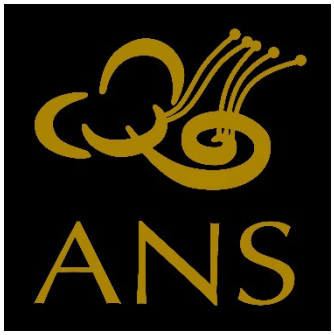

PROGRAM, ABSTRACTS
and MORE

from the

AMERICAN NEUROTOLOGY SOCIETY

59th Annual Spring Meeting

May 17 - 19, 2024
Hyatt Regency
Chicago, IL

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AMERICAN NEUROTOLOGY SOCIETY
MISSION STATEMENT

PURPOSE

The American Neurotology Society (ANS) is committed to improving public health care related to disorders of the ear, hearing and balance primarily through the provision of high-quality continuing medical education (CME) to our members. The overall goals of the ANS educational programs are to organize CME activities addressing the knowledge gaps and enhancing the clinical competence of the participants. The ANS is dedicated to improving public health care through the development, dialogue and dissemination of advances in evidence-based diagnosis and management of neurotologic and related skull base disorders.

Furthermore, the ANS is committed to fulfilling its purpose by encouraging and funding research that promotes the health and wellness of our patients, members, and their communities. Novel information, such as that presented at the annual conferences, as well as solicited and unsolicited manuscripts, are considered for publication in the ANS supported, peer reviewed and evidence-based content of the *Otology & Neurotology* (original and open access) Journals. The focus on the scientific advances in the field of neurotology is translated into approaches to quality care that are consistent with ACGME/ABMS general competency areas and the Institute of Medicine recommendations.

The ANS fully supports a culture of both unbiased, civil dialogue among its members and diversity in all aspects of the field, including education, research and clinical practice. Equally important to our mission is equity of access to the highest quality neurotological healthcare for all patients requiring our services. Our society considers the needs of trainees at all levels interested in learning neurotology in order to develop the next generation of practitioners from among the best and brightest among their peers with the broadest representation of all backgrounds and personal characteristics.

TARGET AUDIENCE

The primary target audience includes members of both the American Neurotology Society and our sister Society, the American Otological Society as well as healthcare professionals in the fields of otology, otolaryngology neurotology and skull base research and healthcare. The members served include physicians, otologists, neurotologists, residents, fellows, researchers, audiologists, and other healthcare professionals who are involved in the care of patients with otologic and neurotologic conditions.

TYPES OF ACTIVITIES PROVIDED

In order to accomplish the goals of the ANS CME program, the Education committee will offer a range of activities with specific educational outcomes in mind. Current offerings include:

- Scientific symposia, delivered twice per year at national venues, showcasing the latest research in the field and featuring national and international experts on related clinical topics.
- Study groups & mini-seminars offered at the annual meeting of the American Academy of Otolaryngology-Head and Neck Surgery.
- Facilitation of manuscript submission on presented materials for publication in a peer reviewed journal (Otology & Neurotology and Otology/Neurotology Open)
- The Otology & Neurotology Journal, and the Otology/Neurotology Open Access publications, provide additional vehicles for further collaboration and dissemination of new information, science and standards of care.

CONTENT

The content of the ANS CME program centers on clinical issues related to Neurotology and disorders of the skull base. The ANS also strives to respond to our members' educational needs that are not being met by other organizations, and therefore also offers activities in the areas of risk management, patient safety, physician-patient communications, coding, HIPAA compliance, and other regulatory issues as they relate to Neurotology. The educational efforts will also highlight the ACGME/ABMS general competencies within the context of this field and relate the significance of communication, professionalism, patient safety and systems-based practice within these workplace environments.

EXPECTED RESULTS

The CME program of the ANS strives to enhance the participants' knowledge and clinical competence in subject areas relevant to the field of Neurotology. The other expected outcome from this CME program is continued development of new evidence-based science, dissemination of ongoing research in the clinical area of Neurotology.

Resolution on Diversity of Meeting Presenters and Participation for the American Otological Society and the American Neurotology Society

- Whereas the councils of the American Neurotology Society and American Otological Society desire to promote inclusivity within the membership of both organizations.

- Whereas it is recognized that diverse leadership and diversity of presenters allows for cross pollination of knowledge, perspective and experiences enabling a stronger and more robust educational experience for our members.

- Whereas the Councils of the organizations recognize the importance of acknowledging diversity among our patients, our trainees, and our colleagues.

- Whereas the purpose of the education programs of both organizations is to disseminate information designed to improve physician knowledge, patient care and outcomes, and advance the respective specialties.

- Whereas valuable scientific contributions to Otology and Neurotology by colleagues (regardless of gender, race, or other attributes) should be presented at the society's respective meetings.

- Be it resolved that the Scientific Program Committees of the American Neurotology Society and American Otological Society will select speakers and panel members endeavoring to balance educational goals while promoting the diversity of our respective Societies' memberships and educational offerings.

- Be it resolved the Executive Councils of the ANS and AOS will select participation at all levels of the organizations endeavoring to reflect diversity of our respective Societies' memberships.

Continuing Medical Education Credit Information

CONTINUING MEDICAL EDUCATION CREDIT INFORMATION

Accreditation

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of American College of Surgeons and American Otological Society. The American College of Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

AMA PRA Category 1 Credits™

The American College of Surgeons designates this live activity for a maximum of **9.25** *AMA PRA Category 1 Credits™.* Physicians should claim only the credit commensurate with the extent of their participation in the activity.

ACS AMERICAN COLLEGE OF SURGEONS

ACCME ACCREDITED WITH COMMENDATION

ADDITIONAL CME INFORMATION

Award of CME credits by ACS is based on compliance of the program with the ACCME accreditation requirements and does not imply endorsement by ACS of the content, the faculty, or the sponsor of the program.

AND

Successful completion of this CME activity, which includes participation in the evaluation component, enables the learner to earn credit toward the CME of the American Board of Surgery's Continuous Certification program.

Program Objectives / Educational Activity Details

What are the practices or patient care problems being addressed by this activity?

Overall, this activity addresses gaps in knowledge and practice that reflect evolving understanding and perspectives in the diagnosis and management of health conditions of the ear and skull base. These sessions highlight the core principles of standard practice while challenging commonly held assumptions that create opportunities for further clarification or research. The scope of the gaps addressed by the following activities is indicated:

Lecture: "Concussion: Little-known Biological Consequences for the Hearing Brain" - This lecture will assess gaps in knowledge about the impact of concussions on auditory function and recommendations for multidisciplinary management of concussion patients.

Cochlear Implant Scientific Sessions – With broadening candidacy criteria, cochlear implants have become a viable option for the management of hearing loss with greater degrees of residual hearing. Early and preliminary experience and performance outcomes for the expanded indications for implantation and unique implant candidates will be addressed. Evolving techniques for the optimization of hearing preservation in cochlear implant surgery and management of imaging artifact after surgery will also be addressed.

Advances in Otology & Neurotology Scientific Session – This session will address evolving paradigms related to hearing reconstruction surgery and advances in ambulatory clinic imaging techniques, pain management following otologic surgery, and diagnosis of cerebrospinal fluid leaks.

Panel- Contemporary Management of Spontaneous CSF Leaks, before and after Surgical Repair – This panel will showcase evolving practices related to the evaluation and multidisciplinary management of spontaneous cerebrospinal fluid leaks.

Vestibular schwannoma Scientific Session – This session will address evolving studies related to novel biomarkers predicting the biology of vestibular schwannomas and novel therapeutic options for these tumors.

Lecture: "Contemporary Management of Acute and Chronic Facial Paralysis: A Focus on Timing and Outcomes": This lecture will assess gaps in knowledge about evolving techniques and outcomes for facial reanimation surgery.

Updates in Neurotology Scientific Session – This session will address knowledge gaps in the management of superior semicircular canal dehiscence, sigmoid sinus wall anomalies, auditory brainstem implants, and resource utilization of vestibular patients in emergency settings.

Panel- Ready, Set, GPT! Supercharge Neurotology Now with AI-Empowered Tools – This panel will showcase evolving applications and current limitations for AI in neurotology education, training, and practice.

Panel- Utilization of Advanced Practice Providers (APPs) in the Setting of a Neurotology/Otology Practice: Academic vs. Privademic vs. Private Practice Considerations – This panel will address strategies for leveraging advanced practice providers in clinic practice settings for otologists/neurotologists to optimize patient care.

How will this activity improve the learners' competence (knowledge in action), performance (skill set) and/or patient outcomes (impact of care)?

- **Competence:**
  The educational program is designed to address the topics identified as practice gaps through individual presentations and in-depth panel discussions. The panels will emphasize case-based learning and opportunity to demonstrate the application of core principles and new information to clinical decision-making.

- **Performance:**
  All activities will review established knowledge, present areas of controversy and define skills that require additional development within our field or in consultation with other disciplines. Means by which these skills can be acquired or improved will also be presented.

- **Patient Outcomes:**
  The impact of clinical decision-making, professionalism, and health system structures on clinical outcomes will be presented and discussed with the assistance of the moderators. Improvement in recognizing, diagnosing, and managing disorders of the ear and skull base.

How do you anticipate this activity improving health care systems?
Increased understanding of interdisciplinary collaborations to advance care, increased understanding of use of physician extenders to improve access to care and clinical efficiency, and increased understanding of the current application of AI tools in clinical education and care. The lecture on skull base coding will increase the current understanding of variations in coding and seek alignment for coding consistency and optimization.

If applicable, how do you anticipate this activity impacting the health of patients and their communities?
Sessions and lectures provide updates for diagnostic and therapeutic options for otologic/neurotologic conditions and increase understanding of factors impacting treatment outcomes. The lecture on biologic consequences of concussions for the hearing brain will increase understanding for diagnosis and management of hearing loss resulting from head trauma.

State the learning objectives for this activity (number can vary). Learning objectives begin with a verb and should complete this statement.

1. To describe the impacts of concussion on the central auditory pathways and develop appropriate care pathways for diagnosis and management of hearing loss in concussion patients.

2. To demonstrate and discuss the implementation of expanded CI candidacy in the clinical management of sensorineural hearing loss and apply hearing preservation strategies cochlear implant surgery.

3. To draw from the latest clinical experience and cutting-edge research when managing patients with vestibular schwannoma.

4. To assess and manage spontaneous cerebrospinal fluid leaks in multidisciplinary teams.

5. To examine the latest approaches for the management of acute and chronic facial paralysis.

6. To assess current hearing outcomes for auditory brainstem implants.

7. To evaluate and apply currently available AI-empowered tools in clinical education, training, and practice.

8. To identify opportunities for incorporation and optimization of advanced providers in a variety of clinical practice models for care access and improvement.

Disclosure Information

In accordance with the ACCME Accreditation Criteria, the American College of Surgeons must ensure that anyone in a position to control the content of the educational activity (planners and speakers/authors/discussants/moderators) has disclosed all financial relationships with any commercial interest (termed by the ACCME as "ineligible companies", defined below) held in the last 24 months (see below for definitions). Please note that first authors were required to collect and submit disclosure information on behalf all other authors/contributors, if applicable.

Ineligible Company: The ACCME defines an "ineligible company" as any entity producing, marketing, re-selling, or distributing health care goods or services used on or consumed by patients. Providers of clinical services directly to patients are NOT included in this definition.
Financial Relationships: Relationships in which the individual benefits by receiving a salary, royalty, intellectual property rights, consulting fee, honoraria, ownership interest (e.g., stocks, stock options or other ownership interest, excluding diversified mutual funds), or other financial benefit. Financial benefits are usually associated with roles such as employment, management position, independent contractor (including contracted research), consulting, speaking and teaching, membership on advisory committees or review panels, board membership, and other activities from which remuneration is received, or expected. ACCME considers relationships of the person involved in the CME activity to include financial relationships of a spouse or partner.
Conflict of Interest: Circumstances create a conflict of interest when an individual has an opportunity to affect CME content about products or services of a ineligible company with which he/she has a financial relationship.

The ACCME also requires that ACS manage any reported conflict and eliminate the potential for bias during the educational activity. Any conflicts noted below have been managed to our satisfaction. The disclosure information is intended to identify any commercial relationships and allow learners to form their own judgments. However, if you perceive a bias during the educational activity, please report it on the evaluation.

Disclosure Information
In accordance with the ACCME Accreditation Criteria, the American College of Surgeons must ensure that anyone in a position to control the content of the educational activity (planners and speakers/authors/discussants/moderators) has disclosed all financial relationships with any ineligible company held in the last 24 months. Please note that first authors were required to collect and submit disclosure information on behalf of all other authors/contributors, if applicable.

A complete list of disclosures is available at the ANS registration table.

OTOLOGY & NEUROTOLOGY JOURNAL REQUIREMENTS

PUBLICATION STATEMENT: The material in these abstracts must not have been published or presented previously at another national or international meeting and may not be under consideration for presentation at another national or international meeting including another COSM society. The study detailed in these abstracts *may be submitted* for consideration for publication to *Otology & Neurotology* at any time after this call for papers begins. However, should the abstract be selected as a poster or an oral presentation, publication of the manuscript will be delayed until after the 2024 COSM meeting takes place. If this policy is violated, the ANS will prohibit presentation at the COSM meeting and the manuscript will be withdrawn from publication in print or online. The penalty for any duplicate presentation/publication is prohibition of the author from presenting at a COSM society meeting for up to three years. Duplicate submission to AOS or another participating COSM Society will disqualify your abstract immediately.

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Manuscripts are required of ALL ORAL presentations. Manuscripts must be submitted online a minimum of four weeks prior to the annual meeting, via the journal's website. Instructions for registering, submitting a manuscript, and the author guidelines can be found on the Editorial Manager site: https://www.editorialmanager.com/on/

The Journals of *OTOLOGY & NEUROTOLOGY* or *ONO (O&N OPEN)* do not accept paper manuscripts. Manuscripts are reviewed prior to the Annual meeting for conflict of interest and resolution.

Failure to comply with the guidelines & requirements of the American Neurotology Society and the O&N Journal will result in the disqualification of your presentation.

MARK YOUR CALENDAR!
The 59th Annual ANS Fall Meeting
"FAB FRIDAY"
September 27, 2024
Fontainebleau Miami Beach

The Abstract deadline for the ANS 60th Annual Spring Meeting is Tuesday, October 15, 2024.
Abstract instructions and the submission form will be available on the website starting September 1st.

ANS 60th Annual Spring Meeting
May 16-17, 2025
Hyatt Regency New Orleans
New Orleans, Louisiana

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THE AMERICAN NEUROTOLOGY SOCIETY WOULD LIKE TO THANK THE FOLLOWING MEMBERS FOR THEIR CONTRIBUTION TO THE 2024 ANS SCIENTIFIC PROGRAM

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Yuri Agrawal, MD, MPH, ANS Education Director

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Peter Weber, MD, MBA
Cameron C. Wick, MD

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Susan D. Emmett, MD, MPH
Courtney C.J. Voelker, MD, PhD
Cameron C. Wick, MD

AMERICAN NEUROTOLOGY SOCIETY
59th Annual Spring Meeting
PROGRAM
May 18-19, 2024
Chicago, IL

(ANS Posters will be displayed on Friday & Saturday, May 17-18, 2024)

SATURDAY MAY 18, 2024

1:00 **BUSINESS MEETING** *(Treasurers report/New Member Induction*)
Members Only

1:30 **SCIENTIFIC SESSION**
OPENING REMARKS BY THE PRESIDENT - *Elizabeth H. Toh, MD, MBA*
(Open to registered Members and Non-members – Badge required for admittance)

1:32 **PRESIDENTIAL CITATIONS**
Carlos David, MD
Barry E. Hirsch, MD
William M. Luxford, MD
Stephanie A. Moody-Antonio, MD
P. Ashley Wackym, MD
Peter C. Weber, MD, MBA

1:40 **5th ANNUAL NOEL L. COHEN AWARD FOR SIGNIFICANT CONTRIBUTIONS TO OTOLOGY AND NEUROTOLOGY**
Presented by Elizabeth H. Toh, MD, MBA, President

1:45 **INTRODUCTION OF WILLIAM F. HOUSE MEMORIAL LECTURE**
Elizabeth H. Toh, MD, MBA

1:46 **WILLIAM F. HOUSE MEMORIAL LECTURE**
Concussion: Little-known Biological Consequences for the Hearing Brain
Nina Kraus, PhD
Hugh Knowles Professor of Communication Sciences, Neurobiology, and Otolaryngology
Northwestern University, Chicago, IL

2:06 **DISCUSSION/Q&A**

2:11 **MICHAEL E. GLASSCOCK SCIENTIFIC MERIT AWARD**
Presented by David S. Haynes, MD, MMHC
Awarded to John P. Marinelli, MD
Cochlear Implantation with Sporadic Inner Ear Schwannomas: An International Multi-Institutional Study of 90 Patients
Presentation will be Sunday May 19, 2024, at 10:22am

2:13 **SESSION A - COCHLEAR IMPLANTATION - CANDIDACY & OUTCOMES**
INTRODUCTION OF ABSTRACTS
Alicia M. Quesnel, MD, Moderator

2:14 **NEUROTOLOGY FELLOW AWARD**
Investigating the Minimal Clinically Important Difference for AzBio and CNC Speech Recognition Scores
Ankita Patro, MD, MS
Aaron C. Moberly, MD
Michael H. Freeman, MD
Elizabeth L. Perkins, MD
Marc L. Bennett, MD, MMHC
David S. Haynes, MD, MMHC
Naweed I. Chowdhury, MD, MPH

2:20 **Qualifying Cochlear Implant Candidates – Does it Matter how Patients are Qualified?**
David S. Lee, MD
Jacques A. Herzog, MD
Cameron C. Wick, MD
Nedim Durakovic, MD
Craig A. Buchman, MD
Matthew A. Shew, MD

2:26 **Cochlear Implantation for Single-Sided Deafness in Pediatric Patients: A Critical Assessment of Long-term Usage Rate**
Robert J. Macielak, MD
Celine Richard, MD, PhD
Prashant Malhotra, MD
Ursula M. Findlen, PhD
Oliver F. Adunka, MD, MBA

2:32 **Single Institution Failure Rates and Speech Recognition Outcomes in HiRes Ultra Series Recall**
Taimur Siddiqui, BSA, BBA
Benjamin D. Lovin, MD
Alex D. Sweeney, MD
Nathan R. Lindquist, MD

2:38 **A Multi-Institutional Analysis of Advanced Bionics HiRes V1 Cochlear Implant Device Failures**
Michael H. Freeman, MD
Nathan R. Lindquist, MD
James R. Dornhoffer, MD
Benjamin D. Lovin, MD
Kristen L. Yancey, MD
Matthew L. Carlson, MD
Marc L. Bennett, MD, MMHC

