed on 6 guinea pigs. Facial nerve function was examined post-operatively and histologic evaluation performed.

Results: Average time required to perform a mastoidectomy was higher with the ultrasonic method, however there were decreased signs of damage to the facial nerve in the ultrasonic group. In the in-vivo study no significant difference was noted for facial nerve function between the two groups. There was however a decreased number of inflammatory cells in the ultrasonic group in comparison to the drill group.

Conclusions: Contact with the ultrasonic device produced a lesser degree of inflammation of the facial nerve than contact with the drill. Use of the ultrasonic device appears to be a safe alternative in temporal bone surgery.
IACUC Approval Protocol#: 2008-11246

Lack of awareness/knowledge of alternative methods and technology in otologic surgery.

Discuss mechanisms of potential facial nerve injury in otologic surgery and introduce ultrasonic dissection as a potential safe alternative to the otologic drill.

Knowledge
(1) Evaluate mechanisms of potential facial nerve injury in otologic surgery.
(2) Discuss how ultrasonic bone removal in comparison to the otologic drill affects facial nerve function and histology in a guinea pig model.

(1) Improved knowledge/awareness of the mechanisms of facial nerve injury.
(2) Discussion of ultrasonic technology in temporal bone surgery which may provide a safe alternative to the otologic drill.
Medical Knowledge

8:31 am

Thermal Properties of Operative Otoendoscopes: An Ovine Model

David D. Pothier, MBChB MSc FRCS
Samuel A. Mac Keith, MBChB MRCS

Hypothesis
The temperature change in tissues of the middle and inner ear caused by oto-endoscopes during surgery can cause thermal injury

Background
Endoscopes are being used more commonly in the middle ear space to improve surgical access. Heat os produced by these endoscopes and the safety of this heat needs to be measured.

Methods
Thermocouples were inserted into the middle ear at the promontory, the inner ear within the cochlea, and on the tympanic membrane. Endoscopes of varying diameters and angulations (0°, 30 °, 70 °) were sequentially inserted into the ovine ear canal to a distance of 5mm from the tympanic membrane and illuminated by a xenon light source for 20 minutes. Changes in temperature were recorded.

Results
The change in temperature caused by the endoscopes was considerable. Temperatures increased rapidly upon introduction of the endoscope, and then continued to rise for the duration of the test. Temperatures of up to 50.1°C were recorded at the tympanic membrane and temperatures within the cochlea rose
by up to 7°C. The angulation of the oto-endoscope did not correlate negatively with the amount of heat produced, as previously thought.

Conclusions
This study has demonstrated that the thermal effect of otoendoscopes can be considerable and may result in damage to middle and inner ear structures. Active cooling of oto-endoscopes must be undertaken to avoid this potentially hazardous effect.

IRB Approval: None required

Define Professional Practice Gap: Lack of knowledge of heat production of endoscopes

Educational Need: To learn about the potential damage caused by otoendosopes and how to reduce the risk of this damage.

Knowledge
Competence
Learning Objective:

Desired Result: Patient Care

8:39 am

A Self-adjusting Ossicular Prosthesis Containing Polyurethane Sponge

Richard L. Goode, MD; Hiroyuki Yamada, MD

Hypothesis: Middle ear ossicular replacement prostheses whose length can adjust in vivo to changes in middle ear dimensions following insertion may have acoustic advantages.
Background: Optimal tension is an important factor in the acoustic performance of incus-stapes replacement prostheses. Length is the primary determinant of post-insertion tension with conventional prostheses.

Post-operative changes in prosthesis tension may occur leading to a worsening of post-operative hearing.

Methods: We studied a self-adjusting prosthesis containing a 2 mm diameter, 2 mm thick polyurethane sponge attached to the head of a titanium PORP; length 4.25mm. We compared this prosthesis to optimal length PORPs in five human cadaveric temporal bones at different tensions. Sound input was 0.1 - 10 kHz at 80 db SPL. Stapes footplate displacement was measured using a laser Doppler vibrometer before and after incus removal and prosthesis insertion between the malleus and stapes head. We then inserted 1-3 glass shims between the malleus and the conventional and adjustable prostheses to change prosthesis tension. Measurement of stapes displacement was repeated with increased prosthesis lengths of 0.15, 0.30 and 0.45mm.

Results: After shim insertion, there was a clear tendency In the conventional PORP's for a decrease in footplate displacement below 1.0 kHz proportional to the increasing length and less so below 0.6 kHz with the self-adjusting prosthesis. The self-adjusting prosthesis provided equivalent transmission at baseline and better transmission below 1 kHz at varying lengths.

Conclusion: A self-adjusting prosthesis appears to have acoustic advantages in a temporal bone model at lower frequencies.

IRB Approval: None

Define Professional Practice Gap: Lack of knowledge of self-adjusting middle ear replacement prostheses.
Educational Need: Provide information on design and potential advantages of self-adjusting middle
ear replacement prostheses.

Knowledge

Learning Objective: Understand reasons for certain inadequate hearing results after middle ear surgery and how improved prosthesis design may improve results.

Desired Result: Improved knowledge of protential role of self-adjusting middle ear replacement
prostheses.

Medical Knowledge

8:47 am

Minimally Invasive BAHA Surgery

Peter C. Weber, MD

Objective: To develop a surgical procedure to place a BAHA that lessens complications and is more cosmetic.

Study Design: Retrospective review of a minimally invasive surgical approach of all BAHA patients over the last 2 years

Setting: Academic Tertiary Medical Center

Patients: All adult patients who received a BAHA implant, for any reason, over last two years.

Interventions: BAHA surgery which eliminates almost all of the current soft tissue removal and the use of the 8.5mm abutment.

Main Outcomes: Complications and Hearing Results

Results: No patient had problems with soft tissue overhanging the abutment, wound breakdown, or non osseous integration. Hearing results were as expected for BAHA

Conclusion: Minimally invasive surgical approach for BAHA offers a technique that minimzes complications and is the best from an aesthetic point of view; all without comprimising hearing.

IRB Approval:

Define Professional Practice Gap: Inconsistent methodology of surgically placing the BAHA and the associated complications

Educational Need: Method of placing the BAHA to eliminate significant risks and patient complaints.

Knowledge
Competence
Patient Outcomes

Learning Objective: To avoid complications associated with BAHA surgery. To understand how the procedure is completed

Desired Result: Be able to surgical place a BAHA in minimal time with minimal complications along with great hearing results.

Patient Care
Medical Knowledge
Practice-Based Learning

System-Based Practice

9:03 am

Patterns of Failure in Heat-Activated-Crimping Prosthesis in Stapedectomy

Yu-Lan Mary Ying, MD: Todd A. Hillman, MD
Douglas A. Chen, MD

Study Design: Retrospective longitudinal stapedectomy case series with controls.

Methods: Retrospective chart review of all primary and subsequent revision stapedectomy surgeries performed by the senior authors with heat-activated-crimping pistons between June 2003 to September 2009. Patients who had history of previous stapedectomy done elsewhere were excluded.