2:44 **HERBERT SILVERSTEIN AWARD FOR RESEARCH EXCELLENCE IN OTOLOGY/NEUROTOLOGY**
Expression of TGFÎ²-1 and CTGF in the Implanted Cochlea and its Implication on New Tissue Formation
Adam Y. Xiao, MD, PhD
Ivan A. Lopez, PhD
Gail Ishiyama, MD
Akira Ishiyama, MD

2:50 **DISCUSSION/Q&A with MODERATOR**

2:56 **INTRODUCTION** - *Ronna Hertzano, MD, PhD - ANS Research Committee Chair*
ANS RESEARCH GRANT PRESENTATION
Sustained Drug Release of Dexamethasone and Neurotrophic Agents from Zwitterionic Thin Film Coatings for Decreased Inflammation and Improved Spiral Ganglion Neuron Survival following Cochlear Implantation
Nir Ben-Shlomo, MD
University of Iowa
ANS Research Grant Recipient 2023

3:03 **DISCUSSION/Q&A with MODERATOR**

3:05 **BREAK WITH EXHIBITORS**

3:35 **INVITED PRESENTATION**
Skullbase Coding Survey Update
Shawn M. Stevens, MD

3:40 **SESSION B - ADVANCES IN OTOLOGY & NEUROTOLOGY**
INTRODUCTION OF ABSTRACTS
Cameron C. Wick, MD, Moderator

3:41 **ANS TRAINEE AWARD**
Impact of Modifiable Surgical Factors on Ossiculoplasty Outcomes after Controlling for Ear Environment Risk: A Multi-Institutional Study
Ryan T. Judd, MD
Richard K. Gurgel, MD, MSCI
John L. Dornhoffer, MD
Matthew L. Carlson, MD
J. Walter Kutz, MD
Jafri Kuthubutheen, MD
Michael B. Gluth, MD

3:47 **Optical Coherence Tomography Imaging of Middle Ear Glomus Tumors in Clinic**
Dorothy W. Pan, MD, PhD
Marcela A. Moran, BS
Wihan Kim, PhD
Jack C. Tang, PhD

Frank D. Macias-Escriva, BS
Brian E. Applegate, PhD
John S. Oghalai, MD

3:53 **Pain Control After Otologic Surgery: Do Nonopioid Analgesics Suffice?**
Mustafa G. Bulbul, MD, MPH
Zulkifl Jafary, BS
Brian M. Kellermeyer, MD
Scott B. Shapiro, MD

3:59 **Detection of CSF Leaks with Intrathecal Gadolinium MRI Cisternograms**
Douglas J. Totten, MD, MBA
Cody Whitted, BS
Kevin T. Booth, PhD
Kristine M. Mosier, DMD, PhD
Evan Cumpston, MD
Nicholas A. Koontz, MD
Rick F. Nelson, MD, PhD

4:05 **NEUROTOLOGY FELLOW AWARD**
Lumbar Puncture Opening Pressure and Polysomnogram Findings in Patients with Lateral Spontaneous Cerebrospinal Fluid Leaks
Evan Cumpston, MD
William Zhang, BS
Douglas J. Totten, MD, MBA
Charles W. Yates, MD
Rick F. Nelson, MD, PhD

4:11 **DISCUSSION/Q&A with MODERATOR**

4:16 **INTRODUCTION of PANEL** - *Elizabeth H. Toh, MD, MBA*

4:18 **PANEL**
Contemporary Management of Spontaneous CSF Leaks, before and after Surgical Repair
Rick F. Nelson, MD, PhD, Moderator
Meredith E. Adams, MD, MS
Bradley Bohnstedt, MD, FAANS
Mark Bennett, MD, MMHC
Emily Z. Stucken, MD

5:08 **CLOSING REMARKS**

5:10 **ADJOURN**

SUNDAY MAY 19, 2024

7:00 **BUSINESS MEETING/COMMITTEE REPORTS**
(All welcome – Coffee, tea and continental breakfast for all registered ANS attendees)

7:30 **SCIENTIFIC SESSION**
OPENING REMARKS BY THE PRESIDENT - *Elizabeth H. Toh, MD, MBA*
(Open to registered Members and Non-members – Badge required for admittance)

7:33 **SESSION C - CURRENT CONCEPTS FOR VESTIBULAR SCHWANNOMAS**
INTRODUCTION OF ABSTRACTS
Courtney C.J. Voelker, MD, PhD, Moderator

7:34 **Long-Term Prospective Quality-of-Life Outcomes in 445 Patients with Sporadic Vestibular Schwannoma**
Eric E. Babajanian, MD
Christine M. Lohse, MS
Nicole M. Tombers, RN
Michael J. Link, MD
Matthew L. Carlson, MD

7:40 **Residual Vestibular Schwannomas and Low Tendency for Future Growth**
Douglas J. Totten, MD, MBA
Evan Cumpston, MD
Samuel Kaefer, BS
Troy Wesson, BS
Brooke Stephanian, BS
Rohit Chatterjee, BS
Sabin Karki, BS
Rick F. Nelson, MD, PhD

7:46 **Effect of Simvastatin and Radiation on Viability of Primary Vestibular Schwannoma**
Matthew Wiefels, BS
Olena Bracho, BS
Mikhail Marasigan, BS
Fred F. Telischi, MD, MEE
Michael Ivan, MD
Cristina Fernandez-Valle, PhD
Christine T. Dinh, MD

7:52 **Angiotensin-Receptor Blockers Prevent Vestibular Schwannoma-Associated Hearing Loss**
Samuel A. Early, MD, MS
Alyssa Brown, BS
Lei Xu, MD, PhD
Konstantina M. Stankovic, MD, PhD (presenter)

7:58 **Amplifying Endoplasmic Reticulum Stress with Adenosine Triphosphate-Coated Gold Nanoclusters: A Promising Approach for the Treatment of Vestibular Schwannoma**
Peter Kullar, MA, PhD, FRCS
Laurent A. Bekale, PhD
Jing Chen
Rohit Duggaraju
Zin Mie Mie Htun
Peter L. Santa Maria, MBBS, PhD

8:04 **DISCUSSION/Q&A with MODERATO**R

8:10 **INTRODUCTION** *Aaron Remenschneider, MD, MPH - ANS Research Committee Chair-Elect*
ANS RESEARCH GRANT PRESENTATION
Extracellular Matrix Remodeling and Tumor Inflammation Markers in Aggressive Vestibular Schwannomas
Yin Ren, MD, PhD
The Ohio State University
2023 ANS Research Grant Recipient

8:17 **DISCUSSION/Q&A with MODERATOR**

8:19 **INTRODUCTION OF WILLIAM E. HITSELBERGER MEMORIAL LECTURE**
Elizabeth H. Toh, MD, MBA

8:20 **WILLIAM E. HITSELBERGER MEMORIAL LECTURE**
Contemporary Management of Acute and Chronic Facial Paralysis: A Focus on Timing and Outcomes
Samuel L. Oyer, MD
Associate Professor
Facial Plastic & Reconstructive Surgery
Department of Otolaryngology
University of Virginia, Charlottesville, VA

8:40 **DISCUSSION/Q&A**

8:45 **SESSION D - UPDATES IN NEUROTOLOGY**
INTRODUCTION OF ABSTRACTS
Syed Ahsan, MD, Moderator

8:46 **Successful Audiologic Outcomes with Auditory Brainstem Implantation including Bilateral Implantation**
Douglas M. Bennion, MD, PhD
Alicia Williams, AuD
Rick A. Friedman, MD, PhD
Marc S. Schwartz, MD, PhD

8:52 **Superior Semicircular Canal Dehiscence in Chronic Ear Disease: Is it Clinically Relevant?**
Kurt C. Mueller, MD

Jacob P. Hagen, BS
Christian K. Kerut, BS
Rahul Mehta, MD
Anne K. Maxwell, MD

8:58 **Long-term Outcomes Following Sinus Wall Reconstruction for Sigmoid Sinus Wall Anomalies**
Adaobi E. Ahanotu, BS
Kimberly Oslin, MD
Marjohn M. Rasooly, MSN
David J. Eisenman, MD

9:04 **NICHOLAS TOROK VESTIBULAR AWARD**
Nationwide Resource Utilization of Dizziness/Vertigo Presentations to the ED
D. O'Neil Danis, III, MD
Matthew Kovoor
Kathryn Y. Noonan, MD
Jonathon S. Sillman, MD

9:10 **DISCUSSION/Q&A with MODERATOR**

9:14 **INTRODUCTION of PANEL** - *Elizabeth H. Toh, MD, MBA*

9:16 **PANEL**
Ready, Set, GPT! Supercharge Neurotology Now with AI-Empowered Tools
Si Chen, MD, Moderator
Matthew G. Crowson, MD, MPA, MASc, MBI
Matthew A. Shew, MD

10:01 **MIDMORNING BREAK**

10:21 **SESSION E - FUTURE DIRECTIONS IN COCHLEAR IMPLANTATION**
INTRODUCTION OF ABSTRACTS
Mark Bassim, MD, Moderator

10:22 **MICHAEL E. GLASSCOCK SCIENTIFIC MERIT AWARD**
Cochlear Implantation with Sporadic Inner Ear Schwannomas: An International Multi-Institutional Study of 90 Patients
John P. Marinelli, MD
J. Thomas Roland Jr., MD
Kevin D. Brown, MD
Elizabeth L. Perkins, MD
Simon K.W. Lloyd, MBBS, FRCS
Matthew L. Carlson, MD
Stefan K. Plontke, MD

10:28 **Simultaneous Ipsilateral Labyrinthectomy and Cochlear Implantation in Patients with Refractory Ménière's Disease**
Robert J. Macielak, MD
Markus E. Harrigan, PhD
Vivian F. Kaul, MD
Aaron C. Moberly, MD
Edward E. Dodson, MD
Oliver F. Adunka, MD, MBA
Yin Ren, MD, PhD

10:34 **Intraoperative Electrical Stapedius Reflex Testing is a Reliable Method for Monitoring Cochlear Nerve Integrity during Simultaneous Vestibular Schwannoma Resection and Cochlear Implantation**
Ghazal S. Daher, MD
Aniket A. Saoji, PhD
Collin L. W. Driscoll, MD
Brian J. Neff, MD
Matthew L. Carlson, MD

10:40 **Electrocochleography-Guided Pull-Back Technique of Perimodiolar Electrode for Improved Hearing Preservation**
Amit Walia, MD, MSCI
Matthew A. Shew, MD
Amanda Ortmann, PhD
Jordan Varghese, MD
Shannon Lefler, AuD
Jacques A. Herzog, MD
Craig A. Buchman, MD

10:46 **Intraoperative Acoustic Monitoring Using Behavioral Audiometry during Cochlear Implantation Under Local Anesthesia: Towards Optimizing Hearing Preservation Outcomes**
Karl R. Khandalavala, MD
Sarah E. Ostlie, AuD
Max M. Ladsten
Amanda R. Lohmann, RN
Matthew L. Carlson, MD

10:52 **Image Quality Improvement in MRI of Cochlear Implants after Metal Artifact Reduction**
Arianna Winchester, MD
Justin Cottrell, MD
Emily Kay-Rivest, MD, MSc
Mary Bruno, RT
Gul Moonis, MD
Mari Hagiwara, MD
Daniel Jethanamest, MD, MSc

10:58 **DISCUSSION/Q&A with MODERATOR**

11:04 **INTRODUCTION of PANEL** - *Elizabeth H. Toh, MD, MBA*

11:06 **PANEL**
Utilization of Advanced Practice Providers (APPs) in the Setting of a Neurotology/Otology Practice: Academic vs. Privademic vs. Private Practice Considerations
Michael Hoa, MD, Moderator
Samuel P. Gubbels, MD
Maria Machala, NP, MS
J. Douglas Green, MD
Judy Nelson, DMSc, PA-C
Peter A. Weisskopf, MD
Angela S. Peng, MD

11:51 **INTRODUCTION OF INCOMING PRESIDENT**
J. Thomas Roland, Jr., MD

11:54 **CLOSING REMARKS** - *Elizabeth H. Toh, MD, MBA*

11:56 **ADJOURN**

SELECTED ABSTRACTS

ORAL PRESENTATIONS

IN ORDER OF PRESENTATION

59th Annual Spring Meeting
AMERICAN NEUROTOLOGY SOCIETY

May 18-19, 2024
Hyatt Regency Chicago
Chicago, IL

NEUROTOLOGY FELLOW AWARD

Investigating the Minimal Clinically Important Difference for AzBio and CNC Speech Recognition Scores

Ankita Patro, MD, MS; Aaron C. Moberly, MD; Michael H. Freeman, MD; Elizabeth L. Perkins, MD
Marc L. Bennett, MD, MMHC; David S. Haynes, MD, MMHC
Naweed I. Chowdhury, MD MPH

Objective: To assess the minimal clinically important difference (MCID) values for speech recognition scores, which have not been previously reported.

Study Design: Retrospective cohort.

Setting: Tertiary referral center.

Patients: 863 adult patients who underwent cochlear implantation between 2009 and 2022.

Main Outcome Measures: MCID values for Consonant-Nucleus-Consonant (CNC) word scores and AzBio sentences in quiet and noise scores using distribution-based methods (half-standard deviation, standard error of measurement, Cohen's d, and minimum detectable change).

Results: In this cohort, the median preoperative CNC score was 8% (IQR, 0—22). The median preoperative AzBio in quiet score was 9% (IQR, 0—34), and the median preoperative AzBio in noise score was 11% (IQR, 3—20). The average MCID of several distribution-based methods for CNC, AzBio in quiet, and AzBio in noise were: 7.4%, 9.0%, and 4.9%, respectively. Anchor-based approaches with the Speech, Spatial, and Qualities of hearing patient-reported measure did not have strong classification accuracy across CNC or AzBio in quiet and noise scores (ROC areas under-the-curve $\leq$ 0.69), highlighting weak associations between improvement in speech recognition scores and subjective hearing-related abilities.

Conclusions: Our estimation of MCID values for CNC and AzBio in quiet and noise allows for enhanced patient counseling and clinical interpretation of cochlear implant-related outcomes research.

Professional Practice Gap & Educational Need: To our knowledge, MCID values for speech recognition scores in the cochlear implant population have not been estimated, representing a critical gap in the current literature.

Learning Objective: To identify MCID values for CNC and AzBio in quiet and noise scores.

Desired Result: Providers will have knowledge about MCID values in speech recognition scores in the cochlear implant population, where certain percentage improvements may offer clinically meaningful results in addition to those that are statistically significant. These findings can be utilized to interpret speech recognition scores with patients as well as interpret past, current, and future research assessing cochlear implant outcomes.

Level of Evidence: Level IV – Historical cohort or case-controlled studies.

Indicate IRB or IACUC: IRB Exempt (221833, Vanderbilt University, approved on 10/12/22).

Qualifying Cochlear Implant Candidates – Does it Matter how Patients are Qualified?

David S. Lee, MD; Jacques A. Herzog, MD; Cameron C. Wick, MD
Nedim Durakovic, MD; Craig A. Buchman, MD; Matthew A. Shew, MD

Objective: Evaluate different qualification criteria for cochlear implant (CI) recipients.

Study Design: Retrospective cohort study

Setting: Single-institution tertiary referral center

Patients: 2,124 adults that underwent unilateral CI categorized by qualifying status: AzBio quiet (n=1,239), +10dB SNR (but not in quiet; n=519), +5dB SNR (but not in quiet or +10 dB SNR; n=366). Separate analysis was performed comparing CNC ≤40% (n=720) vs CNC 41-60% (n=39).

Interventions: CI

Main Outcome Measures: Pre- and post-operative speech perception performance. Clinically meaningful improvement is defined as at least ≥10%.

Results: Quiet qualifiers experienced improvement in AzBio quiet (44.3%[95%CI=42.0-46.7%]), whereas +10dB qualifiers and +5dB qualifiers did not (11.1%[95%CI=8.7-13.5%] and 9.5%[95%CI=5.7-13.3%], respectively). When qualifying in +10dB, CI recipients experienced improvement in +10dB SNR(24.0%[95%CI=21.6-26.3%]); similarly, +5dB qualifiers only experienced improvement in +5dB SNR (31.8%[95%CI=28-35.5%]). When stratified by Medicare eligibility (AzBio ≤60%), patients that qualified in noise experienced clinically meaningful gain when tested in their qualifying condition (e.g., +10dB qualifiers tested in +10dB SNR), but not in quiet, regardless of Medicare eligibility status. CNC ≤40% qualifiers experienced meaningful benefit in CNC and AzBio quiet, but CNC 41-60% qualifiers only experienced meaningful benefit in AzBio quiet (18.1%[95%CI=11-25.2%]) and +10dB (23.8%[95%CI=14.1-33.5%]), but not CNC (6.3%[95%CI=-0.3-12.9%]).

Conclusions: Quiet qualifiers improved regardless of testing condition, while those qualifying in noise received benefit only in their qualifying test condition. This may be due to ceiling effects. Newly proposed CNC criteria (≤60%) shows improvement in AzBio conditions, but should be used with caution. Future studies will need to explore the impact of different qualification criteria on quality of life.

Professional Practice Gap & Educational Need: To highlight how institutional differences in CI candidacy evaluation affect hearing outcomes among unilateral CI recipients.

Learning Objective: To understand the effect of qualification in noise on hearing outcomes among unilateral CI recipients.

Desired Result: To improve knowledge of how qualifying conditions affect hearing outcomes.

Level of Evidence - III

Indicate IRB or IACUC : 201911036, Washington University in St. Louis

Cochlear Implantation for Single-Sided Deafness in Pediatric Patients: A Critical Assessment of Long-term Usage Rate

Robert J. Macielak, MD; Celine Richard, MD, PhD; Prashant Malhotra, MD
Ursula M. Findlen, PhD; Oliver F. Adunka, MD, MBA

Objective: To assess the long-term usage rate of pediatric patients undergoing cochlear implantation (CI) for single-sided deafness (SSD)

Study Design: Historical cohort study

Setting: Tertiary pediatric referral center

Patients: Pediatric patients (age < 18 years-old) who underwent CI for SSD

Interventions: CI with requisite audiometric follow-up

Main Outcome Measures: Implant use and audiometric testing at last available visit up to two years post-implantation

Results: Sixty-six patients were implanted for SSD between 12/2018 and 7/2023 at a median age of 4.7-years-old (IQR 1.7-7.7). The cause of hearing loss was unknown in the majority of cases (27 patients, 41%) with cytomegalovirus being the most common known cause (17 patients, 26%). Hearing loss was pre-lingual in 38 patients (58%). Post-implantation, 12 patients (18%) were identified as lost to follow-up. For the remaining 54 patients, the median length of audiometric follow-up was 1.4 years (IQR 0.9-2.2). At last evaluation, only 10 of these 54 patients (19%) were designated as users (≥6 hours per day), and 13 patients (24%) were designated as limited users (>2 but <6 hours per day). Of patients capable of performing speech-in-noise testing (n=12), 10 patients (83%) showed improvement on BKB-SIN SNR-50 testing with their implant on versus off with a mean improvement of 3 dB. Notably, 3 of these 10 patients (30%) were categorized as non-users despite this benefit.