Results: A total of 192 primary stapedectomies using heat-activated crimping pistons were performed between this period. There were 24 patients who had initial good hearing results that required revision or replacement with a different type of prosthesis. A common finding was lateral displacement of the prosthesis from the stapedotomy with detachment of the nitinol hook from the incus. This group of patients was compared to a control group that utilized manual-crimp prosthesis.

Conclusions: Heat-activated-crimping prosthesis has been reported to enhance stapedecotmy hearing outcomes on short and long-term follow-up studies. Longitudinal analysis on its complication has not been reported. This case series demonstrated a 12% rate of possible eventual loosening of the heat-activated crimp with apparent reopening of the nitinol hook off the incus and/or displaced out of vestibule/stapedotomy. Failure rates were classified. The advantages and disadvantages of this popular prosthesis were reviewed.

IRB Approval: Pending

Define Professional Practice Gap: Lack of awareness regarding patterns of failure in heat-activated-crimping prosthesis in stapedectomy.

Educational Need: Describe the pattern and incidence of failure with heat-activated-crimping prosthesis in stapedectomy.

Knowledge
Competence
Performance
Patient Outcomes

Learning Objective: To understand potential causes of failure in heat-activated-crimping prosthesis in stapedectomy and utilize potential remedy.

Desired Result: same as Learning Objective

Practice-Based Learning

9:11 am

Nitinol Stapes Prosthesis Improves Low-Frequency Hearing Results in Otosclerosis Surgery

Charles A. Mangham Jr., MD, MS

Objective: To determine if nitinol shape-memory stapes prostheses offer a hearing result advantage compared to platinum-Teflon pistons that must be manually crimped.
Study Design: Retrospective chart review.
Patients: 160 consecutive patients with either a platinum-Teflon or a nitinol-Teflon piston and primary stapes surgery between 2000 and 2008
Setting: Subspecialty private practice.
Intervention: One hundred and twenty ears received a platinum-Teflon 0.6 mm diameter piston and 40 ears received a nitinol-Teflon 0.6 mm diameter piston.
Main outcome measures: AAO-HNS guidelines including four-frequency pure-tone average (PTA) air-bone (AB) gap, and success (gap ≤ 10 dB) rate.
Results: Success at closing the AB gap was significantly better for the nitinol group (100% versus 84%, p=0.021). The nitinol group had significantly smaller mean AB gaps in the lower frequencies (at 250 Hz, 9.8 dB versus 16.8 dB; and, at 500 Hz, 0.8 dB versus 6.0 dB, p's<0.01), but not at 1, 2, or 4 kHz. The highly malleable platinum loop was adaptable to various incus diameters and was easy to crimp. The 360 degree circumferential version of the nitinol prosthesis may adapt to various incus diameters better than the original version (minimum heat-crimped diameter 0.70 mm versus 0.76 mm). In some cases, both nitinol versions were difficult to crimp using only a laser and a manual crimp was also required.
Conclusions: The nitinol-Teflon stapes prostheses failed to live up to claims of consistent ease of crimping; however, the significantly better low-frequency hearing results justify an effort to make the devices more user friendly.

The author has no financial interest in the prostheses described above. Chairman of the Swedish Hospital Medical Center IRB approved this study.

Define Professional Practice Gap: Recent publications suggest that nitinol prostheses may help inexperienced surgeons who have difficulty crimping conventional devices, but offer no better hearing outcome for patients of experienced surgeons.
Educational Need: Nitinol prostheses are difficult to crimp in some cases, even for an experienced surgeon; however, ultimately a more secure crimp can be achieved in most cases which correlates with better hearing improvement at 250 and 500 Hz compared to a conventional crimpable prosthesis.

Knowledge
Competence
Performance
Patient Outcomes

Learning Objective: Inexperienced stapes surgeons will regard nitinol prostheses as a new technology that may help them with crimping in some cases, but is not a replacement for experience. Experienced stapes surgeons may consider nitinol prostheses to improve hearing results at frequencies below 1 kHz.

Desired Result: Inexperienced stapes surgeons will not take on cases that they would otherwise refer out just because nitinol is offered as a cure for crimping problems. Experienced surgeons will consider a trial of using nitinol devices in a temporal bone lab setting to see if they are comfortable with using a laser for crimping.

Patient Care
Medical Knowledge
Practice-Based Learning

Professionalism

9:19 am

Reliability of CT-Scan in the Prognosis of Otosclerosis

Sebastien Lagleyre, MD; Mathieu Marx, MD; Young-Je Shin, MD
Bernard Escudé, MD; Olivier Deguine, MD; Bernard Fraysse, MD

Objective: To evaluate on the operated ear the risk of sensorineural hearing loss according to CT-scan locations of otosclerotic focus.

To evaluate on the non-operated ear the audiometric evolution at 3 years after surgery according to CT-scan findings.

Study design: Prospective study
Setting: Tertiary reference center

Patients: 200 patients (209 ears) presenting progressive conductive hearing loss with normal tympanic membrane, abnormal stapedial reflex and scheduled for stapes surgery.

Intervention: All patients underwent CT-scan before surgery. Stapedotomy was performed in 99% of cases.

Main outcome measures: CT-scan results were categorized as positive, doubtful or negative. Concerning the 200 opposite ears, we defined 3 groups from pure tone audiogram: normal hearing, pure sensorineural hearing loss and conductive component.

Results: Of 209 CT-scans of operated ears, 84% were classified positive, 9% doubtful and 7% negative. The sensitivity of CT-scan to otosclerosis was 95.1%. In the operated ears, the mean preoperative and postoperative bone conduction thresholds were significantly lower in cases of otosclerotic focus involving the endosteum ($p<0.005$ and $p<0.0001$ respectively). Among the 200 non-operated ears, 69 ears presented a normal hearing (34.5%), 51 ears a pure sensorineural hearing loss (25.5%) and 80 ears a conductive component (40%). Normal opposite ear (absence of otosclerotic focus on CT-scan with normal hearing), pure opposite cochlear otosclerosis (endosteal involvement with pure sensorineural hearing loss) and infraradiologic opposite form (negative CT-scan with conductive component) were found in respectively 27 (13.5%), 16 (8%) and 9 (4.5%) of the 200 patients.
Conclusion: Foci involving otic capsule, internal auditory canal or round window led to a significantly higher risk of sensorineural hearing loss after stapes surgery. 3 years hearing survey of the non-operated ears will be presented at the congress.
IRB Approval:
Define Professional Practice Gap: Middle ear diseases: otosclerosis
Educational Need: Middle ear surgery
Learning Objective: Evaluate on the operated ear the risk of sensorineural hearing loss according to CT-scan locations of otosclerotic focus. Evaluate on the non-operated ear the audiometric evolution at 3 years after surgery according to CT-scan findings.
Desired Result: Confirm that otosclerotic endosteal involvement increase the risk of sensorineural hearing loss after stapes surgery. Find, 3 years after surgery, a difference of evolution of hearing between normal hearing opposite ear with and without otosclerotic focus on CT-scan. Compare the progression of hearing loss between non-operated ears with pure sensorineural hearing loss and with conductive component

9:27 am

The Incus in Ossicular Chain Reconstruction: Take it or Leave it?