Conclusions: Despite audiometric benefit from CI in the pediatric SSD population, long-term usage rate remains lower than anticipated at a high-volume, well-resourced tertiary pediatric center. Critical assessment is needed to identify trends for these findings to assure appropriate distribution of limited resources.

Professional Practice Gap & Educational Need: Benefit of cochlear implantation in the pediatric single-sided deafness population has been shown, but limited data has been reported regarding long-term results and usage rates in this population.

Learning Objective: The goal of this talk is to describe the difficulties with follow-up and usage rate in pediatric patients undergoing cochlear implantation for single-sided deafness.

Desired Result: The listener will appreciate the difficulties observed in performing cochlear implantation in this population allowing for more comprehensive assessment of this practice.

Level of Evidence: Level IV

Indicate IRB or IACUC: Nationwide Children's Hospital IRB Protocol #00001351

Single Institution Failure Rates and Speech Recognition Outcomes in HiRes Ultra Series Recall

Taimur Siddiqui, BSA, BBA; Benjamin D. Lovin, MD
Alex D. Sweeney, MD; Nathan R. Lindquist, MD

Objective: To report failure rates of Advanced Bionics (AB) HiRes Ultra (V1) and Ultra 3D (V1) cochlear implants (CI) and determine speech recognition outcomes after revision.

Study Design: Retrospective cohort study

Setting: Tertiary referral academic center

Patients: Adult and pediatric patients implanted with V1 devices.

Interventions: CI placement, integrity/audiometric evaluation, revision surgery

Main Outcome Measures: CI failures, revision surgery rate, speech recognition outcomes

Results: Seventy AB V1 were implanted in 25 adults and 27 children. In total, 47 (67.1%) implants failed at a mean 2.75 years after implantation with forty-five (95.7%) believed to be related to the recall issue. Failure was most often determined by recorded performance decline (77.8%) and drop in impedances (73.3%). Of these 45 failures, there was no statistically significant difference in failure rates between adults and children (63.0% and 68.3%, respectively; p=0.65). The mean time to device failure was 2.8 years for adults and 2.7 years for children (p=0.95). To date, 25 (75.8%) patients with recall-related CI failures have undergone revision surgery. For adults, CNC scores improved after revision surgery (mean CNC = 35.0% to mean CNC = 61.4%, p=0.005) and were similar to best pre-revision scores (p=0.51). AzBio scores for adults demonstrated a drop in performance pre-revision (mean best AzBio score = 86.5% to mean pre-revision AzBio = 59.0%, p=0.03), but was did not show significance in improvement post-revision (mean post-revision AzBio = 74.5%, p=0.16).

Conclusions: A significant number of AB V1 implants failed in adult and pediatric patients. While CNC scores returned patients with revision surgery to best pre-revision testing, post-revision AzBio scores did not return to best pre-revision scores. Further investigations and multicenter studies are needed to fully quantify outcomes for these patients.

Professional Practice Gap & Educational Need: CI recalls are an important consideration when providing patient counseling for primary and revision CI surgery. Analyses of CI failure rates from a large healthcare institution provides manufacturer-independent failure rate data, improve patient counseling, and elucidate outcomes for CI failures.

Learning Objective: The audience should be able to quantify CI failure rates among adults and pediatrics at a single institution and understand CI revision outcomes.

Desired Result: To corroborate previous data on AB CI failure rates and improve patient counseling with metrics for CI failures and outcomes of CI revision, if indicated.

Level of Evidence – Level V

Indicate IRB or IACUC : H-49479

A Multi-Institutional Analysis of Advanced Bionics HiRes V1 Cochlear Implant Device Failures

Michael H. Freeman, MD; Nathan R. Lindquist, MD; James R. Dornhoffer, MD; Benjamin D. Lovin, MD
Kristen L. Yancey, MD; Matthew L. Carlson, MD; Marc L. Bennett, MD, MMHC

Objective: To assess Advanced Bionics (AB) HiRes Ultra (V1) and Ultra 3D (V1) cochlear implant electrode failures over time at four large cochlear implant programs.

Study Design: Retrospective cohort.

Setting: Five tertiary referral centers.

Patients: Patients receiving AB HiRes Ultra (V1) and Ultra 3D (V1) devices as of December 31, 2022.

Main Outcome Measures: Failure rate, revision surgery, speech recognition scores.

Results: To date, 206 (42.7%) of the 483 implanted V1 devices have failed. Device failure rate varied across institutions from 32% to 67%. Of the 206 detected failures, 163 (79%) have undergone revision surgery, with 94% of revisions being performed with Advanced Bionics devices. Average time from implantation to diagnosis of device failure was 2.68 ± 1.24 years. After revision, patients had an average CNC score improvement of 23.8% over their most recent pre-revision scores and demonstrated average datalogging of 12.2 ± 4.2 hrs/day at most recent evaluation. 78% of patients with available testing matched or exceeded their best pre-failure speech performance following implant revision.

Conclusions: Comparison of patients across multiple high-volume implant centers confirms the presence of ongoing device failures. There is variability across institutions in the rate of revision surgery once a patient is diagnosed with a V1 device failure, as well as in the rate of device failure detection. Inter-institutional variability in failure rates may be explained by the variation in the routine use of electrical field imaging. Reimplantation with a new device typically results in a return to pre-failure peak performance.

Professional Practice Gap & Educational Need: To our knowledge, a comparison of AB HiRes (V1) device failures across multiple institutions has not been conducted.

Learning Objective: To identify device failure rate across multiple institutions with different testing protocols.

Desired Result: Providers will have an improved understanding of the trajectory of device failures for HiRes (V1) devices over time. Providers will also be able to project

Level of Evidence: Level IV – Historical cohort or case-controlled studies.

Indicate IRB or IACUC: IRB Exempt (230017, Vanderbilt University).

HERBERT SILVERSTEIN AWARD FOR RESEARCH EXCELLENCE IN OTOLOGY/NEUROTOLOGY

Expression of TGFβ-1 and CTGF in the Implanted Cochlea and its Implication on New Tissue Formation

Adam Y. Xiao, MD, PhD; Ivan A. Lopez, PhD
Gail Ishiyama, MD; Akira Ishiyama, MD

Hypothesis: TGFβ-1 and CTGF are upregulated following cochlear implantation and may play an important role in the pathogenesis of post-implantation new tissue formation.

Background: Cochlear implantation can lead to insertion trauma and foreign body reaction resulting in new tissue formation that adversely affects device performance. Transforming growth factor beta-1 (TGFβ-1) and connective tissue growth factor (CTGF) are pro-fibrotic proteins implicated in various pathologic conditions, but little is known about their role in the cochlea. The present study aims to characterize the expression of these proteins in the human implanted cochlea.

Methods: Archival HTB samples acquired from 12 patients with prior CI as well as human intra-cochlear scar tissue harvested during revision CI surgery were used in this study. Histopathologic analysis of fibrosis and osteoneogenesis was conducted using H&E. Protein expression was characterized using immunofluorescence and RNA expression was quantified with qRT-PCR.

Results: TGFβ-1 and CTGF were upregulated in implanted HTB and surgical specimens. TGFβ-1 was diffusely expressed within the fibrous capsule while CTGF was expressed vectorially towards the modiolus. There was also strong expression of CTGF at the fibrosis-osteoneogenesis junction as well as within the new bone. RNA expression of TGFβ-1 ($p<0.05$) was also significantly higher in intra-cochlear scar tissue compared to control.

Conclusions: To our knowledge, this is the first study to demonstrate increased expression of TGFβ-1 and CTGF in the human implanted cochlea and may provide better understanding of the mechanism behind this pathogenic process to guide future therapies.

Professional Practice Gap & Educational Need: Cochlear implantation can lead to new tissue formation that detrimentally affects device performance over time. Better understanding of this process can lead to more effective therapeutic interventions.

Learning Objective: To understand the expression pattern of TGFβ-1 and CTGF in the fibrous capsule and new bone of implanted cochlea.

Desired Result: Participants should better appreciate the potential role of TGFβ-1 and CTGF in new tissue formation following cochlear implantation.

Level of Evidence – Not applicable

Indicate IRB: UCLA IRB #22-001587

TRAINEE AWARD

Impact of Modifiable Surgical Factors on Ossiculoplasty Outcomes after Controlling for Ear Environment Risk: A Multi-institutional Study

Ryan T. Judd, MD; Richard K. Gurgel, MD, MSCI; John L. Dornhoffer, MD
Matthew Carlson, MD; Walter Kutz, MD; Jafri Kuthubutheen, MD
Michael B. Gluth, MD

Objective: To determine the impact of modifiable surgical factors on ossiculoplasty outcomes after controlling for ear environment risk.

Study Design: Multi-institutional retrospective review.

Setting: Six tertiary care centers from 2011-2019.

Patients: Adults and children.

Interventions: Ossiculoplasty, including: synthetic ossicular replacement prosthesis, autograft interposition, bone cement repair, and mobilization.

Main Outcome Measure: Correlation between modifiable surgical factors and pure-tone average air-bone gap (PTA-ABG) at most recent audiogram after controlling for preoperative risk using a new statistically-validated Ear Environment Risk (EER) score previously developed from the presented database.

Results: 1,679 cases were included with median follow-up time of 20 months (IQR 5-51). After controlling for EER score, ossiculoplasty engaging the malleus was associated with lower PTA-ABG versus engaging the tympanic membrane without malleus engagement (beta= -2.6dB (-4.3, -1.0), p=0.001). For total ossicular replacement prostheses (TORP), use of a footplate prosthesis was associated with lower PTA-ABG than footplate engagement without a footplate prosthesis (beta= -3.5dB (-6.1, -1.0), p=0.029). For synthetic prostheses, titanium+hydroxyapatite had lower PTA-ABG than either full titanium or polyethylene prostheses (p<0.05). There was no significant difference in PTA-ABG for: single-stage versus multi-staged approach for cholesteatoma or non-cholesteatoma cases; use of a cartilage cap over reconstruction versus no cartilage; and incudostapedial joint reconstruction with joint prosthesis/bone cement versus synthetic PORP (p>0.05).

Conclusions: In this large multi-center study, prothesis engagement of the malleus and use of a footplate prosthesis with a TORP were associated with better outcomes. Among cases involving synthetic prostheses, combination hydroxyapatite+titanium prostheses were superior to other materials. Staging and use of cartilage cap did not impact outcomes.

Professional Practice Gap & Educational Need: Large volume, multi-center evidence pertaining to the impact of surgical technique on ossiculoplasty outcomes is limited.

Learning Objective: Elucidate which surgical factors can be modified in order to optimize ossiculoplasty hearing outcomes.

Desired Result: Improved ossiculoplasty hearing outcomes

Indicate IRB or IACUC: IRB18-1713, The University of Chicago Biological Sciences Division.
Approved 12/18/2018.

Optical Coherence Tomography Imaging of Middle Ear Glomus Tumors in Clinic

Dorothy W. Pan, MD, PhD; Marcela A. Moran, BS; Wihan Kim, PhD
Jack C. Tang, PhD; Frank D. Macias-Escriva, BS
Brian E. Applegate, PhD; John S. Oghalai, MD

Hypothesis: Optical Coherence Tomography (OCT) can be utilized to diagnose glomus tumors by imaging through the tympanic membrane (TM).

Background: OCT is a noninvasive imaging technique used clinically in ophthalmology. For otology, OCT has been used experimentally to image middle ear structures through the TM, with penetration into the cochlear promontory. In Doppler mode, blood flow within tissues can be measured.

Methods: We designed and built a custom handheld OCT clinical system that can be used similar to an otoscope. It operates with a laser emitting at 1310 nm and 39 nm bandwidth with a 200 kHz sweep rate, and provides 33.4 um axial and 38 um lateral resolution (in tissue, n=1.3). Cross-sectional images of the middle ear space, including Doppler OCT, were recorded in an academic neurotology clinic. The experimental group included patients with glomus tumors and the control group included patients with normal ear exams by otomicroscopy.

Results: OCT images revealed key structures within the middle ear space, including TM, ossicles (malleus and incudostapedial joint), chorda tympani, and cochlear promontory. OCT also identified all four patients with a glomus tumor that was visible on otomicroscopy. This was quantified by comparing image intensity within the mesotympanic space normalized to image intensity of the TM. These values were 0.72±0.11 (mean ± SEM, n=4) for glomus tumors and 0.085±0.013 (mean ± SEM, n=4) for normal ears, a difference that was statistically significant (p=0.001, non-paired t-test). Doppler OCT revealed vascularity within glomus tumors, but no vascularity was found in normal ears.

Conclusions: OCT permits noninvasive imaging of the TM and middle ear space in a clinic setting and provides details beyond otomicroscopic examination. OCT provides information that can help with the diagnosis of glomus tumors.

Professional Practice Gap & Educational Need: Making a conclusive diagnosis of a middle ear mass can be difficult with otomicroscopy alone. OCT is a technology that will soon be available for use in neurotology clinics, and it has the potential to help overcome this limitation.

Learning Objective: OCT permits visualization of middle ear structures non-invasively, and can provide information that can help narrow the differential diagnosis of otopathology

Desired Result: OCT can be used to image and identify middle ear pathology such as glomus tumors in the clinic.

Level of Evidence - Level III

Indicate IRB or IACUC: IRB approved, University of Southern California HS-17-01014

Pain Control After Otologic Surgery: Do Nonopioid Analgesics Suffice?

Mustafa G. Bulbul, MD, MPH; Zulkifl Jafary, BS
Brian M. Kellermeyer, MD; Scott B. Shapiro, MD

Objective: Investigate whether nonopioid analgesics provide adequate pain control after otologic surgery.

Study Design: Retrospective multi-center cohort.

Setting: Two quaternary academic medical centers.

Patients: Patients over 12 years old who underwent otologic surgery involving the middle ear and/or mastoid at two centers over a 4-month period, though the study is ongoing.

Interventions: Patients were prescribed acetaminophen and ibuprofen post-operatively and instructed to contact the surgical team if pain control was inadequate, in which case an opioid medication was prescribed. Level of pain and medication use were assessed with a standardized questionnaire 1 week after surgery.

Main Outcome Measures: Post-operative pain levels during the first week after surgery (0-10), proportion of patients requiring opioid medication.

Results: Fifty-six patients were included. Of these, 39.3% underwent mastoidectomy, 23.2% cochlear implant, 14.3% post-auricular tympanoplasty, 12.5% trans-canal tympanoplasty, and 10.7% had a different surgery. The mean of the average level of pain during the first post-operative week was 4.6/10 (+/-2.5). The mean highest level of pain was 6.1/10 (+/-2.8). Six patients (10.7%) required breakthrough opioid pain medication. The remaining 89.3% utilized nonopioid analgesics only. One week after surgery, 59.9% were taking nonopioid analgesics only while the remaining 41.1% of all patients were not taking any pain medication at all. Though opioids were required infrequently, there were no significant differences in medication use between the two centers.

Conclusions: Nonopioid analgesics provide adequate pain control for most patients after middle ear and mastoid otologic surgery. Opioid analgesics do not routinely need to be prescribed.

Professional Practice Gap & Educational Need: Preliminary research has suggested patients may not require opioid analgesics after routine middle ear and mastoid surgery. Despite this, current pain control regimens utilized are highly variable across the otologic surgery community and often continue to routinely prescribe opioid analgesics.

Learning Objective: Learners will understand that a nonopioid analgesic regimen consisting of acetaminophen and ibuprofen is adequate for most patients after middle ear and mastoid surgery.

Desired Result: Otolaryngologists will not routinely prescribe opioid analgesics after middle ear and mastoid surgery.

Level of Evidence – Level III

Indicate IRB or IACUC: IRB approval was obtained from both institutions (Rutgers protocol #2021001523 April 2, 2023 and WVU Protocol #2106339604 September 29, 2021)

Detection of CSF Leaks with Intrathecal Gadolinium MRI Cisternograms

Douglas J. Totten, MD, MBA; Cody Whitted, BS; Kevin T. Booth, PhD
Kristine M. Mosier, DMD, PhD; Evan Cumpston, MD
Nicholas A. Koontz, MD; Rick F. Nelson, MD, PhD

Objective: To compare the efficacy of MRI and CT Cisternograms on detection of cerebrospinal fluid (CSF) leaks

Study Design: Retrospective cohort study.

Setting: Tertiary referral center.

Patients: Adult patients with suspected CSF leak who underwent computed tomography (CT) or magnetic resonance (MR) imaging cisternograms alone or in combination to assess for CSF leak between 2018-2022.

Main Outcome Measures: Evidence of CSF leak on single or multiple cisternogram types.

Results: 32 patients (66% female) had an age range of 22-80 years where a CSF leak was absent in 18 and confirmed in 14 patients. CT cisternogram was performed in 31 (97%) patients while MR cisternogram was performed in 16 (50%) patients. There were no false positive tests for either CT or MR cisternograms. CT cisternograms had sensitivity of 69% and a negative predictive value (NPV) of 82% while MR cisternograms had a 100% sensitivity and 100% NPV. No adverse events were experienced by any patient.

Conclusions: MR cisternograms appear to be more sensitive than CT cisternograms in detecting CSF leaks. MR cisternograms should be utilized when appropriate to assess for lateral skull base CSF leaks when there is a high-index of suspicion with inconclusive imaging and beta-2 transferrin testing.

Professional Practice Gap: Incidence of CSF leaks continues to increase across the United States. While beta-2-transferrin requires collection of draining fluid and often has a delayed result, cisternograms allow for highly accurate and more immediate results while showing anatomic area of defect.

Learning Objective: CT and MR cisternograms are helpful tools in diagnosis of CSF leaks

Desired Result: CT and MR cisternograms are highly effective in diagnosing or ruling out CSF Leaks in patients with a high degree of suspicion of a CSF leak.

Level of Evidence: IV

IRB: Indiana University IRB #13133 (approved 10/14/2022)

NEUROTOLOGY FELLOW AWARD

Lumbar Puncture Opening Pressure and Polysomnogram Findings in Patients with Lateral Spontaneous Cerebrospinal Fluid Leaks

Evan Cumpston, MD; William Zhang, BS; Douglas J. Totten, MD, MBA
Charles W. Yates, MD; Rick F. Nelson, MD, PhD

Objective: Evaluate postoperative opening pressures (OP) on lumbar puncture (LP) and polysomnogram (PSG) findings in patients who underwent middle cranial fossa (MCF) repair in patients with lateral spontaneous cerebrospinal fluid (sCSF) leaks.

Study Design: Retrospective cohort

Setting: Tertiary referral center

Patients: Temporal bone sCSF leak who underwent MCF repair with bone cement between 8/2019-3/2023.

Interventions: MCF repair of sCSF leak, PSG, and postoperative LP.

Main Outcome Measures: Incidence of intracranial hypertension, IIH (LP OP >25 cm H20), and of OSA (apnea-hypopnea index (AHI) >5)

Results: 66 patients had an average (standard deviation) age of 56.7 (±11.7) years and BMI of 39.0 (±9.9) kg/m2. There were no unilateral recurrent CSF leaks. OP was completed by 31 patients at a mean 155.5 days (±172.3) postop with a mean OP 22.3 cmH_2O (±8.3). Only 10 (32%) patients had an LP ≥25 cmH_2O. Papilledema was observed in 1 of 11 patients on retinal exam. OSA was observed in 93% of patients (n = 32) with a mean AHI was 25.7 (±35.1). There was no significant correlation between OP and AHI (p=0.57). In the 3 patients who developed a contralateral leak, the mean OP was 27.5 (±8.8), AHI 16.5 (±2.5), and mean BMI 37.2 (±12.6). Only one had a history of anterior sCSF leak.

Conclusions: The incidence of IIH on postoperative LP is observed in 32% of lateral sCSF leak patients and papilledema is rare, yet nearly all patients have OSA. Concomitant anterior and lateral CSF leaks are rare, yet patients are at risk for development of a contralateral temporal bone sCSF leak.

***Professional Practice Gap & Educational Need:** The association of IIH, OSA and sCSF leaks following repair of sCSF leaks of the lateral skull base. This study describes the OP and polysomnogram findings in a series of sCSF leak patients who underwent repair.

***Learning Objectives:** Most patients with lateral sCSF leaks have OP less than 25 cmH_2O following repair. OSA is common in patients with lateral sCSF leaks.

***Desired Results:** Define the mean opening pressure in patients with previous lateral sCSF leak repair.

Level of Evidence: IV

IRB: Indiana University IRB #1907071217.

Long-Term Prospective Quality-of-Life Outcomes in 445 Patients with Sporadic Vestibular Schwannoma

Eric E. Babajanian, MD; Christine M. Lohse, MS; Nicole M. Tombers, RN
Michael J. Link, MD; Matthew L. Carlson, MD

Objective: To evaluate the long-term changes in sporadic vestibular schwannoma (VS) disease-specific quality-of-life (QOL) outcomes.

Study Design: Prospective longitudinal study using the Penn Acoustic Neuroma Quality of Life (PANQOL) scale.

Setting: Large academic skull base center and Acoustic Neuroma Association.

Patients: Patients with sporadic VS who completed a baseline survey before treatment and at least one follow-up survey.

Interventions: Observation, microsurgery, radiosurgery.

Main Outcome Measures: Change in PANQOL scores from baseline to most recent survey.

Results: A total of 445 patients were eligible for study with a mean duration of follow-up of 4.4 (SD 2.3) years, including 122, 218, and 105 in the observation, microsurgery, and radiosurgery groups, respectively. Patients managed with observation ($p=0.03$) or microsurgery ($p<0.001$) demonstrated improvement in anxiety scores. Changes in facial function scores differed significantly by management group ($p=0.01$), with patients undergoing microsurgery demonstrating a mean decline of 10 in facial function scores compared with mean declines of 3 for those managed with observation or radiosurgery. Hearing loss scores decreased similarly over time for all three groups ($p=0.3$). There were minimal changes in total PANQOL scores over time across all management groups ($p=0.5$).

Conclusions: Long-term changes in total QOL among VS treatment groups are not significantly different. Microsurgery may continue to confer an advantage with regard to anxiety, presumably due to the benefit of a "cure," but with a greater decline in facial function when compared to observation or radiosurgery. Long-term decline in hearing was not statistically significant among groups.

Professional Practice Gap & Educational Need: With differing practice patterns across institutions, we need to better understand whether treatment strategy for VS impacts long-term QOL for patients.

Learning Objective: To describe long-term disease-specific QOL outcomes in patients with VS over time.

Desired Result: To provide guidance on long-term QOL outcomes in VS depending on treatment strategy.

Level of Evidence: III

Indicate IRB: Mayo Clinic IRB#14-009331

Residual Vestibular Schwannomas and Low Tendency for Future Growth

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Troy Wesson, BS; Brooke Stephanian, BS; Rohit Chatterjee, BS
Sabin Karki, BS; Rick F. Nelson, MD, PhD

Objective: To assess growth rates of residual vestibular schwannoma after subtotal and near-total surgical resection

Study Design: Retrospective cohort study

Setting: Tertiary referral center

Patients: Patients with residual vestibular schwannoma after surgical resection

Main Outcome Measures: Tumor growth after subtotal or near-total surgical resection of vestibular schwannoma

Results: 51 patients with residual tumor from 2011-2022 were included. Patients were further subdivided into those with subtotal resection or near-total resection (less than 5 mm of remaining tumor). Most patients (44, 79%) had tumors of 2 cm or larger. Mean (SD) follow-up time of 21 (22) months. Residual growth requiring further intervention was noted in 6 (12.2%) of patients. Four patients received salvage radiosurgery while two patients underwent salvage surgical resection. No further growth was seen in any tumor at an average of 21 months after salvage radiosurgery or 20 months after salvage surgery. Of remaining tumors, 15 (31%) had shrank while 25 (51%) did not grow and five (10%) experienced mild growth (mean 0.5, SD 0.4 cm) but at last follow up were still being observed. Of 46 patients with postoperative data, 31 (67.4%) had a Good facial nerve outcome (House-Brackmann I-II/VI) was achieved in 31 (67%) of patients at last follow up. Single variable logistic regression did not identify STR vs. NTR or pre-operative tumor size as significantly predictive of likelihood of growth of residual tumor (p=0.62 and 0.65, respectively) or increased likelihood of poor facial nerve outcomes (p=0.63 and 0.67, respectively).

Conclusions: Patients with residual tumor after surgical resection often have large initial tumor volume complicating surgical resection and placing patients at higher risk of facial nerve weakness postoperatively. Residual tumors appear to have low rates of future growth regardless of initial tumor size. More conservative surgical resection may be warranted if facial nerve function may be more effectively preserved.

***Professional Practice Gaps:** The determination of when to allow residual tumor to remain on the vestibular nerve remains highly controversial. This study attempts to assess how likely residual tumor is to re-grow and/or require further intervention.

***Learning Objectives:** Residual vestibular schwannoma is unlikely to grow to the point of requiring further intervention.

***Desired Results:** Patients with residual vestibular schwannoma after tumor resection do not often require further surgical and/or radiosurgical intervention.

Level of Evidence: IV

IRB: Indiana University IRB #13133 (approved 10/14/2022)

Effect of Simvastatin and Radiation on Viability of Primary Vestibular Schwannoma

Matthew Wiefels, BS; Olena Bracho, BS; Mikhail Marasigan, BS; Fred F. Telischi, MD, MEE
Michael Ivan, MD; Cristina Fernandez-Valle, PhD; Christine T. Dinh, MD

Hypothesis: Simvastatin reduces viability of irradiated and non-irradiated *NF2*-mutant human Schwann cells (HS01) and primary vestibular schwannoma (VS) cells.

Background: Statin drugs are cholesterol lowering medications that promote apoptosis, inhibit proliferation, and enhance radiation response in several cancers. Although radiotherapy is a standard treatment for VS, ~9-12% of irradiated VS continue to grow. In this study, we determine the effect of simvastatin on viability of irradiated and non-irradiated HS01 and VS cells.

Methods: HS01 and primary VS cells (n=3) were cultured on 384-well plates (5,000 cells/well) and pre-treated with simvastatin (0 or 1 μM) prior to irradiation (0 or 18 Gy). Viability was measured using cell-based assays. Immunocytochemistry was performed for γ-H2AX nuclear foci (DNA damage) and RAD51 expression (DNA repair). Statistical analysis was performed with two-way analysis of variance.

Results: HS01 cells demonstrated small decreases in viability (~10%) with simvastatin but had greater reductions (~30-35%) with 18 Gy or 18 Gy + Simvastatin. VS cells also had small decreases in viability (~20%) with simvastatin; however, viability responses with radiation and simvastatin were variable. Irradiated VSB13 and VSB14 demonstrated ~20% decrease in viability, and addition of simvastatin caused greater reductions (~30-45%). Although VSB11 was resistant to radiation, simvastatin caused small reductions in viability (~20%) regardless of radiation status. Expression patterns for γ-H2AX and RAD51 are described in relation to viability.

Conclusions: Simvastatin reduced viability of VS cells and may improve radiation response in select VS. Further investigations are warranted to assess whether statin drugs alone or with radiation are effective for VS tumor control.

Professional Practice Gap & Educational Need: Long-term tumor control rates for VS are approximately 10%. It is unknown whether simvastatin alone or with radiation may be effective at tumor control in patients with VS.

Learning Objective: Describe the effect of simvastatin on cell viability, DNA damage, and DNA repair in irradiated and non-irradiated *NF2*-mutant Schwann cells and primary VS cells.

Desired Result: Physicians understand that statin drugs are a class of cholesterol lowering drugs that may be beneficial in tumor control in non-irradiated and irradiated VS.

Level of Evidence: N/A

Indicate IRB or IACUC: IRB #20150637. Vestibular Schwannoma. Date of University of Miami IRB approval: 9/26/2017.

Angiotensin-Receptor Blockers Prevent Vestibular Schwannoma-Associated Hearing Loss

Samuel A. Early, MD, MS; Alyssa Brown, BS; Lei Xu, MD, PhD
Konstantina M. Stankovic, MD, PhD (presenter)

Objective: Vestibular schwannomas (VS) tumors typically present with sensorineural hearing loss (SNHL). Losartan has recently demonstrated prevention of tumor-associated SNHL in a mouse model of VS through suppression of inflammatory and pro-fibrotic factors, and the current study investigates this association in humans.

Study Design: Retrospective.

Setting: This is a retrospective study of patients with unilateral VS and hypertension followed with sequential audiometry at a tertiary referral hospital from January 1994 through June 2023. Patients were stratified into subgroups by anti-hypertensive medication class. SNHL progression was assessed using Kaplan-Meier analysis to account for variable follow-up times.

Patients: Two hundred thirty six patients were identified with diagnosis of both VS and hypertension, and with sequential audiometry. Of these, 186 were taking anti-hypertensive therapy at time of initial VS diagnosis, and 23 were taking losartan or another angiotensin receptor blocker (ARB).

Interventions: None (retrospective analysis).

Main Outcome Measures: Serial audiometry over time.

Results: Patients taking an ARB were both more likely to have normal baseline hearing and no progressive hearing loss with 36.5 total patient-years of follow-up. Patients taking other anti-hypertensives all showed expected declines in hearing consistent with natural history of VS tumors.

Conclusions: This study represents the first statistically significant association between ARB intake and hearing preservation in a real-world VS patient population. Significant confounding factors, such as concomitant hypertension in these patients, cloud still cloud the full effect of ARB medications' interaction with SNHL progression. Given that ARBs are well-tolerated and safe, the results advocate for a prospective clinical trial to validate this effect.

Professional Practice Gap & Educational Need: Treatment options for Vestibular Schwannoma are currently limited to surgery, radiation treatment and observation. No reliable drug therapies exist. This study supports the possible role of an established, well-tolerated, FDA-approved medication class to reduce progression of tumor-associated hearing loss.

Learning Objective: Understand the role of angiotensin receptor blockers in modulating the inflammatory pathways associated with tumor-associated hearing loss.

Desired Result: Appreciation for the potential role of new medical therapies for treating Vestibular Schwannoma.

Level of Evidence: IV

Indicate IRB or IACUC: Human Studies Committee at Massachusetts Eye and Ear and Massachusetts General Hospital (IRB 16-103H)

Amplifying Endoplasmic Reticulum Stress with Adenosine Triphosphate-Coated Gold Nanoclusters: A Promising Approach for the Treatment of Vestibular Schwannoma

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Jing Chen; Rohit Duggaraju; Zin Mie Mie Htun
Peter L. Santa Maria, MBBS, PhD

Hypothesis: Novel gold nanoclusters coated with adenosine triphosphate (AuNC@ATP) can enhance endoplasmic reticulum stress and inhibit the growth of vestibular schwannoma (VS).

Background: There is an unmet need for an effective pharmacotherapy for the treatment of VS that does not carry the risk profile of current therapeutic modalities.

The endoplasmic reticulum (ER) is a multi-functional cellular organelle critical in protein synthesis and folding. ER stress is an essential regulator of tumor growth and is thus an appealing target for antitumor therapy. Our previous research demonstrated that AuNC@ATP display antimicrobial properties through their ability to induce a stress response that results in the accumulation of unfolded proteins. We therefore sought to determine whether AuNC@ATP could enhance ER stress and inhibit schwannoma growth *in vitro*.

Methods: AuNC@ATP were synthesized and characterized using spectrophotometry and transmission electron microscopy. Rat schwannoma cells (S16) were grown in DMEM/F-12 supplemented with 10% FBS and 1% Penicillin-Streptomycin. S16 viability was measured using a colorimetric MTT assay. Cell growth was measured using automated cell counting. ER stress was measured by Thioflavin T (Th-T) fluorescence.

Results: Addition of AuNC@ATP to S16 for 24 hours caused a decrease in cell viability directly related to its concentration. A concentration of 27.93 μM led to a substantial loss of cell viability (95%). We next cultured S16 in a medium containing a sub-lethal concentration of AuNC@ATP (6.98 μM). After 96 hours, S16 cells reached 10^7 when growing without AuNC@ATP compared to 10^5 when growing with it. Additionally**,** AuNC@ATP caused a concentration dependent increase in Th-T fluorescence.

Conclusions: We have demonstrated that AuNC@ATP can inhibit schwannoma cell growth *in vitro.* The antitumor activity of AuNC@ATP appears to be mediated through amplified ER stress. This study reinforces the concept of engineering nano-drugs that induce ER stress for tumor treatment.

Professional Practice Gap & Educational Need: Vestibular schwannoma are common skull base tumors that are associated with significant morbidity. There is a current unmet need for a non-surgical, non-radiation based treatment that reduces the risk of adverse events associated with these treatments.

Learning Objective: To deepen the understanding of the potential of nanomedicines in the treatment of vestibular schwannoma.

Desired Result: This work demonstrates the potential of AuNC@ATP as novel pharmacotherapy for vestibular schwannoma.

Level of Evidence - Level V

Indicate IRB or IACUC : Exempt.

Successful Audiologic Outcomes with Auditory Brainstem Implantation including Bilateral Implantation

Douglas M. Bennion, MD, PhD; Alicia Williams, AuD
Rick A. Friedman, MD, PhD; Marc S. Schwartz, MD, PhD

Objective: Auditory brainstem implantation (ABI) is an option for patients with profound deafness resulting from auditory nerve pathology, as in Neurofibromatosis type 2. Performance outcomes in ABI recipients vary widely, with achievement of rudimentary auditory function (e.g. sound awareness) typically considered a successful endpoint. We set out to characterize recent audiologic outcomes among ABI patients treated at our institution since 2018.

Study Design: Retrospective case series

Setting: Single tertiary care hospital

Patients: Audiologic outcomes were reviewed in sixteen patients who underwent ABI placement at our institution since 2018. Implantation in four of these patients was on their second side.

Interventions: Auditory brainstem implantation and audiometric testing

Main Outcome Measures: Sound awareness (sound-field threshold testing) and speech understanding (spondee, CNC word, HINT sentence scores)

Results: Sound awareness was achieved in 100% of patients (16/16) using an average of 13 electrodes (range 7-20). Persistent non-auditory sensations were reported by 19% (3/16). Among those with sufficient follow-up from the time of implantation, improved speech understanding was achieved in 92% (12/13). Among four patients who underwent second sided ABI placement, one uses bilateral ABIs at all times with remarkable benefit: HINT sentence score of 92% with auditory-only input.

Conclusions: While results vary based on a variety of patient and center-specific factors, ABI represents a viable option for patients who are at risk of developing bilateral profound deafness. Further, for those patients in whom second sided implantation becomes an option at the time of contralateral tumor resection, second sided device implantation has the potential to significantly improve auditory outcomes.

Professional Practice Gap & Educational Need: As an uncommon procedure, ABI and associated outcomes are often reported in smaller groups over extended periods of time. The inclusion of 16 patients over a five year period represents a uniquely large sample for assessing outcomes in this population.

Learning Objective: Learners will come to appreciate key factors to maximizing success in auditory brainstem implantation, which include:
-The use of reliable intraoperative electrophysiologic feedback
-Reliance on detailed anatomic knowledge to guide precise array placement
-Patient participation in appropriate post-implantation device programming and comprehensive auditory rehabilitation

Desired Result: Learners will come away with useful data to assist in clinical decision making, prognostication of outcomes and implementation of best practices to promote optimal audiologic function in ABI patients.

Level of Evidence: Level V

IRB: Exempt

Superior Semicircular Canal Dehiscence in Chronic Ear Disease: Is it Clinically Relevant?

Kurt C. Mueller, MD; Jacob P. Hagen, BS; Christian K. Kerut, BS
Rahul Mehta, MD; Anne K. Maxwell, MD

Objective: To investigate if radiographic evidence of superior semicircular canal dehiscence (SSCD) in patients with chronic otitis media (COM) coincides with symptomatic manifestation of SSCD syndrome.

Study Design: Retrospective chart review

Setting: Tertiary referral center

Patients: 848 patients (1696 temporal bones) who underwent surgery and high-resolution computed tomography (HRCT) of their temporal bones for chronic ear disease.

Interventions: HRCT of each ear was reviewed for SSCD or thinning. Presence and site of cholesteatoma/COM, subjective symptoms, and vestibular testing were ascertained for those with radiographic SSCD or thinning.

Main Outcome Measures: Presence of subjective and objective manifestation of SSCD syndrome in patients with COM, chronic otomastoiditis, and/or cholesteatoma with radiographic evidence of SSCD or thinning.

Results: Of the 1696 temporal bones and superior semicircular canals analyzed, 44 (2.6%) were dehiscent, 103 (6.1%) were thin, and 1549 (91.3%) were normal.

86 temporal bones had both COM and SSCD or thinning. Of these, 23 (26.7%) were dehiscent and 63 (73.3%) were thin. 82 (95.3%) had evidence of chronic otomastoiditis and 32 (37.2%) had cholesteatoma. Locations of cholesteatoma included epitympanum (75.0%), tympanic cavity (62.5%), mastoid (62.5%), and protympanum (3.1%). Only six ears (7.0%) had true vertigo and three (3.5%) had pulsatile tinnitus. None had autophony, sound-induced vertigo, or pressure-induced vertigo. cVEMP was obtained on eight ears; four were normal and four were absent. Four ears underwent Tullio and fistula testing; none were abnormal. No superior canals were repaired surgically for SSCD syndrome.

Conclusions: Although COM may increase the radiographic presence of SSCD, it may not necessarily increase the risk of symptomatic manifestation of SSCD syndrome.