Samuel D. Turner, MD; David P. Mullin, MD; Xianxi Ge, MD
Travis J. Pfannenstiel, MD; Ronald L. Jackson, PhD
Jianzhong Liu, MD; Ben J. Balough, MD

Hypothesis: The presence or absence of the incus body is an important determinant of middle ear sound transmission in ears reconstructed with partial or total ossicular replacement prostheses (PORP or TORP).

Background: The incus is necessarily removed in many earsurgeries, and its removal impacts the vibratory motion of the malleus by dissociating the incudomalleal joint. Whether the absence of the incus body is favorable or unfavorable to middle ear reconstruction is unknown.

Methods: Six cadaveric human temporal bones were prepared by performing a mastoidectomy and facial recess approach. Incudostapedial joint discontinuity was created using a KTP laser with the long process of the incus being removed. Ossicular chain reconstruction (PORP or TORP) was performed. Measurements of round window membrane (RWM) response were taken using a Laser Doppler Vibrometer at frequencies from 250 - 8000 Hz with the incus body both present and removed.

Results: Pooled RWM velocity measurements for reconstructed middle ears with and without the incus in place were compared. A difference in RWM velocity was observed from 1000 to 4000 Hz, showing higher velocities with the incus body removed. In this frequency range the RWM velocity was 0.0032 ± 0.0010 (mean±SD) mm/sec with incus present and was 0.0056 ± 0.0018 mm/sec with incus removed ($p < 0.05$).

Conclusions: With regard to placement of PORP or TORP prostheses, the presence or absence of the incus body impacts the transfer of sound energy. A statistically significant increase in RWM velocity was seen from 1000 to 4000 Hz when the incus was removed.

IRB Approval: Not required

Define Professional Practice Gap: Basic Science: Middle Ear Mechanics

Educational Need: Effect of incus removal during ossicular chain reconstruction on middle ear sound transmission
Knowledge
Learning Objective: 1) To better understand the role of the incus in middle ear reconstruction. 2) To learn how removal of the incus during middle ear reconstruction affects middle ear sound transmission during middle ear reconstruction
Desired Result: 1)To determine whether removal of the incus or leaving it in place results in greater sound transmission after middle ear ossicular chain reconstruction

Medical Knowledge

9:35 am

Active Middle Ear Implant Application in Case of Stapes Fixation: A Temporal Bone Study

Kanthaiah Koka, PhD; Arnaud Devèze, MD; Stéphane Tringali, MD
Herman A. Jenkins, MD; Daniel J. Tollin, PhD

Hypothesis: Driving the oval window (OW) with an active middle ear implant (AMEI) can produce high levels of input to the inner ear.

Background: Treatment of otosclerosis bypasses the stapes with a piston that penetrates the vestibule. Although this treats the conductive component of hearing loss it does not treat the sensorineural. AMEIs have been proposed to treat otosclerosis-related conductive and sensorineural hearing losses.

Methods: Seven temporal bones were prepared to expose the stapes and round window (RW). Stapes and RW velocities were measured while driving with an AMEI the stapes head with a bell shaped tip. The stapes footplate was then fixed with glue; fixation was confirmed via attenuated RW velocities. A cylinder tip (0.5 mm) was then used to drive the inner ear through a stapedotomy (KTP laser) with and without interposition of fascia material.

Results: Driving the stapes with an AMEI produced mean maximum equivalent ear canal sound pressure levels of 138 dB SPL (0.25-8 kHz, 1 Vrms). Stapes fixation caused ~25 dB attenuation. Driving with a cylinder tip through the stapedotomy produced 14 and 21 dB less performance with and without fascia, respectively, compared to the normal condition. Peformance with fascia was significantly greater than without.

Conclusions: Driving the OW with an AMEI in a scenario of stapes fixation was demonstrated to be feasible with performance comparable to traditional AMEI coupling to the incus or stapes. These possibilities offer new perspectives to treat mixed hearing loss in otosclerosis.

Support: Otologics LLC Education Grant. Use of temporal bone tissue was in compliance with the University of Colorado Denver Institutional Biosafety Committee.

Middle Ear Mechanics Proper use of standard and novel strategies for improving conductive and mixed hearing losses.

Knowledge
Active Middle ear implants are nowadays available to treat conductive and mixed hearing loss. The aim of this study was to assess the efficiency of an active middle ear implant in a scenario of stapes fixation.Driving the oval window with an active middle ear implant in a scenario of stapes fixation in temporal bone study was demonstrated to be feasible with performance comparable to traditional coupling to the incus or stapes. These possibilities offer new perspectives to treat mixed hearing loss in otosclerosis.

Medical Knowledge

10:15 am

Magnetic Resonance Imaging after Cochlear Implantation Using 1.5 Tesla Magnet

Benjamin T. Crane, MD, PhD; John K. Niparko, MD

Objective: To assess the safety of 1.5 Tesla (T) magnetic resonance imaging (MRI) in patients with cochlear implants (CI) with the internal magnets.
Study Design: Retrospective review of 10 unilateral CI patients who underwent an MRI.
Patients: Patients averaging 42 years of age underwent a total of 12 clinically indicated MRI scans. Devices from 3 major CI manufactures were represented.
Interventions: Binding of CI with mold material and gauze was performed prior to most MRIs. Most patients were given oral sedation. Gadolinium contrast was used in all but one study.
Main Outcome Measures: Patients were assessed with regard to ability to complete the MRI, size of the artifact caused by the device, ability to make a diagnosis from the studies, post-MRI CI function, and magnet position.
Results: No CI malfunction, displacement, or magnet displacement was observed post-MRI. One patient did not tolerate the procedure due to device site pressure. One patient required intravenous sedation. The CI produced an artifact with a mean maximal anterior-posterior dimension of 6.7 cm and lateral dimension of 4.8 cm near the device. The contralateral internal audiotory canal (IAC) was visualized in all patients and the ipsilateral IAC was at least partly visible in all but one patient.
Conclusions: Patients can safely undergo 1.5 T MRI after CI if the device is bound prior to scanning. Magnet displacement did not occur and we believe the risk to be minimal, when compared with the risk an inconvenient of removing the magnet prior to the study. IRB approval - pending

DIAGNOSTICS
Practice Gaps- Under-utilization of recommended diagnostic strategies in cochlear and vestibular disease

COCHLEAR IMPLANTS
Practice Gaps- Lack of awareness/knowledge as to the expected results and limitations of cochlear implants. Applying appropriate diagnostic strategies to inner ear (cochlear and vestibular) disease.Outline the expected results and limitations of cochlear implants with respect to patient outcomes and quality of life.