Professional Practice Gap & Educational Need: Current evidence indicates that patients with COM have an increased prevalence of radiographic superior semicircular canal dehiscence compared to non-diseased ears. However, the clinical significance of this is undetermined, as many patients have radiographic evidence of dehiscence without symptoms. This study aims to further elucidate the relationship between radiographic SSCD and clinically active symptoms among patients with COM.

Learning Objective: Understand the impact of chronic ear disease on the radiographic appearance of the superior semicircular canals. Understand the clinic relevance of radiographic SSCD in chronic ear patients with regards to its symptomatic manifestations.

Desired Result: Attendees will have a better understanding of the relationship of radiographic evidence of SSCD with symptomatic manifestations of the syndrome in patients with chronic ear disease.

Level of Evidence - Level IV

IRB: Louisiana State University Health Sciences Center - New Orleans IRB #2172. Exempt.

Long-term Outcomes Following Sinus Wall Reconstruction for Sigmoid Sinus Wall Anomalies

Adaobi E. Ahanotu, BS; Kimberly Oslin, MD
Marjohn M. Rasooly, MSN; David J. Eisenman, MD

Objectives: To assess long-term outcomes following transtemporal sinus wall reconstruction (SWR) for pulsatile tinnitus (PT) due to sigmoid sinus wall anomalies.

Study Design: Prospective observational study of previously treated patients

Setting: Tertiary care academic medical center in the United States

Patients: Ninety-nine ears from 97 patients underwent SWR from 2007-2022, sixty of which (60 ears, 58 patients) were greater than five years status-post surgery. Thirty-five (58.3%) eligible patients with 37 ears operated on completed the survey via email, mail, or telephone

Interventions: None

Main Outcome Measures:
1. Recurrence or persistence of PT
2. Development of other symptoms or signs of idiopathic intracranial hypertension (IIH)

Results: There were no significant differences in demographics and clinical findings between the study cohort and the complete cohort of patients undergoing SWR. Survey results indicated that sinus wall reconstruction was successful in eliminating PT in 24 out of 37 (64.9%) ears and significant partial resolution of PT in an additional 10 ears (27%), for a total long-term satisfactory result of 91.9%. Three (8.6%) patients developed idiopathic intracranial hypertension (IIH) at some point during the follow up period, one of whom required a ventriculoperitoneal (VP) shunt. Another had cerebrospinal fluid (CSF) leak repair. Another two (5.7%) patients had transverse sinus stents placed but did not report a formal diagnosis of IIH.

Conclusions: By five or more years post-operatively, patients who underwent SWR can achieve either complete or significantly partial tinnitus resolution. A small percentage developed symptomatic IIH at some point in the follow up period.

Professional Practice Gap & Educational Need: Uncertainty still exists about long-term outcomes, both regarding PT and development of IIH, for patients undergoing SWR for PT associated with sigmoid sinus wall anomalies. In particular, there is concern about recurrence of PT because of persistence of associated transverse sinus stenosis, or development of complications due to compromised posterior fossa venous outflow. This long-term follow-up study with mean follow up of 9.5 years provides cross-sectional data on outcomes in this treated group of patients

Learning Objective: To evaluate the long-term effects of SWR in treating PT

Desired Results:
- Quantify long-term success of SWR for PT due to sigmoid sinus wall anomalies
- Describe incidence of IIH and its potential complications in this cohort

Level of Evidence – Level III

Indicate IRB or IACUC : Exempt

NICHOLAS TOROK VESTIBULAR AWARD

Nationwide Resource Utilization of Dizziness/vertigo Presentations to the ED

D. O'Neil Danis, III, MD; Matthew Kovoor
Kathryn Y. Noonan, MD; Jonathon S. Sillman, MD

Objective: This study aims to assess overall rates of neuroimaging (computed tomography [CT] or magnetic resonance imaging [MRI]) and cerebrovascular accidents (CVAs) in patients presenting to the emergency department (ED) with primary diagnoses of dizziness/vertigo to determine if neuroimaging is overutilized in this population.

Study Design: Population-based ED registry analysis.

Setting: 2020 Nationwide Emergency Department Sample.

Patients: Patients presenting to the ED with dizziness/vertigo.

Interventions: Rates of neuroimaging (both CT and MRI), common associated diagnoses and symptoms, and CVAs.

Main Outcome Measures: Odds ratio (OR) and multivariate analysis was performed on the associations of variables of interest with admission and CVAs.

Results: 1,115,826 ED presentations received a primary diagnosis of vertigo/dizziness resulting in $8.4 billion in ED charges. Of patients discharged from the ED, 42.29% underwent neuroimaging. Overall, 2,046 (0.18%) patients had a diagnosis of CVA. 89.46% of vertigo/dizziness patients with a CVA had at least one of 24 risk factors, including diabetes, history of thromboembolic event, nystagmus, and others, that were significantly associated with presence of CVA in multivariate analysis. Current procedural terminology (CPT) codes of H81.2 (vestibular neuronitis) and H81.4 (vertigo of central origin) were significantly associated with CVA when compared to other forms of dizziness/vertigo (adjusted ORs of 3.26 and 3.98; $p<0.001$).

Conclusions: A high proportion of ED patients with vertigo/dizziness undergo neuroimaging to rule out CVA, while only 0.18% are diagnosed with CVA. 24 diagnoses are positively associated with CVAs in patients primarily presenting with vertigo/dizziness and can potentially help stratify neuroimaging and lower healthcare costs.

Professional Practice Gap & Educational Need: Vertigo/dizziness is a common reason for patients to present to the ED, and these visits are associated with significant healthcare costs. Neuroimaging is frequently obtained for these patients to rule out CVAs, although most of these patients do not have CVAs. There is limited research on the risk factors associated with CVAs in patients with vertigo/dizziness or on when to obtain neuroimaging in these patients.

Learning Objective: Determine when neuroimaging is appropriate for patients presenting to the ED with vertigo/dizziness.

Desired Result: Physicians will better understand factors that are associated with CVA in patients with vertigo/dizziness. Physicians will use the presence of these associated factors to risk stratify the utility of obtaining head imaging in patients with vertigo/dizziness and to lower healthcare costs.

Level of Evidence - Level V

Indicate IRB or IACUC: Exempt.

Cochlear Implantation with Sporadic Inner Ear Schwannomas: An International Multi-Institutional Study of 90 Patients

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Elizabeth L. Perkins MD; Simon K.W. Lloyd, MBBS, FRCS
Matthew L. Carlson, MD; Stefan K. Plontke, MD

Objective: To evaluate cochlear implant speech perception outcomes among patients with sporadic inner ear schwannoma who underwent ipsilateral implantation.

Study Design: Retrospective cohort study.

Setting: Twelve tertiary academic medical centers across the United States and Europe.

Patients: Ninety patients with sporadic inner ear schwannoma who received an ipsilateral cochlear implant from 2011 to 2022.

Interventions: Ipsilateral cochlear implantation with observation, radiosurgery, or microsurgery for tumor management.

Main Outcome Measures: Monosyllabic speech perception testing scores and rates of open-set speech acquisition.

Results: Among 90 patients studied, 87 (97%) achieved open-set speech perception with a median of 18 months (IQR 12-36) of audiometric follow-up. Median ipsilateral monosyllabic word testing at last follow-up was 70% (IQR 54-85) and median ipsilateral AzBio in quiet was 77% (IQR 55-90). The majority (n=77; 86%) underwent microsurgery for tumor control, with cochlear implantation performed simultaneously in 75 patients. Open-set speech performance did not significantly differ between those undergoing microsurgical resection compared to observation (n=11) (p=0.7). Thirteen of the 90 patients studied (14%) experienced deterioration in cochlear implant performance over time. Among a subset of 32 patients with available imaging, the region where the tumor was/is located could be visualized postoperatively on MRI in all patients.

Conclusions: Open-set speech perception is achieved in most patients with inner ear schwannoma undergoing ipsilateral cochlear implantation. Tumor surveillance with MRI is feasible with protocoling modifications.

Professional Practice Gap & Educational Need: The advent of MRI and widespread adoption of screening protocols for asymmetrical sensorineural hearing loss has resulted in a significant increase in the detection rate of inner ear schwannomas. However, existing data surrounding cochlear implantation outcomes among patients with sporadic inner ear schwannomas is limited.

Learning Objectives: (1) Describe cochlear implant performance outcomes among patients with sporadic inner ear schwannoma who undergo ipsilateral cochlear implantation; (2) Understand the influence of tumor location within the inner ear on cochlear implant performance; (3) Describe the feasibility and limitations of postoperative MRI surveillance in the setting of inner ear schwannoma with ipsilateral cochlear implantation.

Desired Result: At the conclusion of this presentation, providers should be better equipped to understand the benefits and limitations of cochlear implantation in the setting of sporadic inner ear schwannoma.

Level of Evidence: III

Indicate IRB or IACUC: IRB approval was obtained from each participating center prior to data collection (15-008224 for group).

Simultaneous Ipsilateral Labyrinthectomy and Cochlear Implantation in Patients with Refractory Ménière's Disease

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Aaron C. Moberly, MD; Edward E. Dodson, MD
Oliver F. Adunka, MD, MBA; Yin Ren, MD, PhD

Objective: To assess the efficacy and safety of simultaneous ipsilateral labyrinthectomy and cochlear implantation (CI) in patients with refractory Ménière's disease (MD).

Study Design: Historical cohort study

Setting: Tertiary academic referral center

Patients: Patients with refractory MD and hearing loss

Interventions: Simultaneous ipsilateral labyrinthectomy and CI

Main Outcome Measures: Control of vertigo, Consonant-Nucleus-Consonant (CNC) word testing in quiet, and AzBio sentence testing in quiet

Results: Eighteen patients underwent simultaneous transmastoid labyrinthectomy and CI between 7/2015 and 2/2023 (median age 57-years-old, range 21-71 years, 67% female). Preoperative median aided CNC score was 23% (range 0-88%, n=10), and median AzBio score was 18% (range 0-96%, n=14). Two patients (11%) developed delayed postoperative facial weakness which recovered completely. No other postsurgical complications occurred. Complete resolution of vertigo was noted in 17 patients (94%). Evaluating available data at ≥6 months postoperatively, AzBio scores significantly improved (41% pre-op vs. 62% post-op, p=0.02; n=10), and CNC scores improved but did not reach statistical significance (33% pre-op vs. 43% post-op, p=0.60; n=8); however, these improvements are even greater when considering the results from a surgically deafened ear where testing would otherwise show profound deafness. Further localization testing comparing results with the device off versus on (n=5) noted improvements in both sound identification (27% vs. 37%, p=0.06) and degree error (47.1 vs. 24.5, p=0.10) at a median of 7 months postoperatively.

Conclusions: The present study represents one of the largest cohorts of refractory MD patients undergoing simultaneous labyrinthectomy and CI. Combination of these procedures appears safe and allows for excellent vertigo control and aural rehabilitation in appropriately selected candidates.

Professional Practice Gap & Educational Need: The practice gap is knowledge of the efficacy and safety of simultaneous ipsilateral labyrinthectomy and CI for the MD population.

Learning Objective: The learner should be able to understand the efficacy and potential benefits of simultaneous ipsilateral labyrinthectomy and CI in the refractory MD population.

Desired Result: The desired result is that the provider will understand the potential benefits and intricacies of managing patients with MD through this combined procedure.

Level of Evidence: IV

Indicate IRB or IACUC: The Ohio State University Study ID #2017H0273

Intraoperative Electrical Stapedius Reflex Testing is a Reliable Method for Monitoring Cochlear Nerve Integrity during Simultaneous Vestibular Schwannoma Resection and Cochlear Implantation

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Brian J. Neff, MD; Matthew L. Carlson, MD

Objective: To compare the utility of intraoperative electrically evoked stapedial reflex testing (eSRT), electrically evoked auditory brainstem response (eABR), and streaming neural response telemetry (NRT) for cochlear nerve integrity monitoring during simultaneous translabyrinthine resection of vestibular schwannoma (VS) and cochlear implantation.

Study Design: Retrospective chart review

Setting: Tertiary academic referral center.

Patients: Seven patients (8 ears) who underwent translabyrinthine resection of VS with simultaneous placement of a commercial cochlear implant device. One patient with neurofibromatosis type II-related schwannomatosis underwent bilateral resection of VS and cochlear implantation.

Interventions: Prior to tumor resection, a standard commercial cochlear implant was placed, facilitating intraoperative cochlear nerve monitoring during tumor resection using eSRT, eABR, and NRT through a CI-delivered electrical stimulus.

Main Outcome Measures: Correlation of intraoperative monitoring outcomes with postoperative cochlear implant speech perception.

Results: Four ears lost eSRT signal during surgery and were found to perceive no sound through the cochlear implant postoperatively. Of the 4 ears that retained eSRT signal at the end of tumor resection, all are currently successful cochlear impant users with good open-set speech perception (CNC word scores 71-98%; AzBio sentence scores in quiet 78-93%). Electrical ABR and NRT were intact in all 8 patients intraoperatively, indicating that half of cases yielded a false-positive result using the latter 2 monitoring methods.

Conclusions: Intraoperative eSRT through a commercial CI is a promising new method for monitoring the integrity of the cochlear nerve during VS resection. Patients that retained eSRT at the end of tumor resection had favorable cochlear implant outcomes. NRT and eABR were less reliable at predicting postoperative hearing outcomes in this series.

Professional Practice Gap & Educational Need: A reliable intraoperative monitoring technique of the cochlear nerve is necessary.

Learning Objective: Understand the significance of intraoperative monitoring techniques, such as eSR, eABR, and NRT, in predicting postoperative outcomes for vestibular schwannoma patients undergoing simultaneous cochlear implant and resection.

Desired Result: Acquire a comprehensive understanding of how intraoperative monitoring techniques like eSR, eABR, and NRT can be utilized to predict and assess postoperative outcomes for patients undergoing simultaneous vestibular schwannoma resection and cochlear implantation.

Level of Evidence - Level V

Indicate IRB or IACUC : ID 16-007363 approved prior to study date, Mayo Clinic

Electrocochleography-Guided Pull-Back Technique of Perimodiolar Electrode for Improved Hearing Preservation

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Jordan Varghese, MD; Shannon Lefler, AuD; Jacques A. Herzog, MD
Craig A. Buchman, MD

Objective: To evaluate whether electrocochleography-guided pull-back of the perimodiolar electrode improves perimodiolar proximity, hearing preservation (HP), and cochlear implant performance.

Study Design: Prospective cohort study

Setting: Tertiary referral center

Patients: 60 adult CI recipients with residual acoustic hearing (low-frequency pure tone average of 125, 250, 500 Hz, LFPTA ≤60 dB HL)

Intervention: Unilateral implantation, comparing standard insertion (N=30) with electrocochleography-guided electrode pull-back (N=30). The guided method uses active electrocochleography from the apical electrode during adjustment and post-insertion electrode sweep ('optimal response' defined as maximum response for 250 Hz at most apical electrode on electrode sweep).

Main Outcome Measures: Perimodiolar proximity (wrapping factor on postoperative CT); speech-perception testing at 6-months post-activation (CNC, AzBio in noise +10 dB SNR); and HP (LFPTA ≤80 dB HL)

Results: Of the subjects undergoing electrocochleography-guided insertion, 14 needed pull-back based on responses, while the remaining 16 exhibited 'optimal responses' post-insertion, requiring no adjustment. Improved perimodiolar proximity was achieved with the electrocochleography-guided method (mean wrapping factor difference, 8.2, 95% CI:3.2-11.8). Forty percent preserved hearing using electrocochleography versus 27.5% without (LFPTA shift mean difference 10.3 dB HL, 95% CI:6.1-16.3). There was no difference in CNC scores among both cohorts, but AzBio in noise at 6-months was improved in the electrocochleography-guided pull-back cohort (mean difference, 11.4%; 95% CI, 4.2-18.6).

Conclusions: Electrocochleography-guided pull-back increased perimodiolar proximity and HP rates. While there was no difference in CI performance in quiet environments, a significant improvement was noted in noisy conditions, potentially attributable to HP and the utilization of hybrid stimulation.

Professional Practice Gap & Educational Need: Recent developments have highlighted the potential of intraoperative, intracochlear electrocochleography, using the electrode array, as an instrument for hearing preservation. However, most existing literature concentrates on its use with lateral wall electrodes and subsequent adjustments during insertion, such as pausing insertion or leaving electrodes out to optimize electrode positioning for hearing preservation. The investigation of electrocochleography's application during insertion with precurved perimodiolar electrode arrays has been limited. This may be attributed to challenges posed by sheath-based insertions and the potential risk of tip roll-over upon adjustments. Here, we investigate a potential method for using electrocochleography with precurved perimodiolar electrode arrays after full insertion, specifically to assess the need for electrode pull-back for optimal modiolar proximity and potentially enhancing hearing preservation outcomes.

Learning Objective: To understand how electrocochleography responses can be used after full insertion of the precurved perimodiolar electrode array to determine whether pull-back is necessary and whether this results in improved hearing preservation and speech-perception outcomes.

Desired Result: Practitioners and researchers will further realize the value of using electrocochleography with the precurved perimodiolar electrode array to optimize electrode positioning and cochlear implant performance.

Level of Evidence - IV

Indicate IRB or IACUC: Washington University in St. Louis IRB #202007087 (5/16/23).

Intraoperative Acoustic Monitoring Using Behavioral Audiometry during Cochlear Implantation Under Local Anesthesia: Towards Optimizing Hearing Preservation Outcomes

Karl R. Khandalavala, MD; Sarah E. Ostlie, AuD; Max M. Ladsten
Amanda R. Lohmann, RN; Matthew L. Carlson, MD

Objective: To demonstrate feasibility of monitoring acoustic hearing on awake patients using intraoperative behavioral responses to supra-threshold stimuli while undergoing cochlear implantation (CI) without general anesthesia or conscious sedation.

Study Design: Retrospective single-institution review.

Setting: Tertiary care academic medical center.

Patients: Adult patients with significant residual acoustic hearing undergoing CI.

Interventions: CI under local anesthesia, without any sedation.

Main Outcome Measures: Procedural tolerance, reliability of intraoperative audiometry, and correlation of intraoperative findings with postoperative residual hearing.

Results: Three patients underwent implantation, including two males and one female, with a median age of 48 years. Intraoperatively, patients reported behavioral responses to supra-threshold stimuli, and provided real time feedback on perceived stimulus change to the surgeon just prior to, during, and immediately following electrode insertion. All patients were able to complete the operation under local anesthesia. During electrode insertion, two patients reported no change, and one patient reported diminished stimulus perception that reversed with limited electrode pull back. Immediate postoperative audiogram demonstrated preservation of bone conduction thresholds within 10 dB of their preoperative baseline for all patients. Postoperative AzBio scores ranged from 45-75% at 2-month follow up. At time of writing, two additional patients are scheduled for surgery and will be presented.