Knowledge
Competence
Performance
Patient Outcomes

This paper will specifically address how it is safe and effective to perform MRI on patients after cochlear implantation. Most clinicians are unwilling to perform an MRI in a patient with a cochlear implant due to concerns about potential harm to the patient or the device. This paper will address these concerns by demonstrating that MRI is safe and effective after cochlear implantation when proper procedures are followed. Doing the MRI with the cochlear implant in place has several advantages over alternatives such as doing a CT scan, or removing the magnet prior to the MRI. Clinicians will understand that cochlear implantation is not a contraindication to MRI. MRI is a safe and diagnostic procedure in this patient population.

Patient Care
Medical Knowledge
Practice-Based Learning

10:23 am

Binaural Speech Recognition in Noise by Cochlear Implanted Patients

Bernard Fraysse, MD; Matthieu Marx, MD
Olivier Deguine, MD; Marie-Laurence Laborde; Chris James

Background: « Squelch » effects provide normal hearing listeners with a binaural advantage where speech and noise sources are separated. True "binaural release from masking" appears to be very limited or non-existent in many bilaterally implanted patients. Recent studies compare the within-subject performance of residual hearing patients implanted with "Hybrid" cochlear implants with similarly separated speech and noise. The aim of our study was to compare binaural release from masking between subjects for a range of cochlear implant and residual hearing configurations using the same test set-up.

Material and methods: Subjects were 15 unilaterally implanted patients with residual hearing (5 with bilateral, 10 with unilateral residual hearing) and 5 bilaterally implanted patients. A group of 10 unilaterally implanted "no residual hearing" subjects was used as a control to estimate the head-shadow and microphone effects. Sentence recognition in noise was tested for diotic S0°N0° and dichotic S-60°N+60° listening.

Conclusions: preliminary data suggests that Hybrid patients (CI + bilateral residual hearing) can show large squelch effects with a gain of 5 dB. Bimodal patients (CI + contralateral residual hearing) show little or no squelch although there appear to be several confounding factors such as the relative performance of each ear and the level of residual hearing.

Define Professional Practice Gap:

Educational Need:
Performance
Patient Outcomes
Learning Objective:

Desired Result:

Medical Knowledge

10:31 am

Residual Hearing Preservation during Cochlear Implantation in Gerbils with Noise Induced, High-Frequency Hearing Loss

Thomas A. Suberman, BA; Adam P. Campbell, BA
Craig A. Buchman, MD; Oliver F. Adunka, MD
Douglas C. Fitzpatrick, PhD

Hypothesis: Damage to high-frequency portions of the cochlea that are initially accessed during an insertion of cochlear implant will be identifiable in the residual responses to low frequency sounds.
Background: Thus far we have shown that cochlear microphonics (CM) and cochlear action potentials (CAP) can be used as markers to identify damage to intracochlear structures. Now that we have established reliable markers, we turn our focus to the clinical relevant scenario of high-frequency noise loss.
Methods: Gerbils are exposed to high-pass noise sufficient to produce high-frequency hearing loss, while preserving low frequency hearing. After two weeks of rest, an electrode is placed at the round window and the CAP and CM are measured in response to free field tone bursts. The electrode is then advanced and measurements are taken and compared with those of the round window. When a change in potentials is noted, the electrode is withdrawn to determine if the damage is reversible. Finally, the cochlea is fixed and histology is used to identify the extent of damage caused by both the noise and the electrode.
Results: In response to noise exposure, animals show equivalent bilateral hearing loss, as evidenced by increase in thresholds of CAP and CM in recordings taken at the round window. Furthermore, changes in the CAP and CM are detectable even when damage due to electrode impact is in the high-frequency region of the cochlea.
Conclusion: CM and CAP remain reliable markers of intracochlear damage in gerbils with noise induced, high-frequency hearing loss.

IRB Approval:
UNC IACUC 08-135
Define Professional Practice Gap: To preserve residual hearing during cochlear implantation, surgeons currently utilize "soft surgical practices," including careful opening of the cochlea, avoidance of intracochlear fluid disturbance, and careful handling of the electrode to facilitate proper cochlear electrode insertion. Though these may improve outcome, there is a lack of real-time physiological feedback that could help reduce intracochlear damage and subsequent loss of residual hearing. It is therefore important that real-time markers be established so that insertion techniques can be improved to optimize the preservation of electric and residual hearing.
Educational Need: To establish the reliability of electrophysiological markers (compound action potential (CAP) and cochlear microphonics (CM)) in animals with noise induced hearing loss.
Knowledge
Performance
Patient Outcomes
Learning Objective: To learn how best to approximate typical human hearing loss in an animal model, and to establish a near real-time monitoring system for improved cochlear implant insertion that can be translated to human cochlear implantation.
Desired Result: To create an animal model that mimics human hearing loss such that established markers could be used to create a near real-time monitoring system for improved cochlear implant insertion in humans
Patient Care
Medical Knowledge
Practice-Based Learning
System-Based Practice

10:35 am

Pediatric Cochlear Implantation in Children with Eighth Nerve Hypoplasia

Nancy M. Young, MD; Francine Kim, MD; Beth Tournis

Objective: The purpose of this study is to characterize the range of auditory and speech perception skills achieved subsequent to cochlear implantation of children with eighth nerve hypoplasia.

Study Design: Retrospective review of the pediatric implant population at a tertiary care medical center. The study will examine nine children with significant eighth nerve hypoplasia identified pre-operatively in the ear to be implanted by magnetic resonance (MR) imaging. The main outcome measures are standard measures of auditory and speech perception in implanted children.

Results: Case studies will illustrate that MR imaging alone is not an accurate predictor of outcomes in children with eighth nerve hypoplasia.

Conclusion: Outcomes in children with eighth nerve hypoplasia as determined by MR are variable. Optimal management of children with eighth nerve hypoplasia requires further investigation and consideration.

IRB Approval: This retrospective study has been submitted for expedited review.

Define Professional Practice Gap: Cochlear Implantation - Lack of awareness/knowledge as to the expected results and limitations of cochlear implants in pediatric population.

Educational Need: benefits and limitations of cochlear implantation in children with eighth nerve hypoplasia is necessary to help determine implant candidacy and to better counsel families about range of outcomes.

Knowledge
Patient Outcomes
Learning Objective: A range of outcomes is possible in pediatric implant candidates with eighth nerve hypoplasia.

Desired Result: 1.improved counseling of parents of children who are potential cochlear implant candidates. 2.consideration of implant candidacy in some children with nerve hypoplasia.

Patient Care
Medical Knowledge

10:47 am

Apparent Cochlear Nerve Aplasia: To Implant or not to Implant?

Frank M. Warren III, MD; Richard H. Wiggins III, MD
H. Ric Harnsberger, MD; Clough Shelton, MD

Objective: To describe the imaging findings and clinical outcomes of children with apparent cochlear nerve aplasia undergoing cochlear implantation.
Study Design: Retrospective case review.
Setting: Tertiary care center.
Patients: Two patients with imaging findings consistent with absent cochlear nerve canal on diagnostic imaging and no reproducible audiometric responses on testing that underwent promontory stimulation and subsequent cochlear implantation.
Intervention(s): MRI and CT imaging, audiologic assessment and cochlear implantation.
Main Outcome Measure(s): Audiologic performance following cochlear impantation.
Results: Both patients were identified to have profound sensorineural hearing loss on newborn hearing screening and underwent ABR testing revealing absent brainstem responses. ASSR testing was inconclusive in each case as well. Imaging in both cases identified one ear with a small IAC with two nerves present, one of which appears to enter the vestibule in each case the other is assumed to be the functioning facial nerve. There was a bony plate present over the entrance to the cochlea in both patients. Over time, both families reported responses to auditory stimuli with amplification. Promontory stimulation testing showed reproducible responses to electrical stimuli in the ears in question. Following cochlear implantation, both patients have shown responses to auditory stimuli.
Conclusion: The absence of cochlear nerve canal in patients with apparent cochlear nerve aplasia does not preclude auditory innervation of the cochlea. Cochlear implantation in appropriately studied ears is a viable option for these patients.

IRB Approval: Utah IRB_00030685
Define Professional Practice Gap: Limitations of knowledge in the evaluation and mangement of congenital sensorineural hearing loss in the face of cochlear nerve aplasia/hypoplasia.

Educational Need: Outline the role of diagnostic testing in the evaluation of congenital sensorineural hearing loss with associated cochlear nerve abnormalities, and describe the outcomes of cochlear implantation in these cases.
Knowledge

Learning Objective: There are limitations to the current diagnosis and management of congenital sensorineural hearing loss with associated cochlear nerve abnormalities.

Desired Result: Following this presentation, clinicians will better understand the limitations of clincal testing in the evaluation of children with cochlear nerve aplasia/hypoplasia, and the outcomes of cochlear implantation in this population.

Medical Knowledge

PROGRESS REPORT – AOS Clinician Scientist Award
PI: Konstantina Stankovic, MD, PhD

Since the last report a year ago, the following progress has been made:

(1) We have further pursued functional characterization of osteoprotegerin (OPG) secretion by the auditory nerve. We have extended our *in vitro* data using primary cultures of spiral ganglion neurons (presented in the last progress report) to *in vitro* data using auditory neuroblast cell lines and inner-ear derived stem cells. In addition, we have histologically characterized degenerative changes in spiral ganglion neurons (SGNs) lacking OPG *in vivo* using OPG knockout mice. Taken together, our results indicate that OPG is important for proliferation of inner ear stem cells and their differentiation into neurons, that OPG promotes survival of adult SGNs, that lack of OPG makes SGNs susceptible to oxidative stress, and that OPG plays a role in neurite extension. We are in the final stages of drafting a manuscript describing our finding; we plan to submit it within a month. A poster describing a subset of these data was presented at a conference on Molecular Biology of Hearing Deafness in 2009: Kao SY and **Stankovic KM**, "Osteoprotegerin is important for function and survival of the auditory nerve."

(2) Given the delayed nature of the noise-induced primary auditory neuropathy that we have been studying, a major effort has been spent on determining whether the phenomenon originally described in 16 week old mice is applicable to 6 week old mice. The advantage of 6 week old mice is that data gathering can be expedited and cost of animal husbandry significantly decreased, which is important because we study a degenerative phenomenon whose half life is 3 years. We have exposed 6 week old mice to 8-16kHz band filtered noise for 2 hours at intensities ranging from 82-100 dB, and analyzed the mice 1, 2 and 4 weeks after exposure using a combination of ABR and OAE measurements, quantitative confocal microscopy to count afferent synapses, and conventional light microscopy of araldite-embedded specimens to assess cellular damage. We are now confident that the phenomenon of primary delayed noise-induced neuropathy exists in young animals, and that the same sound levels are applicable as in adult animals, despite the increased susceptibility of young mice to noise insult. We are now ready to embark on detailed characterization of the molecular mechanisms of noise-induced auditory neuropathy, as originally proposed, and expanded in the recently funded K08 application (please see below).

(3) In preparation for functional characterization of candidate molecules that we anticipate to obtain from genome-wide deep sequencing of noise-exposed and unexposed mice that is in progress, we have started deep sequencing of a neuroblast cell line. We have created first libraries, which we plan to sequence in 2010. Comparison of the neuroblast transcriptome with microdissected SGN transcriptome before and after noise exposure will allow us to determine to what extent neuroblast cell line is useful in rapidly assessing function of genes that have not been previously described in SGNs, yet are implicated in noise damage.

Funding

Based on preliminary data gathered through AOS funding, 2 grants have been awarded:
(1) K08 through NIDCD titled "Understanding Noise-Induced Primary Degeneration of the Auditory Nerve", and (2) New Investigator Research Matching Grant through Massachusetts Life Sciences Center titled "Functional Role and Therapeutic Implications of Osteoprotegerin Secretion by the Auditory Nerve."

Publications

Two papers have been accepted for publication:

Stankovic KM et al, Differences in gene expression between the otic capsule and other bones. *Hearing Research* 2010.

Stankovic KM et al, A 50 year old woman with loss of hearing, pain and a mass in the left ear. *New England Journal of Medicine* 2010.

Three papers have been submitted for publication:

Lysaght A, Kao SY, Paulo J, Merchant S, Steen H, **Stankovic KM**. The proteome of human perilymph. Submitted to *J Proteome Research* 2010.

Gomez-Casati M, Murtie J, Rio C, **Stankovic KM**, Liberman MC, Corfas G. Non-neuronal cells regulate synapse formation in the vestibular sensory epithelium via erbB-dependent BDNF expression. Submitted to *Nature Neuroscience* 2009.

Stankovic KM et al, Cochlear implantation in children with DFN3 congenital X-linked d

AOS Research Grant—Progress Report
PI: Cliff Megerian, MD

Validation of a Mouse Model of Endolymphatic Hydrops

We have made significant progress using the Phex mouse as a model for endolymphatic hydrops. Over the past year we have accomplished a number of goals. First we have been able to successfully use ECoG in the mice and show a correlation between the degree of hydrops and increases in the SP/AP ratio. These results are being prepared for a manuscript. We have also recently been able to show abnormalities in VEMP testing results in these animals that appear to correlate with the human condition. This has been published in Otology and Neurotology. With regards to using the model as a vehicle to test neuroprotective agents in hopes of preserving hearing, we have made the following observations. Although the mice show hearing loss beginning at 20 days of age with associated endolymphatic hydrops, they do not show light microscopic evidence of inner hair cell or spiral ganglion cell degeneration until 40 days of age. We hypothesized that early hearing loss therefore was mediated by chemical toxicity at the afferent dendrite level, perhaps by way of excitotoxicity and therefore treated a group of mice with Rilizole and DMSO (agents known to block neurotoxicity). We have been able to demonstrate hearing protection at this early stage. This is being prepared for submission to JARO. Finally by virtue of the fact that the Phex mutation in the BALB/c mouse produces hydrops, whereas the same mutation in the B6 mouse does not, we have preliminary evidence that a background modifier gene in concert with Phex, is necessary for hydrops production. Efforts are underway to elucidate this modifier gene through backcross experiments and serve as the basis now for an R01 application.