Conclusions: This novel study demonstrates the feasibility of intraoperative behavioral audiometry during CI under local anesthesia, using feedback during electrode insertion to optimize hearing preservation surgery. Akin to other surgical subspecialties that utilize live patient feedback where objective intraoperative measures of neurofunction are imperfect, we demonstrate feasibility and potential utility of live acoustic monitoring during cochlear implantation.

Professional Practice Gap & Educational Need: Historically CI has been performed under local and monitored anesthesia for patients with significant comorbidities. Recently, the senior author has begun performing CI awake under only local anesthesia, with the use of intraoperative behavioral audiometry to facilitate real time monitoring of potential acoustic damage and subsequent loss of acoustic hearing during electrode insertion, as an alternative to indirect measures such as Electrocochleography (ECoG).

Learning Objective: To demonstrate the feasibility of intraoperative behavioral audiometry to monitor acoustic hearing during cochlear implantation under local anesthetic as an alternative to indirect measures of cochlear function such as Electrocochleography (ECoG).

Desired Result: For learners to understand the described technique and how it can guide acoustic hearing preservation.

Level of Evidence – Level V

Indicate IRB or IACUC: Mayo Clinic IRB#:22-000183, approved 2/25/2022.

Image Quality Improvement in MRI of Cochlear Implants After Metal Artifact Reduction

Arianna Winchester, MD; Justin Cottrell, MD; Emily Kay-Rivest, MD, MSc; Mary Bruno, RT
Gul Moonis, MD; Mari Hagiwara, MD; Daniel Jethanamest, MD, MSc

Objective: Observe if metal artifact reduction (MAR) techniques applied to magnetic resonance imaging (MRI) performed on patients with cochlear implants (CI) or auditory brainstem implants (ABI) improves image quality.

Study Design: Prospective cohort.

Setting: Tertiary care center.

Patients: Patients with CI or ABI undergoing MRI after the application of MAR techniques.

Interventions: Patients who underwent whole brain or internal auditory canal (IAC) MRI with and without MAR techniques were identified from 2022-2023. Images were analyzed by two experienced neuroradiologists.

Main Outcome Measures: Visibility of 14 intracranial structures graded on a 4-point Likert scale to assess image artifact and impact on diagnosis. The average score for each structure and sequence was compared using paired two tailed t-tests and change in mode score.

Results: Ten patients underwent pre- and post-MAR MRI. Six had a unilateral CI, 3 had a unilateral ABI, and 1 had a CI and an ABI. One unilateral ABI patient had the device magnet removed; the remainder were all in place for both scans. One unilateral CI was manufactured by MEDEL; remaining devices were from Cochlear Americas. All structures had improved visibility on the post-MAR scan, although ipsilateral parietal and occipital lobes did not demonstrate statistically significant difference. Mode score increased from 2 to 4 for the ipsilateral occipital lobe and from 3 to 4 for the ipsilateral semicircular canals, brainstem, and cerebellar peduncles. Significant improvement was seen on all sequences except ipsilateral structures on T1w-axial pre-contrast and contralateral structures on T1w-coronal post-contrast. ABI images did not improve as much as CI because they scored better on the pre-MAR scan.

Conclusions: MAR techniques improve image quality for patients with MRI-compatible implants.

Professional Practice Gap & Educational Need: Patients with an MRI-compatible auditory implant undergo MRI more frequent imaging, however image quality still suffers due to the interference of the device magnet and the MRI magnet.

Learning Objective: Understand the clinical impact of MAR correction of MRI imaging for CI and ABI patients.

Desired Result: Improve MRI quality for patients with CIs or ABIs

Level of Evidence - III

Indicate IRB or IACUC: This study was exempt from IRB review as it was classified as a quality improvement study.

SELECTED ABSTRACTS

POSTER PRESENTATIONS

IN ORDER OF PRESENTATION

Posters displayed on Friday and Saturday, May 17-18, 2024

59th Annual Spring Meeting
AMERICAN NEUROTOLOGY SOCIETY

May 17-19, 2024
Hyatt Regency Chicago
Chicago, IL

Gender Differences in Letters of Recommendations and Personal Statements for Neurotology Fellowship Over 10 Years: A Deep Learning Linguistic Analysis

Vikram Vasan, BA; Christopher P. Cheng, AB; Caleb J. Fan, MD
David K. Lerner, MD; Alfred Marc Iloreta, MD; Seilesh C. Babu, MD
Maura K. Cosetti, MD

Objective: The personal statement (PS) and letters of recommendation (LORs) are critical components of the Neurotology fellowship application process but can be subject to implicit biases. This study evaluated general and deep learning linguistic differences between the applicant genders over a ten-year span.

Study Design: Retrospective cohort.

Setting: Two institutions.

Main Outcome Measures: PSs and LORs were collected from 2014-2023 from two institutions. The Valence Aware Dictionary and sEntiment Reasoner (VADER) natural language processing (NLP) package was used compare the positive or negative sentiment in LORs and PSs. Next, the deep learning tool, Empath, categorized the text into scores and Wilcoxon rank-sum tests were performed for comparisons between applicant gender.

Results: Among 177 applicants over ten years, 123 were male and 54 were female. There were no differences in word count or VADER sentiment scores between genders for both LORs and PSs. However, among Empath sentiment categories, male applicants had more words of trust ($p=0.03$) and leadership ($p=0.002$) in LORs. Temporally, the trends show a consistently higher VADER sentiment and Empath 'trust' and 'leader' in male LORs from 2014 to 2019, after which there was no statistical significance in sentiment scores between genders, and females even have higher scores of trust and leadership in 2023.

Conclusions: Linguistic content overall favored male applicants, since they were more frequently described as trustworthy and leaders. However, the temporal analysis of linguistic differences between male and female applicants found an encouraging trend suggesting a reduction of gender bias in recent years, mirroring an increased composition of women in neurotology over time.

Professional Practice Gap & Educational Need: Gender bias, diversity, and inclusion are important in Neurotology. Little is currently known regarding objective gender differences in the Neurotology fellowship match process.

Learning Objective: To identify linguistic differences between male and female applicants in their LORs and PSs throughout ten years.

Desired Result: While linguistic content overall favored male applicants, the gender disparity narrowed over time with a reduction of gender bias in the last few years. Neurotology programs should continue to promote inclusivity and diversity in the field.

Level of Evidence – Level III.

Indicate IRB or IACUC : Exempt.

Hearing Impairment and Dementia in Older U.S. Adults: A Role for Otolaryngologists in Dementia Care?

Sharanya Thodupunoori, BS; Henrique Ochoa Scussiatto, MD
Kristen E. Wroblewski, MS; Terence E. Imbery, MD; Jayant M. Pinto, MD

Objective: To determine whether hearing impairment is associated with poor cognitive function and dementia in older U.S. adults.

Study Design: Longitudinal cohort analysis.

Setting: National Social Life, Health, and Aging Project

Patients: Nationally representative sample of older U.S. adults living at home.

Main Outcome Measures: Cognitive function was measured using survey adapted Montreal Cognitive Assessment (MoCA-SA) and self-reported physician diagnosis of dementia.

Results: Older U.S. adults with better functional hearing, determined by a structured interviewer-rated scale (subjective, scored 1-5), had better cognitive function in cross section at baseline (OR=1.19; 95% CI 1.09-1.29; n= 3196, mean age = 73.2, SD = 7.3) and at 5-year follow-up (OR=1.22; 95% CI 1.10-1.35; n=4377, mean age = 67.6, SD = 10.9). Those with better functional hearing also had decreased odds of being diagnosed with dementia (OR=0.63; 95% CI 0.41-0.99), in similarly adjusted cross sectional analyses (at 5-year follow-up). In longitudinal analyses, older U.S. adults with better functional hearing at baseline had increased odds of better cognition (OR=1.10; 95% CI 1.01-1.18) and decreased odds of being diagnosed with dementia 5 years later (OR=0.81; 95% CI 0.69-0.94). All analyses were adjusted for demographics, self-rated mental health, comorbidities, and social isolation.

Conclusions: Older U.S. adults with decreased hearing face worse cognition and increased odds of being diagnosed with dementia in 5 years. Thus, Otolaryngologists can use hearing tests to identify older adults at risk for neurodegenerative disease and thereby advance their care.

Professional Practice Gap & Educational Need: Older adults seen by Otolaryngologists for decreased hearing may be at risk for developing dementia.

Learning Objective: To demonstrate that hearing impairment is a predictor of subsequent cognitive function and incident dementia.

Desired Result: Otolaryngologists can use hearing loss to screen patients at risk for dementia care and thereby help reduce the global burden of this prevalent condition. Patients with hearing loss merit referral for potential cognitive function assessment and potentially should receive aggressive hearing interventions (hearing aids, cochlear implants) that may reduce the risk of neurodegenerative disease.

Level of Evidence - III

Indicate IRB or IACUC : Exempt

Current State of Robotics for Neurotologic and Otologic Procedures: A Systematic Review

Alex Z. Graboyes; Kevin Wong, MD; Jason A. Brant, MD

Objective: To review robotic systems currently in use for otologic and neurotologic procedures.

Data sources: *Pubmed*, *Embase*, and *Cochrane Library* were searched using the following search query: (robotics OR "robotic surgery" OR "robot-assisted surgery") AND ("ear surgery" OR "mastoid surgery" OR "cochlear implants" OR "lateral skull base surgery" OR otology OR neurotology) NOT (TORS OR transoral OR thyroid OR otolaryngology).

Study selection: Included articles were those describing a clinical usage of robotics applied to neurotologic and otologic procedures in live patients. Exclusion criteria included poster abstracts, review papers, studies performed on non-living subjects, if no surgical intervention was performed, and non-English articles. PRISMA guidelines were followed for article review and selection.

Data extraction: Initial search conducted in September 2023 produced 236 results (Pubmed:124, Embase: 97, Web of Science:15). Sixty-one duplicates were removed, leaving 175 studies. 71 underwent full text review, and 59 studies were excluded. An additional 4 were included from bibliographies of reviewed papers leaving 16 papers included in the final review.

Data synthesis: The 16 studies included 191 pediatric and adult subjects and six distinct robotic systems: RobOtol (7 studies), HEARO (4), Rosa (1), RoboticScope (2), IotaSoft (1), and Aesculap Aeos (1). A total of 58 participants underwent middle ear procedures, 132 underwent cochlear implantation, and 1 underwent mastoidectomy Three studies reported complications (5 participants). Meta-analysis was not possible due to the heterogenous nature and quality of the outcomes reported.

Conclusions: While still in early development, several robotic systems for otologic applications have progressed to clinical testing. Here we review the available literature and summarize reported patient outcomes.

Professional Practice Gap & Educational Need: Major progress has been made in regard to robotics across all subspecialities in recent years. In the field of neurotology, over the last six years, there has been a move from strictly ex-vivo studies to clinical studies, demonstrating reproducible results. This presents a systematic review of all the systems currently in use and provide the types of surgeries they were used in, how they were utilized, and the outcomes.

Learning Objective: To know what robotic systems are being used in neurotology, how each of the systems are utilized in each respective procedure, and to understand the results produced.

Desired Result: For providers to have a better understanding of robotics in the field of neurotology, and considerations of usage of such systems when they become more widely available.

Level of Evidence – Level III

Indicate IRB or IACUC : Exempt

Risk Factors of Recurrence in Stage II Pars Flaccida Cholesteatoma

Yoko Shimizu, MD; Yuka Morita, MD, PhD; Chihiro Yagi, MD, PhD; Tatsuya Yamagishi, MD, PhD
Shinsuke Oshima, MD, PhD; Shuji Izumi, MD, PhD; Arata Horii, MD, PhD

Objective: In the EAONO/JOS joint consensus of middle ear cholesteatoma, stage II includes broad range of disease extensions, i.e., two or more sites without extra/intra cranial complications so that treatment outcome may differ among individual stage II patients. We aimed to investigate the risk factors of recurrence in stage II pars flaccida (PF) cholesteatoma.

Study Design: Retrospective cohort.

Setting: University Hospital.

Patients: Consecutive 228 patients with stage II PF cholesteatoma.

Interventions: Either of transcanal atticotomy, canal wall up mastoidectomy, or canal wall down mastoidectomy (CWD) with or without mastoid obliteration (MO) was performed.

Main Outcome Measures: Recurrence rates were estimated by Kaplan-Meier method. Risk factors including age, location and the number of involving sites, involvement in difficult access sites, i.e., supratubal recess (S1) and sinus tympani (S2), and surgical procedures were correlated with recurrence.

Results: Overall recurrence rate was 10.1%. Recurrence rate was significantly higher in pediatric cases (≤15 years-old) than adults (43.4% vs. 6.3%). There were 107, 86, and 35 patients involved with two, three, and four sites, respectively. Although more radical surgeries were selected for patients with more involving sites, the recurrence rate significantly increased as the number of affected sites increased. Recurrence was significantly higher in those with S1 extension (25.5% vs 5.6%). CWD+MO achieved significantly lower recurrence rate than the other methods, even in S1(+) patients.

Conclusions: Among stage II patients, age, number of involving sites, and S1 extension increased the recurrence rate, while the CWD+MO surgery may have potential to reduce the recurrence.

Professional Practice Gap & Educational Need: Stage II PF cholesteatoma includes a variety of extension sites and number of extension sites, and a variety of surgical methods is selected. Risk factors of recurrence are not fully understood.

Learning Objective: To understand the difference in recurrence rate by several factors in stage II PF cholesteatoma.

Desired Result: Recurrence rate may depend on the location and the number of involving sites.

Level of Evidence - Level IV

Indicate IRB or IACUC : Niigata University Hospital (No. 2021-0271)

The Use of Steroids for Cochlear Impedance in Humans: A Systematic Review

Jessica L. Lewis-Cruz, MD; Alex W. Yang, MD; Jakob L. Fischer, MD
Elicia M. Pillion, AuD; Anthony M. Tolisano, MD

Objective: To review evidence evaluating the effect of steroids on impedance values following human cochlear implantation.

Data sources: English language literature from PubMed, Web of Science, Embase, Ovid, and Cochrane databases from inception through April 27, 2023.

Study selection: Included studies reported post-operative cochlear implant impedances in surgical recipients and compared patients undergoing intra-operative topical steroid use and/or oral post-operative steroid use to patients not receiving either intervention. Studies that focused on intravenous intraoperative steroids alone, testing in animals, and loss of residual hearing were excluded.

Data extraction: Following PRISMA guidelines, the following data were extracted from the included studies: study design, clinical aim, type of electrode(s), number of participants, relevant primary or secondary outcome, and assessment of main findings.

Data synthesis: 144 articles were screened, and 12 studies met inclusion criteria. For intratympanic and intracochlear applications, five studies showed a decrease in impedance only until first fitting (1 month), one study showed decreased impedance for up to 3 months, and two studies showed decreased impedance up to 12-20 months. Two studies involving drug-eluting electrodes saw an initial difference in impedance values compared to controls up to four weeks post-operatively that did not persist long-term. Two studies examining postoperative oral steroid use found no significant difference in impedance values between groups.

Conclusions: Steroids, particularly intratympanic and intracochlear applications, have the potential to lower postoperative impedances after cochlear implantation but the data remains inconclusive. Better delivery techniques and consistent measurements of impedance are needed to further understand this relationship.

Professional Practice Gap & Educational Need: Although the use of steroids in cochlear implant surgery is relatively common practice, there is no standard guideline developed for its use. Various techniques for steroid delivery are employed to include topical intraoperative, drug-eluting electrodes, and oral postoperative applications. Our review seeks to identify if a difference exists in postoperative impedance values based on delivery technique.

Learning Objective: To systematically review the current literature to better understand how the use of steroids affect impedance values in patients following cochlear implantation.

Desired Result: To increase understanding of the relationship between impedance and steroid use as well as contribute to a growing identity of cochlear impedance as a method of monitoring cochlear implant function.

Level of Evidence - Level III

Indicate IRB or IACUC: Exempt

Tumor and Hearing Outcomes in Observed Vestibular Schwannoma Patients: A Systematic Review and Meta-Analysis

Debbie R. Pan, MD; Amanda Del Risco, BA; *Connor L. Pratson, MD*
Rhea Choi, MD, PhD; Margaret Graton, MSc; David M. Kaylie, MD
Kristal M. Riska, AuD, PhD

Objective: To summarize evidence on outcomes in observed vestibular schwannoma patients.

Data Sources: A search of Medline, Embase, Web of Science, CINAHL Plus, Scopus, and Cochrane databases was performed per PRISMA guidelines for English literature from January 1, 1995, to June 8, 2022.

Study selection: Eligible studies included quantitative or categorical tumor-related, hearing, or symptom data for adult patients with diagnosis of unilateral vestibular schwannoma electing for initial conservative management.

Data extraction: A title and abstract review was conducted on 1596 citations and full article review on 242 studies. Standardized collection was used for data extraction and quality assessment utilized the Newcastle-Ottawa Scale on 89 eligible studies.

Data synthesis: RevMan Web Software was used to perform a meta-analysis using random-effects modeling. The mean age at diagnosis was 60.2 years. Approximately 33.3% of observed patients ultimately underwent either radiation or surgical intervention at a mean of 32.1 months. Observed tumors were 2.94 times more likely to demonstrate no growth compared to growth (pooled OR: 0.34, 95% CI: 0.18-0.63). Patients with serviceable hearing at diagnosis were 3.70 times more likely to maintain than lose serviceable hearing (pooled OR: 0.27, 95% CI: 0.16-0.47). Patients were 16.7 times and 25 times more likely to experience no change or improvement compared to worsening in their initial tinnitus (pooled OR: 0.06, 95% CI: 0.01, 0.52) and balance symptoms (pooled OR: 0.04, 95% CI: 0.01, 0.15), respectively.

Conclusions: This study gives relevant information for counseling vestibular schwannoma patients. Generally, a third of observed patients will ultimately undergo intervention at a mean of almost three years after diagnosis.

Professional Practice Gap & Educational Need: Management decisions for vestibular schwannoma patients are multifactorial with consideration of initial observation mainly employed in settings where the tumor is small, asymptomatic, or minimally symptomatic, and slow growing. Understanding expected outcomes for this cohort can better guide clinical counseling and informed decision making for physicians and patients.

Learning Objective: To review literature on tumor and hearing outcomes in vestibular schwannoma patients who initially elected for observation.

Desired Result: Audience members will better understand the prognosis for conservatively managed vestibular schwannomas to better guide conversations with patients regarding expected changes to hearing, tumor growth, and presenting symptoms.

Level of Evidence: Level III

Indicate IRB or IACUC: Exempt

Comparison of Western Blots and ELISA Methods for Quantification of Ototoxicity Biomarker Prestin

Desiree T. Campbell, BS; Priya Prakash, MBBS; James Naples, MD
Kourosh Parham, MD, PhD

Hypothesis: There are several variants of prestin in the blood, of which the ~132 kDa variant is the cisplatin-ototoxicity biomarker.