AOS Research Grant—Progress Report
PI: Marci Lesperance, MD, University of Michigan

An Integrative Genomic Approach to Discovering Otosclerosis Genes

The goal of this project is to identify a gene responsible for otosclerosis in a large family (Family 52) with linkage to the OTSC9 locus. Secondly, we aim to characterize molecular pathways involved in the pathogenesis of otosclerosis by identifying genes that are differentially expressed in cell lines from subjects with otosclerosis vs. controls.

As hearing loss associated with otosclerosis is often delayed in onset, followup audiograms were obtained from several family members. Linkage analysis was then carried out with this updated phenotype data, using the MERLIN package to calculate multipoint logarithm-of-odds (LOD) scores. Suggestive evidence for linkage was detected for two loci, one on chromosome 8q24.3 as previously reported, and one on chromosome 10q25.3-10q26.13. Neither locus overlaps with the 7 previously reported OTSC loci. Preliminary sequence data for candidate genes *FOXH1* and *NDRG1* on chromosome 8 and for *FGFR2* on chromosome 10 were negative for mutations. Further sequence analysis of candidate genes is in progress.

To identify genes differentially expressed in otosclerosis, RNA was isolated from lymphoblastoid cell lines of 3 affected individuals, age- and sex-matched controls, and subjects with isolated sensorineural hearing loss of varying etiologies. Comparison of gene expression using hybridization to Illumina Human-6 v.2 Expression beadchips containing >48,000 probes was carried out. Interestingly, genes with statistically significant differences in expression were identified for each of the known OTSC loci, as well as for OTSC9. This method may be helpful to identify "expression candidate" genes to be considered for mutation analysis in the respective families, as no gene for any of these loci has yet been identified. In addition, characterization of the molecular pathways may provide insights into future therapeutic targets for treatment of otosclerosis.

AOS Research Grant—Progress Report
PI: Fitzakerley, J.L. and Trachte, G.J.
January 15, 2010

Role for Natriuretic Peptides in Meniere's Disease Treatment

Ménière's disease (MD) is an episodic disease characterized by vertigo, hearing loss and tinnitus. Although it was first described in 1861, the cause of the pathophysiology of MD is still debated. The prevailing hypothesis is that disruption of endolymph homeostasis initiates the disease process, although there is still considerable controversy regarding the molecular mechanisms that ultimately produce the characteristic Ménière's symptoms. The global hypothesis of this research is that natriuretic peptides (NPs) represent a link between changes in plasma volume and the acute physiological changes that occur in the inner ear during an acute MD attack.

Specific aim #1: To determine the role of ANP in mediating the effects of a high salt diet on hearing. These experiments are designed to test the hypothesis that a high salt diet increases circulating ANP levels, and that the increased ANP levels improve hearing. Six control experiments have been completed, and there was a small, but statistically significant, increase in plasma osmolarity in control CBA/J mice maintained on a low salt (0.02% NaCl) diet compared to mice on high salt (8% NaCl) diet. Although plasma concentrations of ANP were significantly elevated in the animals on the high salt diet, preliminary analyses indicate that there were no significant differences in acoustic thresholds measured in response to 12 kHz tones. Experiments testing the effects of a high salt diet on animals deficient in natriuretic peptide receptor A will begin this month, and it is expected that they will be complete by the end of the funding period.

Specific aim #2: To determine the effect of acute experimental manipulation of ANP levels on hearing. These experiments are designed to test the hypothesis that the effect of elevating plasma ANP levels is biphasic, i.e., that low-to-moderate increases in ANP concentrations improve hearing, but that large increases cause hearing loss. Oral administration of glycerol is being used to manipulate ANP levels. These experiments have been slow to progress, as there is significant variability in both the changes observed in hearing thresholds and in the changes in plasma ANP levels in both CBA/J and natriuretic peptide receptor C mice. Although glycerol administration consistently resulted in large increases in plasma osmolarity, changes in ANP concentrations were more varied, and 12 kHz threshold changes ranged from 0 to an increase of 35 dB. Several approaches are being taken to address the variability problem, and it is expected that these experiments will also be completed by the end of the funding period.

In summary, significant progress has been made on the experiments funded by this grant. Both manipulations of dietary salt concentration and acute administration of glycerol have been shown to significantly alter plasma osmolarity and ANP concentrations. Analysis of the effects of these manipulations on hearing is ongoing.

AOS Research Grant—Progress Report
PI: Keiko Hirose, MD

Mononuclear phagocytes in the mammalian cochlea: Studies on inhibition and activation of leukocytes in the inner ear

Mononuclear phagocytes have been observed in large numbers in the lateral wall and the spiral ganglion of experimental mice after acoustic injury. We hypothesize that these inflammatory cells play an important role in phagocytosis of dying cells and in the recovery process after hair cell destruction. We have proposed two experiments to investigate the function of these inflammatory cells during noise induced injury. First, we proposed the use of liposome-encapsulated clodronate to deplete circulating monocytes before noise exposure. In order to assess the efficacy of monocyte reduction with a regimen of one intraperitoneal injection of liposomal clodronate administered every three days, we performed flow cytometry on peripheral blood of control mice in approximately 25 mice. We have found that in the absence of an inflammatory stimulus, the peripheral monocyte population is difficult to deplete as the number of circulating monocytes is low at baseline. After induction of monocyte proliferation with an agent such as systemic lipopolysaccharide, clodronate effectively reduced the numbers of peripheral blood monocytes as measured by flow cytometry in mouse peripheral blood. We have also observed a significant decrease in macrophage recruitment to the inner ear in mice pretreated with liposomal clodronate after acoustic overexposure, thus validating the use of clodronate as a means to reduce the number of recruited of macrophages in the inner ear. However, we observed a reduction of only 30-50% of the total number of cochlear macrophages; thus we plan to increase the dosing and the total number of clodronate injections administered prior to the experimental endpoint in order to achieve 80-90% reduction of inner ear macrophages. At this time, we cannot conclude whether macrophage depletion affects hearing threshold after acoustic injury. Our preliminary data suggest that hearing thresholds in the first week after noise are not altered by monocyte/macrophage reduction, but a more effective reduction of the circulating monocyte pool is necessary to assess this intervention. ABRs from mice at later time points will also be studied to determine if there is a long term difference in hearing outcome after noise as a result of monocyte depletion.

Pretreatment of mice with intraperitoneal injection of low dose lipopolysaccharide (LPS) has been shown in our preliminary data to protect against acute threshold shifts secondary to noise. Surprisingly, low dose systemic LPS treatment alone leads to massive recruitment of cochlear macrophages without altering ABR thresholds or disrupting cochlear architecture. We have proposed two possible sources of protection by systemic LPS: one, monocytes that enter the ear from the vasculature promote survival and reduce injury after noise or two, LPS itself diffuses into the perilymph through the vasculature to exert changes on the endogenous cells of the inner ear. We are currently in the process of replicating the optimal LPS dosing and optimal noise levels in preparation for our next experiment where we will use clodronate to deplete the monocyte supply before LPS priming. Depletion of monocytes after LPS exposure will allow us to test whether monocyte entry into the inner ear is necessary for LPS protection against noise. In our next application to the AOS, we propose additional experiments that will supplement our current understanding of the mechanism of LPS protection, including the use of in vitro-primed macrophages injected into the mouse circulation or the use of supernatant from in vitro primed macrophages to test if cytokine production by monocytes and macrophages in circulation are necessary and sufficient to replicate the protective effect observed in LPS priming. These new experiments are included in our application for renewal of this grant for the year 2010-2011.

American Otological Society Clinician-Scientist Award
Progress Report
PI: Alan Cheng, MD

Differentiation of Inner Ear Stem Cells

The early postnatal mammalian cochlea contains a population of undifferentiated cells that can self-renew as free-floating clonal spheres and differentiate into various cell types including hair cells and supporting cells. However, this cell population rapidly disappears during the first 3 weeks of life, the mechanism underlying this phenomenon remains unclear. Because Wnt signaling plays a role in maintaining stem cell populations in other organ systems, we assumed that the canonical Wnt pathway is involved in the maintenance of cochlear progenitor/stem cells. We further hypothesized that changes in Wnt pathway-related gene expression will coincide with loss of stemness in the neonatal organ of Corti. We have found that the expression of several Wnt pathway factors decreases during the first three weeks in the mouse cochlea. Using the Axin2-lacZ mouse line as a reporter, we have identified Wnt responsive cells residing in the sub-basilar membrane region and Kolliker's organ in the early postnatal period. This population of Axin2-positive cells decreases over the first three weeks. When isolated via flow cytometry, these Axin2-positive cells have the ability to self-renew by forming clonal spheres and form hair cell-like cells *in vitro*. Ongoing studies including gain- and loss-of-function manipulations of the Wnt pathway are performed to further characterize the Axin2-positive cells, which appear to be a candidate cochlear stem/progenitor cell population.

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George A. Gates, MD (Senior 2005 (1987))
Boerne, TX

Michael Glasscock III, MD (Senior 1997 (1973))
Austin, TX

Robert A. Goldenberg, MD (Senior 2009 (1989))
Dayton, OH

Malcolm D. Graham, MD (Senior 2001 (1979))
Atlanta, GA

Irwin Harris, MD (Senior 1993 (1970))
Los Angeles, CA

Cecil W.J. Hart, MD (Senior 2001 (1992))
Palm Springs, CA

David A. Hilding, MD (Senior 1990 (1972))
Salt Lake City, UT

Albert Hohmann, MD (Senior 1990 (1970))
New Brighton, MN

Jack V.D. Hough, MD (Senior 1990 (1960))
Oklahoma City, OK

William F. House, MD (Senior 1995 (1964))
Aurora, OR

Gordon B. Hughes, MD (Senior 2009 (1987))
Bethesda, MD

Robert A. Jahrsdoerfer, MD (Senior 2001 (1982))
Afton, VA

Donald B. Kamerer, MD (Senior 2004 (1988))
Pittsburgh, PA

Athanasios Katsarkas, MD (Senior 2004 (1991))
Montreal, Qc, CANADA

Robert I. Kohut, MD (Senior 1998 (1976))
Woodleaf, NC

Fred H. Linthicum, Jr., MD (Senior 1991 (1967))
Los Angeles, CA

William H. Lippy, MD (Senior 1999 (1988))
Warren, OH

Ward B. Litton, MD (Senior 1995 (1969))
Bonita Springs, FL

Charles A. Mangham, Jr., MD (Senior 2009 (Active 1987))
Seattle, WA

Gregory J. Matz, MD (Senior 2002 (1979))
Chicago, IL

William L. Meyerhoff, MD (Senior 2002 (1981))
Dallas, TX

Eugene N. Myers, MD (Senior 1994 (1974))
Pittsburgh, PA

George T. Nager, MD (Senior 1994 (1968))
Baltimore, MD

Michael M. Paparella, MD (Senior 2000 (1968))
Minneapolis, MN

Dennis Pappas, MD (Senior 2005 (1985))
Birmingham, AL

James J. Pappas, MD (Senior 2002 (1983))
Little Rock, AR

Claude L. Pennington, MD (Senior 1993 (1973))
Macon, GA

Shokri Radpour, MD (Senior 1998 (1989))
Noblesville, IN

J. H. Thomas Rambo, MD (Senior 1983 (1958))
New York, NY

Frank N. Ritter, MD (Senior 1993 (1972))
Ann Arbor, MI

Max L. Ronis, MD (Senior 1997 (1972))
Philadelphia, PA

Robert J. Ruben, MD (Senior 1996 (1974))
Bronx, NY

Wallace Rubin, MD (Senior 1992 (1967))
Metairie, LA

Richard L. Ruggles, MD (Senior 1993 (1967))
Cleveland, OH

William H. Saunders, MD (Senior 1996 (1972))
Columbus, OH

Arnold G. Schuring, MD (Senior 2006 (1990))
Warren, OH

John J. Shea, Jr., MD (Senior 1998 (1967))
Memphis, TN

George T. Singleton, MD (Senior 2007 (1972))
Gainesville, FL

J. Brydon Smith, MD (Senior 1980 (1958))
Willowdale ON M2L 2B4, CANADA

Mansfield F.W. Smith, MD (Senior 2000 (1973))
Davis, CA

James B. Snow, Jr., MD (Senior 1993 (1973))
West Grove, PA

Gershon Jerry Spector, MD (Senior 2007(1979))
St. Louis, MO

Malcolm H. Stroud, MD (Senior 1990 (1967))
Dallas, TX

G. Dekle Taylor, MD (Senior 1985 (1965))
Jacksonville, FL

Paul H. Ward, MD (Senior 1994 (1972))
Los Angeles, CA

Roger E. Wehrs, MD (Senior 1996 (1975))
Tulsa, OK

Robert J. Wolfson, MD (Senior 1994 (1971))
Philadelphia, PA

Eiji Yanagisawa, MD (Senior 2003 (1996))
New Haven, CT

ASSOCIATE MEMBERS

Joe C. Adams, PhD (Associate 2001)
Boston, MA

James F. Battey, Jr., MD, PhD (Associate 2001)
Bethesda, MD

Ricardo F. Bento, MD, PhD (Associate 2004)
Sao Paulo, BRASIL

Karen I. Berliner, PhD (Associate 1995)
Marina del Rey, CA

Barbara A. Bohne, PhD (Senior Associate 2006 (1979))
St. Louis, MO

Robert A. Butler, PhD (Senior Associate 2006 (1978))