Background: There is a need for biomarkers of ototoxicity, which may help prevent disabling sensorineural hearing loss and tinnitus. Prestin has been proposed as a biomarker for early diagnosis of ototoxicity for timely management. Previous investigations using ELISA showed that prestin had statistically significant changes before hearing thresholds. We recently introduced western blot (WB) analyses, which yielded a more detailed assessment of the biomarker. Here, we compare the two techniques to gain new insights.

Methods: Ten guinea pigs treated with a single dose of cisplatin (8 mg/kg) underwent threshold measurements of click-evoked auditory brainstem response, and blood draws at baseline, 24, 48, 72 hours, and 7 days after treatments. Serum levels of prestin were quantified using both ELISA and WB techniques. We compared each peak height from the western blot data to ELISA-determined prestin levels and ABR thresholds at each time point.

Results: WB analysis revealed four distinct bands/peaks at ~38, ~50, ~71 and ~132 kDa. Peak 4 (~132 kDa) was the highest peak with an initial increase 24 hours after cisplatin exposure, it peaked at 72 hours, and then declined at day 7. The pattern of change in peak 4 was consistent with that seen with ELISA. Both methods demonstrated significant changes before click-evoked ABR threshold showed a significant decrease after cisplatin.

Conclusions: Changes in blood levels of the ototoxicity biomarker prestin are primarily related to a ~132 kDa variant.

Professional Practice Gap & Educational Need: Ototoxicity at present has no effective means of diagnosis unless there are subjective complaints or measurable changes in hearing thresholds. There is a need for biomarkers to facilitate early diagnosis and management of ototoxicity.

Learning Objective: To discuss the role of biomarkers in management of ototoxicity.

Desired Result: To utilize western blot prestin levels as an alternative method of quantification of biomarkers toward surveillance and management of ototoxicity.

Level of Evidence - III

Indicate IRB or IACUC : IACUC protocol 101275-0119, approved on 4/15/2016

Transmit field (B1) Shimming Techniques to Improve Inner Ear Spatial Resolution in 7-Tesla Magnetic Resonance Imaging Scanners

Zahra N. Sayyid, MD, PhD; Adrian Paez, BS; Diane Jung, BS
John P Carey, MD; Dan Gold, MD; Jun Hua, MD; Bryan K. Ward, MD

Objective: To apply shimming techniques to optimize inner ear imaging using 7-Tesla magnetic resonance imaging (MRI) in healthy adults and patients with idiopathic vestibular disorders.

Study Design: Prospective case series

Setting: Tertiary referral center

Patients: Patient 1 presented with intense horizontal vertigo and head-jolting nystagmus, Patient 2 had fluctuating high-frequency hearing loss and a recurrent sense of head tilting, and Patient 3 had recurrent episodic vertigo and tinnitus.

Interventions: Healthy adults and patients underwent 7T MRI (Achieva, Philips Healthcare) using a two-channel transmit and 32-channel receive whole-head coil (Nova Medical). Various Barium Titanate dielectric pad (Multiwave Imaging) combinations around the mastoid were trialed. A B1 mapping scan was performed, and an advanced radiofrequency (RF) shim algorithm minimizing the root-mean-square error was applied using the MRCodeTool software (version 1.5.14, Tesla Dynamic Coils, Zaltbommel, Netherlands) to produce a better RF excitation near the inner ears.

Main Outcome Measures: Ability to visualize the inner ear at 7T MRI.

Results: A single pad at the left mastoid and the B1 mapping scan using an RF shim algorithm consistently allowed visualization of the inner ears in healthy adults. Patient 1 was found to have a partial filling defect in the superior semicircular canal. Patient 2 was found to have an enhancing saccule and basal turn of the cochlea, suggesting a leaky blood-labyrinth barrier. Patient 3 was found to have a vestibular schwannoma of the superior vestibular nerve.

Conclusions: Dielectric pads and RF shimming, when used concurrently, reduced magnetic field inhomogeneity near the inner ear, improving inner ear spatial resolution and diagnostic precision.

Professional Practice Gap & Educational Need: 7-Tesla imaging is not commonly used in clinical practice due to significant inhomogeneities resulting in signal drop-off. This study aims to provide insights into optimizing transmit field (B1) shimming protocols to improve spatial resolution of the inner ear.

Learning Objective: The learning objective is to understand the benefit of 7-Tesla MRI imaging to visualize anatomical microstructures of the inner ear that are too fine to identify with current standard imaging techniques.

Desired Result: Implementing transmit field (B1) shimming techniques in 7-Tesla MRI scanners into clinical practice. While the MRCodeTool software is unique to the Philips MRI scanner, the basic approaches should be translatable across other MRI scanners.

Level of Evidence: Level III

Indicate IRB or IACUC: Johns Hopkins University School of Medicine IRB#00259196.

Longitudinal Trends in Cochlear Implant Programming in Over 600 Implants

James R. Dornhoffer, MD; Karl R. Khandalavala, MD; Aniket A. Saoji, PhD
Christine M. Lohse, MS; Matthew L. Carlson, MD

Objective: To examine stability of comfort (C) and threshold (T) levels in adult cochlear implant recipients over their first year post-activation.

Study Design: Retrospective review

Setting: Tertiary academic center

Patients: 665 implants in patients undergoing cochlear implantation for moderate-to-profound sensorineural hearing loss

Interventions: Cochlear implantation with Cochlear Ltd. devices with subsequent programming to behavioral standards using Custom Sound® fitting software

Main Outcome Measures: C- and T-levels measured longitudinally using Custom Sound® from activation to a minimum of 6 months post activation with analysis of change in these levels over time. C and T levels were analyzed in terms of charge levels (nC) by calculating the product of the pulse duration (μsec) and pulse amplitude (μA).

Results: Over 500 patients with 665 implants were identified with 6 months or more of clinical programming data. From review of programming data over time, we identify trends of general stability in C- and T-levels after the initial activation period. After 3 months, many patients show little change in either C- or T-levels. Further analyses and discussion of these trends over time may influence programming patterns or provide evidence for change in the general paradigm of cochlear implant care after activation.

Conclusions: Review of C-and T-levels measured longitudinally after activation are often stable after the initial post-activation period. Such findings may support change in cochlear implant programming practices. Specifically, stability of programming levels over time may support a de-escalation of cochlear implant follow-up or greater acceptance of remote-care options.

Professional Practice Gap & Educational Need: Cochlear implantation is a valuable modality for the rehabilitation of hearing in patients with moderate-to-profound sensorineural hearing loss. However, specific, evidenced-based schedules of programming after the initial post-activation period are lacking. As such, many patients may have their implant programming changed more frequently than needed, causing undo burden with respect to time and/or finances for both patients and implant centers.

Learning Objective: To explore cochlear implant programming levels in adult implant recipients and identify useful trends that may influence clinical practice or further research.

Desired Result: Practitioners and researchers will recognize important trends in cochlear implant programming levels over time. Namely, they will see that levels may often be stable after the initial post-activation period. As such, review of such data may provide guidance for the clinical practice of programming/cochlear implant follow-up and may provide evidence for de-escalated programming paradigms.

Level of Evidence – Level IV: Historical cohort or case-controlled studies

Indicate IRB or IACUC : 22-000183

Immediate versus Delayed Reimplantation Following Cochlear Implant Explantation: Does Timing Affect Performance?

Lisa Zhang, MD; Robert J. Macielak, MD; Diana Hallak, BS
Edward E. Dodson, MD; Oliver F. Adunka, MD, MBA; Yin Ren, MD, PhD

Objective: To assess audiometric outcomes of cochlear reimplantation and effects of delayed reimplantation

Study Design: Retrospective cohort

Setting: Tertiary academic cochlear implant (CI) referral center

Patients: Thirty-three patients underwent CI explantation, of which 19 patients underwent reimplantation in the ipsilateral ear. Immediate reimplantation was defined as patients who underwent reimplantation during the same surgery as CI explantation.

Main Outcome Measures: Hearing outcomes including AzBio sentence (in quiet) and Consonant-Nucleus-Consonant (CNC) word scores pre- and post-reimplantation.

Results: Thirty-three patients (61% female) underwent CI explantation between April 2014 and October 2022. The mean ipsilateral AzBio sentence score prior to explantation was 43.7 (SD 37, range [0-97]) and binaural CNC score was 50.6 (SD 28). Nine percent (N=3) had post-binaural CNC scores better than 60%. Most of the patients underwent cochlear reimplantation (58%, N=19), with 58% (N=11) who underwent immediate cochlear reimplantation, and 8 patients (42%) who underwent delayed implantation. Median follow-up after reimplantation was 8 months (IQR 4-16). Patients who underwent immediate cochlear reimplantation trended towards better ipsilateral AzBio sentence scores (66 [SD 18.7, N=8] vs 43 [SD 40, N=5], p=0.17). Mean improvement in AzBio scores following reimplantation was 12.5 (SD 25, range [-11-66]). Post-reimplantation, 32% (N=6) patients had binaural CNC scores better than 60%.

Conclusions: Patients with immediate cochlear reimplantation trended towards better hearing outcomes than those with delayed reimplantation. However, overall, hearing post-reimplantation was better than prior to explantation. We demonstrate trends towards improvement in both ipsilateral AzBio scores and binaural CNC regardless of duration between explantation to reimplantation.

Professional Practice Gap & Educational Need: The practice gap includes understanding audiometric outcomes of cochlear reimplantation.

Learning Objective: Patients who undergo immediate cochlear reimplantation may trend towards better post-reimplantation hearing outcomes.

Desired Result: These data can guide surgeons in discussing cochlear reimplantation hearing outcomes for shared decision-making goals with patients.

Level of Evidence – Level IV

Indicate IRB or IACUC: The Ohio State University IRB Protocol #2020H0457

Post-operative Hearing Outcomes of Surgically Treated Jugular Foramen Schwannomas

Charvi Malhotra, MD; Peter Kullar, MD, PhD; Jennifer Alyono, MD

Objective: To explore the hearing outcomes after surgical resection of jugular foramen schwannomas.

Study Design: Retrospective case review- case series.

Setting: Tertiary referral care hospital.

Patients: Adults patients above the age of 18, diagnosed with jugular foramen schwannomas of non-vestibular origin between 1993-2023 who have undergone surgical resection and have had audiometric evaluation before and after their treatment.

Interventions: Therapeutic- Surgical resection

Main Outcome Measures: Hearing change after surgical resection of the tumor: defined as the difference in the pure tone average (PTA) calculated using thresholds at 500Hz, 1, 2, and 4KHz and word recognition score (WRS) in the ipsilateral ear before (within 1 year) and after (within 6 months) the surgical resection.

Results: Retrospective chart review revealed 32 patients (M:F, 18:14, mean age 63.4±17.2 years) diagnosed with jugular foramen schwannoma, of which 7 had surgical resection (2 retrosigmoid, 5 transjugular approach). The median postoperative audiogram was at 1.75 months (range 1-4 months). The average preoperative PTA and WRS were 38.2±27.7 dB and 65±41.7% respectively. Four of 7 cases showed mean post-operative audiometric improvement in PTA in the ipsilateral ear of 20.3±10.2dB ($p=0.14$). Two patients had post-operative profound hearing loss in the ipsilateral ear and one patient had a mild reduction (8dB). Of the patients with improvement in postoperative PTA, two had improved WRS (by 10% and 56%) and two had a reduction (by 5% and 8%). All patients had pre-operative ipsilateral tinnitus that remained unchanged post-operatively.

Conclusions: Post-operative audiometric improvement is possible after the surgical resection of jugular foramen schwannoma and this should be considered in surgical planning and patient counselling.

Professional Practice Gap & Educational Need: Jugular foramen schwannoma are rare tumors that may be associated with significant morbidity. Management depends on clinical presentation and preoperative functional deficits, including hearing loss. Currently, there are no consensus guidelines on the management of these tumors, but our results suggest surgical management may be associated in improvement in hearing levels and this should be considered in the choice of surgical approach.

Learning Objective: Understand the hearing outcomes after surgical resection of jugular foramen schwannoma.

Desired Result: Evaluation of hearing outcomes after jugular foramen schwannoma surgical resection, to improve patient counselling and in anticipation of guiding current standard of care clinical guidelines.

Level of Evidence - Level V

Indicate IRB: Stanford IRB 69938, Approval date 04/25/23

Surgical Guidance with Intraoperative Computed Tomography and Metallic Object Placement in Cochlear Implantation in the Ossified and Anatomically Distorted Cochlea

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Asma Ahmad, BS; Zina Drott, RN; Genrieta Bochorishvili, PhD

Objective: Introducing a useful technique to guide surgeons intraoperatively in identifying a safe drilling path for implant insertion in cases of cochlear ossification and revision surgery.

Study Design: Case Report

Setting: Private Practice Cochlear Implant Center.

Patients: Profound hearing loss patients with an ossified and operatively challenging cochlea.

Interventions: Use of intraoperative computed tomography (O-arm) combined with placement of a small metallic object in the operative field to guide further drilling in an ossified cochlea. This technique can help avoid complications with successful implantation. A small staple and dummy electrode can be used as metallic tracers.

Main Outcome Measures: Successful implantation in an ossified cochlea.

Results: 2 patients with cochlear ossification and highly challenging and distorted anatomy underwent implantation with support of intraoperative computed tomography using the O-arm. The first case had complete ossification of the vestibule and significant ossification of the cochlea with no oval window and a dehiscent and inferiorly herniating facial nerve. The second case was a revision case 2 years after explanation that had ossification of the basal and mid turns of the cochlea with distorted anatomy and a prior violent intraoperative gusher.

Conclusions: The use of intraoperative computed tomography in conjunction with placement of a metallic object in the drilled intraoperative territory can guide the cochlear implant surgeon on location and path that is required to complete a safe cochlear drill-out for implant placement in the ossified and distorted cochlea. This technique may allow for higher successful implantation rates in delayed and revision meningitis cases.

Professional Practice Gap & Educational Need: Establishing techniques and using intraoperative technology used in different disciplines to support safe and successful cochlear implantation in nearly impossible cases with ossification and distorted anatomy.

Learning Objective: Introducing a surgical technique combining intraoperative Computed Tomography using the O-arm with metallic tracers to identify location and safe drilling paths for cochlear drill-out while avoiding complications.

Desired Result: Introduction of a safe and useful technique for cochlear implantation in challenging ossified and revision cases.

Level of Evidence - Level V

Indicate IRB or IACUC : Exempt-Case Report.

Audiologic Outcomes Following Spontaneous Temporal Bone Encephalocele and CSF Leak Repairs

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Objective: To examine audiometric outcomes following transmastoid (TM), combination transmastoid/middle fossa (TM/MF), and MF repair of spontaneous temporal lobe encephaloceles (TLE) and cerebrospinal fluid (CSF) leaks.

Study Design: Retrospective cohort study.

Setting: Tertiary academic neurotology practice.

Patients: Those with spontaneous TLEs and cerebrospinal fluid (CSF) leaks undergoing repair with various grafts.

Interventions: Surgical repair of TLEs and CSF leaks.

Main Outcome Measures: Air Conduction Pure Tone threshold (ACPTA measured at 250/500/1000/2000 Hz), mean Air-Bone Gap (ABG) at 250/500/1000/2000 Hz.

Results: 69 patients underwent repair. The cohort was 75.4% female and 71.6% had a body mass index (BMI) >30. The size of the defect in the coronal plane was >5.0mm in 61.2% of cases. The epitympanum was involved in 43.4%, the antrum in 46.3%, and combination TM/MF approach taken in 78.3% and TM approach in 17.4%. Isolated defects of the petrous apex were approached through a MF approach in 4.3%. Three or Four grafting materials were used in 73.9%. The overall treatment failure rate was 4.3%. Postoperative ABG (pABG) was ≤20 dB in 73.0%. Surgical approach, graft type, individual surgeon, defect location, prior repair, and defect size in the coronal plane did not affect the rate of ABG closure to ≤20dB. The postoperative mean ACPTA was 30.9dB (range 7.5-65.0dB) and mean BCPTA 13.7dB (range 0.0-43.8dB). There were no patients with profound SNHL.

Conclusions: Surgical repair of temporal lobe encephaloceles and CSF leaks is effective and with satisfactory audiometric outcomes. There were no patient or defect-related factors that affected audiometric outcomes.

Professional Practice Gap & Educational Need: The primary objective of surgical repair of temporal lobe encephaloceles and CSF leaks is to reduce the lesion and separate the temporal bone from the middle fossa. The secondary objective is to examine audiometric outcomes postoperatively. There is a paucity of literature on the audiometric outcomes after such cases.

Learning Objective: To examine audiometric outcomes following temporal lobe encephalocele and CSF leak repair.

Desired Result: Closure of the postoperative Air-Bone Gap to ≤20dB. For attendees to appreciate that regardless of approach, audiometric outcomes following such surgical repair is satisfactory.

Level of Evidence - IV

Indicate IRB or IACUC : Icahn School of Medicine, IRB #21-01768.

Tumor Stem Cells and Radiation Resistance in *NF2*-mutant Schwann Cells and Vestibular Schwannoma

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Hypothesis: Tumor stem-like cells (TSC) in *NF2*-mutant Schwann cell cultures promote tumor progression and radiation resistance.

Background: TSCs are a subset of neoplastic cells that express stem cell markers, form spheroids in culture, self-renew to drive tumor growth and promote tumor recurrence. In this study, we enrich *NF2*-mutant Schwann cell cultures with TSCs and measure spheroid formation, proliferative potential and response to radiation.

Methods: *NF2*-mutant mouse and human Schwann cells were cultivated in various culture conditions for the enrichment of tumor spheroids. Time lapse imaging was performed after irradiation (0 or 18 Gray) and spheroid counts were obtained. Cell proliferation was measured using viability assays. Tumor stem cell markers (OCT4, NANOG, SOX2) were quantified using Simple Western for cultures and immunohistochemistry (IHC) for patient-derived VS.

Results: In *NF2*-mutant mouse Schwann cells, TSC media promoted tumor spheroids enriched with TSC markers. Although tumor spheroids in TSC media demonstrated less proliferative potential, they were highly resistant to radiation, maintaining high spheroid count after 18 Gray exposure. Tumor spheroids enriched with TSC markers were also seen in *NF2*-mutant human Schwann cells. Furthermore, IHC of VS tumors showed positivity for OCT4, NANOG and SOX2.

Conclusions: *NF2*-mutant Schwann cells can be enriched with TSCs to promote tumor spheroids that are resistant to radiation *in vitro.* Although TSC markers are expressed in VS, their contribution to tumor progression and radiation resistance is unknown. Further investigations into the role of TSCs can lead to new targets and novel therapies that improve tumor control and treatment outcomes for VS patients.