Mohamed A. Hamid, MD, PhD (Associate 1992)
Cleveland, OH

Maureen T. Hannley, PhD (Associate 1992)
Milwaukee, WI

Raul Hinojosa, MD (Senior Associate 2006 (1989))
Chicago, IL

Vincente Honrubia, MD (Senior Associate 2006 (1972))
Los Angeles, CA

Makoto Igarashi, MD (Senior Associate 2006 (1973))
Tokyo 102, JAPAN

Salvatore J. Iurato, MD (Senior Associate 2006 (1994)
Bari, ITALY

Pawel J. Jastreboff, PhD (Associate 1997)
Ellicott, MD

Walter H. Johnson, PhD (Senior Associate 2006 (1960))
Toronto ONT M4G 3E2, CANADA

Lars-Goran Johnsson, MD (Senior Associate 2006 (1979))
FINLAND

Steven K. Juhn, MD (Senior Associate 2006 (1980))
Minneapolis, MN

Paul R. Kileny, PhD (Associate 1994)
Ann Arbor, MI

Robert S. Kimura, PhD (Senior Associate 2006 (1978))
Weston, MA

David J. Lim, MD (Senior Associate 2006 (1973))
Los Angeles, CA

Brenda Lonsbury-Martin, PhD (Associate 1997)
Loma Linda, CA

Michael Merzenich, PhD (Senior Associate 2006 (1986))
San Francisco, CA

Josef M. Miller, PhD (Senior Associate 2006 (1979))
Ann Arbor, MI

Tetsuo Morizono, MD DMS (Senior Associate 2006 (1985))
Nishi-Ku, Fukuoka City, JAPAN

Carlos A. Oliveira, MD, PhD (Associate 2004)
Brasília-DF 71650-245, Brasil

John J. Rosowski, PhD (Associate 2003)
Boston, MA

Edwin W Rubel, PhD (Senior Associate 2006 (1986))
Seattle, WA

Alec N. Salt, PhD (Associate 2006)
St. Louis, MO

Isamu Sando, MD (Senior Associate 2006 (1975))

Jochen Schacht, PhD (Associate 1992)
Ann Arbor, MI

Neil T. Shepard, PhD (Associate 2004)
Rochester, MN

Ruediger Thalmann, MD (Senior Associate 2006 (1971))
St. Louis, MO

Galdino Valvassori, MD (Senior Associate 2006 (1970))
Wilmette, IL

Thomas R. Van De Water, PhD (Associate 1987)
Miami, FL

Charles G. Wright, PhD (Associate 1999)
Dallas, TX

Sabina Regina Wullstein, MD (Senior Associate 2006 (1999))
D- 97074, Wurzburg GERMANY

Joseph J. Zwislocki, ScD (Senior Associate 2006 (1984))
Syracuse, NY

EMERITUS MEMBERS

Warren Y. Adkins, MD (Emeritus 2001 (1987))
Mt. Pleasant, SC

Sean R. Althaus, MD (Emeritus 2004 (1987))
Georgetwon, TX

B. Hill Britton, MD (Emeritus 2000 (1978))
Las Cruces, NM

Newton J. Coker, MD (Emeritus 2008 (1991))
Santa Fe, NM

Lee A. Harker, MD (Emeritus 2006 (1987))
Omaha, NE

C. Gary Jackson, MD (Emeritus 2007 (1990))
Brentwood, TN

Nelson Y.S. Kiang, PhD (Emeritus 2006 (1969))
Boston, MA

Horst R. Konrad, MD (Emeritus 2005 (1991))
Springfield, IL

K. J. Lee, MD (Emeritus 2006 (1997))
New Haven, CT

Roger C. Lindeman, MD (Emeritus 2001 (1987))
Mercer Island, WA

Anthony J. Maniglia, MD (Emeritus 1999 (1989))
Cleveland, OH

Ralph A. Nelson, MD (Emeritus 2004 (1995))
Manchester, WA

James L. Parkin, MD (Emeritus 1997 (1986))
Salt Lake City, UT

Leonard R. Proctor, MD (Emeritus 1997 (1989))
Lutherville, MD

CORRESPONDING MEMBERS

Marcus D. Atlas, MBBS, FRACS (Corresponding 2005)
Nedlands, WESTERN AUSTRALIA

Daniel J. Bagger-Sjoback, MD (Corresponding 1995)
Stockholm S104 1, SWEDEN

Sandra G. Desa Souza, MBMS (Corresponding 2003)
Chowpatty, Mumbai 400007, INDIA

Vicente G. Diamante, MD (Corresponding 2000)
ARGENTINA

Bernard Gil Fraysse, MD (Corresponding 1999)
FRANCE

Juichi Ito, MD (Corresponding 2007)
Sakyo-Ku, Kyoto 606-8507, JAPAN

Chong-Sun Kim, MD (Corresponding 1998)
Seoul 110-744, KOREA

Thomas E. Linder, MD (Corresponding 2001)
SWITZERLAND

Wolf J. Mann, MD (Corresponding 1996)
55101 Mainz, GERMANY

Mr. David A. Moffat, MA, FRCS (Corresponding 1996)
Cambridge CB2 2QQ, ENGLAND

Lars Odkvist, MD, PhD (Senior Corresponding 2006 (1999))
Linkoping, SWEDEN

Jose-Antonio Rivas, MD (Corresponding 2009)
Bogota/D.C./00008, Colombia

Alain Robier, MD (Corresponding 2008)
Tours 37100, FRANCE

Masafumi Sakagami, MD, PhD (Corresponding 2006)
Hyogo 663-8501, Japan

Olivier Sterkers, MD, PhD (Corresponding 2003)
75016 Paris, FRANCE

Haruo Takahashi, MD (Corresponding 2005)
Nagasaki, 852-8501, JAPAN

Thomas P.U. Wustrow, MD (Corresponding 2000)
D-80333 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 2002)
AUSTRALIA

Ugo Fisch, MD (Honorary 1985)
CH-8703 Erlenbach, SWITZERLAND

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

William E. Hitselberger, MD (Honorary 1997)
Los Angeles, CA

L.B.W. Jongkees, (Honorary 1968)
S2 1071, THE NETHERLANDS

Yasuya Nomura, (Honorary 1992)
Tokyo 142, JAPAN

Michel Portmann, (Honorary 1983)
Bordeaux 33000, FRANCE

Naoaki Yanagihara, MD (Honorary 2008)
Matsyama, JAPAN

Members Deceased Since Last Spring Meeting

Antonio De La Cruz, MD
Active Member: 1991
Date of Death: 7/31/2009

Robert J. Keim, MD (Emeritus 1997 (1987))
Oklahoma City, OK
Date of Death - 2/28/2009