Professional Practice Gap & Educational Need:
The reasons for radiation failure in VS are unknown. TSCs are a subset neoplastic cells that are inherently radiation resistant and may contribute to radiation failure in VS. An improved understanding of TSCs can improve counseling in VS patients undergoing radiotherapy.

Learning Objective:
VS may have TSC properties that contribute to radiation resistance.

Desired Result:
Clinicians recognize biological factors that may contribute to radiation resistance in VS and improved knowledge will help in counseling patients about radiation outcomes.

Level of Evidence – N/A

Indicate IRB or IACUC: IRB#20150637

Recurrent Flight-Associated Facial Baroparesis Despite a Pressure Equalization Tube

Matthew Groysman, MD; Nicholas Dewyer, MD

Objective: Familiarize clinicians with the diagnosis, management, and treatment of facial baroparesis (FB), especially in patients with a history of otologic surgery.

Study Design: Retrospective case report

Setting: Academic Hospital

Patients: One patient with a remote history of tympanoplasty for cholesteatoma who developed recurrent ipsilateral temporary facial paralysis on commercial flights. Symptoms were not relieved by an ear tube.

Interventions: Tympanomastoidectomy with middle ear lysis of adhesions, replacement of ear tube

Main Outcome Measures: Resolution of flight-associated FB.

Results: Intraoperatively, an air space was found around the dehiscent tympanic facial nerve that was sequestered from both Eustachian tube and the ear tube. Adhesions were taken down and the ear tube was replaced. The patient has taken flights since the operation with no further facial paralysis.

Conclusions: Most idiopathic FB can be managed by medical treatment or ear tube. However, when an ear tube fails to prevent further episodes, exploratory surgery to evaluate anatomic barriers to pressure equalization along the course of the facial nerve may be useful.

Professional Practice Gap & Educational Need: FB is a rare condition and very rarely associated with prior otologic surgery. We discuss management in the context of published literature. We propose a novel algorithm for managing FB.

Learning Objective: Become familiar with the presentation and management options of facial baroparesis

Desired Result: Understand the presentation and management options of facial baroparesis.

Level of Evidence - Level V

Indicate IRB or IACUC : Exempt.

Characterizing Human Vestibular Sensory Epithelia from Translabyrinthine Surgery

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Samuel P. Gubbels, MD; Katie Rennie, PhD; Anna Dondzillo, PhD

Hypothesis: Immunohistochemical findings of human vestibular epithelia relate to patient characteristics.

Background: Knowledge of vestibular epithelia is largely inferred from rodents, where increasing rodent age is associated with hair cell (HC) loss and development of actin spikes, thought to participate in HC autophagy (Bucks 2017).

Methods: Seven patients undergoing translabyrinthine surgery were consented, and vestibular epithelia were harvested intraoperatively. Six utricles and one crista were fixed and stained for HCs (myosin7a), ribbon synapses (CtBP2), afferent fibers (TubulinB3), and actin filaments (phalloidin). Imaging was performed with confocal microscopes. Main outcome measures included patient characteristics and density of HCs, ribbon synapses, and actin spikes.

Results:
Seven patients (30-76y, 4M/2F), six with vestibular schwannomas (VS, Koos2-3) and one with cholesterol granuloma, all with nonserviceable hearing, underwent translabyrinthine surgery. Preoperatively, PTA was 69.2+/-13.2 dB, median WRS 4%, and 4/7 described disequilibrium.

In utricles and crista, phalloidin staining revealed disorganized/absent stereocilia. There were abundant calyces, many without HCs. Large actin spikes were identified crossing through the HC axis with an average length of 11.1+/-3.5um. HC density did not correlate with disequilibrium.

In the utricles of VS patients, average density of HCs was 0.25+/-0.19 cells per 100um^2, ribbon synapses 10.1+/-7.5 per HC, and actin rods 0.27+/-0.31 per HC. As age increased, HC density decreased (p=0.04*). HC density did not correlate with Koos grade.

Conclusions: Utricular HC density decreases with increasing patient age, and numerous actin spikes were identified, aligning with observations in aging rodents. Utilizing human tissue from surgery facilitates crucial translational studies to better understand human vestibular epithelia.

Professional Practice Gap & Educational Need: Knowledge of vestibular epithelia is largely inferred from rodent research. This study provides valuable human data.

Learning Objective: Immunohistochemically examine human utricles and cristae

Desired Result: identify relationships between patient characteristics and the state of their vestibular epithelia

Level of Evidence – N/A (bench research), could consider level V (case series)

Indicate IRB or IACUC: Colorado Multiple Institution Review Board (COMIRB 19-1340), approved Dec 2, 2020

Measuring Changes in Neural Activation Associated with Cochlear Implantation in Single-Sided Deafness

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Akiva Mintz, MD, PhD; H. Ana Kim, MD

Objective: To understand the neurobiological mechanisms responsible for hearing restoration in individuals with single-sided deafness (SSD) after cochlear implantation (CI).

Study Design: Observational longitudinal study.

Setting: Academic hospital.

Patients: Two adult patients with single-sided deafness who underwent cochlear implantation.

Interventions: Cochlear implantation.

Main Outcome Measures: The main outcome measure of this study is the change in neural activation patterns in individuals with SSD after receiving CI. To assess these changes, the study analyzed 18F-FDG-PET neuroimaging data acquired both before CI and six months after CI activation. 18F-FDG radioactivity measured 30 minutes after tracer injection was used as a proxy of neural activity. The comparative analysis of these images was carried out using statistical parametric mapping (SPM). Voxel-based paired t-test statistics, conducted across the whole brain, compared the intensities in pre-CI and post-CI images. The intensity of each image was normalized by the image's global mean intensity. Regions with a p-value (family-wise error corrected) of less than 0.05 and a size threshold of at least 10 voxels were considered statistically significant.

Results: The results of the study indicate a statistically significant increase in neural activation in the anterior region of the superior temporal gyrus (ipsilateral to the side of hearing loss) after CI in individuals with SSD. This region of increased activation was found to have a size of 13 voxels and a p-value of 0.042. These findings were further validated by examining the patients' auditory function tests and cochlear implant usage data, which revealed significant improvements in auditory function post-implantation and substantial usage of the cochlear implant. This strengthened the inference that the heightened activation was attributable to the cochlear implant.

Conclusions: PET CT may be a novel method of examining cortical changes after CI. SSD provides a useful model to examine hemispheric differences. In this preliminary study in two patients, we observed increased neural activation within the anterior region of the superior temporal gyrus, ipsilateral to the side of hearing loss. This region plays a crucial role in auditory processing, language comprehension, and speech perception, making it a significant contributor to the neurobiological mechanisms underlying hearing restoration in SSD patients following CI.

Professional Practice Gap & Educational Need: The neurobiological mechanisms underlying hearing restoration after CI in SSD patients are poorly understood.

Learning Objective: To identify changes in neural activity following CI in individuals with SSD.

Desired Result: The study's desired results include enhancing physicians' understanding of the neurobiological mechanisms underlying hearing restoration in SSD patients following CI, which may help in understanding variations in CI outcomes among different individuals.

Level of Evidence – V

Indicate IRB or IACUC: Columbia University, IRB-AAAU0501

Sociodemographic Factors Associated with Pediatric Cochlear Implantation Compliance Differs from Provider Perception

Jacob Schneider, BS; Maja Svrakic, MD, MSEd

Objective: To evaluate the perceived versus true sociodemographic variables that may influence pediatric cochlear implant compliance

Study Design: Retrospective chart review and provider survey

Setting: Tertiary care center

Patients: Pediatric patients who received a cochlear implant between 2013-2023

Interventions: Retrospective chart review for collection of sociodemographic data (zip code, language spoken, insurance, race, ethnicity, immigration status), implant data logging hours (6-month, 1-year, and 2-year time points), appointment compliance (number of appointments 1 year and 1-5 years post-implant). Provider survey evaluating perceived influence of various sociodemographic factors on implant compliance (wear and follow-up).

Main Outcome Measures: Influence of sociodemographic factors on implant compliance (number of appointments and data logging hours), and the difference between perceived and true significant sociodemographic variables.

Results: 56% of providers predicted that a patient's primary household language spoken influences data logging hours and the number of appointments attended 1-year post-implant, however this was not found to be significant ($p=0.312$ and $p=0.153$ respectively). The number of appointments attended by pediatric cochlear implant patients was considered "compliant" one-year post-implant (at least 5 appointments) regardless of sociodemographic variables (mean 8.89 appointments).

Conclusions: There is a difference between the true and perceived compliance of pediatric cochlear implant patients among providers based on sociodemographic variables, suggesting a potential bias present among the treatment team.

Professional Practice Gap & Educational Need: Social determinants of health remain under-researched in most fields of otolaryngology. Specifically, there are few studies analyzing the difference of perceived and true sociodemographic factors influencing compliance with treatment. There is a lack of representation among otolaryngologists in the United States, which may contribute to potential biases present.

Learning Objective: To inform providers of their potential biases when treating and following-up with pediatric cochlear implant patients and all other patients.

Desired Result: To prevent potential provider biases from negatively influencing the treatment of pediatric cochlear implant patients, in terms of formulating follow-up plans, tests, and interventions. Increased diversity and representation in the field of otolaryngology may reduce provider biases present.

Level of Evidence – Level IV

Indicate IRB or IACUC : Exempt

BMI Does Not Predict Rates of CSF leak in Vestibular Schwannoma Resection

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Donald Solomon, MD

Objective: To determine whether BMI affects postoperative cerebrospinal fluid (CSF) leak rates after resection of vestibular schwannoma

Study Design: Retrospective Review

Setting: National Surgery Quality and Safety Project (NSQIP) for the years 2014-202

Patients: Subjects with an ICD10 code of D33.3 that were surgically resected were analyzed in the NSQIP database. After these cases were selected, the cases were further narrowed by only selecting those cases with CPT codes as listed in prior literature. Additionally, patients without a calculable BMI were excluded. The presence of a CSF leak was determined through a combination of CPT, ICD9, and ICD10 codes.

Interventions: None

Main Outcome Measures: The main objectives for this study are evaluating BMI and postoperative CSF leak. The study evaluated overall incidence of postoperative CSF leak after surgical resection of vestibular schwannoma. Additionally, the study evaluated patient characteristics and perioperative variables that could predict a postoperative CSF leak based on prior literature.

Results: A total of 2415 patients met inclusion criteria with a reported postoperative CSF leak in 110. There were no significant differences in average age ($p=0.245$), sex ($p=0.140$), or BMI ≥ 30 vs <30 ($p=0.841$). Comparison of BMI categorized as 18.5-24.9, 25-29.9, 30-39.9, or ≥ 40 did not yield significance ($p=0.169$). Diabetes, smoking status, severe COPD, CHF, medically treated hypertension, steroid use, or ASA class were not predictive of CSF leak.

Conclusions: In conclusion, neither average BMI, categorization of BMI, nor a cutoff of BMI at 30 significantly predicted postoperative CSF leak.

Professional Practice Gap & Educational Need: Surgical resection of vestibular schwannoma carries a postoperative CSF leak rate of approximately 10%. Prior studies investigating CSF leak rates after resection of vestibular schwannoma have suggested that tumor size, body mass index, surgical approach, male sex, case volume, operative time >8 hours, and repair type can lead to postoperative CSF leak. However, most of the above studies are single institution with a heterogeneous sample size. Two studies involve larger databases such as the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database and the California Office of Statewide Health Planning and Development (COSHPD) database. The former study did not report a difference in leak rates with BMI, but only reported averages as a comparison. The latter study analyzed patients over a 25 year period and found that BMI was a predictor of 30 day readmission with CSF leak. Additional studies must be performed to better delineate whether there is an association between BMI in CSF leak rates after vestibular schwannoma resection.

Learning Objective: Due to controversies in the literature, the current study aims to further evaluate BMI as a predictive factor in CSF leak rates using the NSQIP database.

Desired Result: The evaluation of BMI as a predictive factor for postoperative CSF leak in a large national database.

Level of Evidence - Level IV

Indicate IRB or IACUC : Cooper University Health Care, IRB 23-003

Histological Analysis of the Inner Ear Sensory Structures in the COVID-19 Hamster Model

Megan Bradley, BS; Nadia Z. Quadri, MS; Rebecca Cook, BS
Junki Maruyama, DVM, PhD; Slobodan Paessler, DVM, PhD
Tomoko Makishima, MD, PhD

Hypothesis: Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection causes structural damage to the cochlea and vestibule leading to auditory and vestibular dysfunction.

Background: SARS-CoV-2 is responsible for coronavirus disease 2019. This systemic disease affects multiple organs, causing an expanding list of clinical manifestations including audio-vestibular dysfunction.

Methods: 36 hamsters were inoculated intranasally with either SARS-CoV-2 alpha strain or PBS as a control. The temporal bones of the hamsters were harvested at days post-infection (dpi): 2, 3, 5, 8, 17, 21, 35, 42. The temporal bones were processed in paraffin, thin sectioned, and stained with H&E and labeled with the SARS-CoV-2 nucleocapsid antibody.

Results: In the hamsters infected with SARS-CoV-2, antigen was detected in the middle ear early after infection from 3-42 dpi, and then was observed in cochlear structures including the stria vascularis, spiral ganglion, and Reissner's membrane from 5-35 dpi, with structural damage around 21 dpi. In the vestibule, the structural damage and antigen positivity peaked at 17 dpi, and localized to the vestibular nerve. Furthermore, antigen was detected in the perilymph and perineural areas at 3-8 dpi.

Conclusions: Given the abundance of SARS-CoV-2 antigen in the perilymph at early timepoints after infection, we speculate the most likely mechanism of viral transmission to the inner ear is through the central nervous system, rather than direct invasion from the middle ear.

Professional Practice Gap & Educational Need: Little is known about the mechanism of viral transmission to the temporal bone.

Learning Objective: Learn the histological changes in the inner ear caused by SARS-CoV-2 infection.

Desired Result: Locate the structures within the cochlea and vestibule are affected by SARS-CoV-2 invasion, and correlate with time after infection, and to determine the route of viral transmission.

Level of Evidence – N/A.

Indicate IRB or IACUC: The University of Texas Medical Branch at Galveston. IACUC #2005060.

Hyaluronic Acid Binding Protein is a Biomarker of Increased Stiffness in Vestibular Schwannoma

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Vivian F. Kaul, MD; Arunark Kolipaka, PhD; Yin Ren, MD, PhD

Objective: The biomolecular and biophysical properties of the vestibular schwannoma (VS) extracellular matrix (ECM) and microenvironment (TME) could influence tumor stiffness and clinical outcomes. Stiffer tumors are thought to demonstrate worse hearing preservation and increased morbidities, such as facial paralysis, due to greater compression of the brainstem and cranial nerves. This study aims to uncover the molecular determinants of tumor stiffness in VS.

Methods: In a prospective, double-blinded study, adult patients with sporadic VS undergoing microsurgical resection were enrolled. Magnetic resonance elastography (MRE) was performed prior to surgery to characterize tumor stiffness. Immunohistochemical (IHC) staining of ECM proteins (HABP, CD44, trichrome) and TME cellular subpopulations (αSMA, CD68, CD163) were performed on tumors postoperatively. Biomarker expression was validated in a human schwannoma cell line.

Results: Sixteen patients (75% male, mean age 48±11 years) were included. Average tumor diameter was 2.77±0.83 cm. The mean pre-op tumor stiffness was 2.97 kPa (range, 1.58 - 5.53 kPa, higher value being stiffer). Masson's Trichrome, hyaluronan binding protein (HABP), activated fibroblasts (αSMA), and tumor infiltrated M2 polarized macrophages (CD163) were all independently and significantly correlated with tumor stiffness (All $p<0.01$). Increased stiffness due to hyaluronan production was next explored, demonstrating a dose-dependent upregulation of hyaluronan synthetases (HAS1/2/3) from stimulation with TNFα, a pro-inflammatory cytokine known to be expressed in the VS TME milieu.

Conclusions: Several molecular markers correlate with VS stiffness. HABP is upregulated potentially through pro-inflammatory signaling via TNFα in VS cells.

Professional Practice Gap & Educational Need: Tumor consistency can be a major determinant in the success of vestibular schwannoma microsurgical resection. While MRE can now be utilized to preoperatively measure stiffness, we don't yet understand the mechanism behind stiffness. This study provides insights into these mechanisms.

Learning Objective: To understand molecular determinants of tumor tissue stiffness in posterior fossa tumors that are correlated with preoperative measurements using MR elastography and delineate a possible underlying mechanism for their development.

Desired Result: Attendees will be able to identify potential molecular targets and additional tumor biomarkers for the treatment and classification of aggressive vestibular schwannomas.

Level of Evidence - Level IV

Indicate IRB or IACUC : The Ohio State University Wexner Medical Center Institutional Review Board, IRB# 1994H0241 and 2012H0027, Approved 06/02/2022 and 08/08/2023, respectively.

Stria Vascularis Integrity in Implanted Cochlea: Histopathological Temporal Bone Study

Armine Kocharyan, MD; Ivan A Lopez, PhD
Gail Ishiyama, MD; Akira Ishiyama, MD

Hypothesis: An increased CD68 immunoreactivity (IR) in the stria vascularis (SV) of human temporal bone specimens from patients who received cochlear implant (CI) compared to the contralateral non-implanted controls may play a role in preserving the integrity of the SV.

Background: SV plays a crucial role in maintaining endocochlear homeostasis. Macrophages have a pivotal role in responding to cochlear injury, with CD68+ scavenger cells shown to have a surveillance function. In this study, we investigate the status of the SV in the implanted cochlea of human temporal bones using hematoxylin and eosin (H&E) sections and immunohistochemistry for CD68.

Methods: Formalin-fixed 20-micron H&E celloidin sections of the cochlea of patients who received CI (n=10, five males, five females, 50-70 years old) were immunohistochemically stained with CD68 rabbit polyclonal antibodies. A quantitative analysis of CD68-IR was performed in the SV of CI and contralateral non-CI temporal bones. CD68-IR area measurements of the apical, middle, and basal regions of SV were collected for each specimen.

Results: H&E-stained sections of the CI cochlea showed remarkable integrity of the SV. The mid-apical region was the most preserved. Comparisons of CD68-IR in the SV showed a statistically significant increase in CI cochlea compared to non-CI ($p < 0.05$). Regional distribution of the CD68-IR in SV correlated with its histologic integrity.

Conclusions: The histological preservation of SV correlates with increased CD68-IR in the cochlea of implanted human temporal bones, indicating an active protective response to electrode insertion trauma and playing an essential role in maintaining endocochlear homeostasis.

Professional Practice Gap & Educational Need: There continues to be a lack of knowledge in understanding the potentially antagonizing role of macrophages in the cochlea, including response to cochlear trauma and maintenance of cochlear homeostasis. Histopathologic studies of implanted human temporal bone specimens provide a unique opportunity to investigate the integrity of stria vascularis and analyze the immune profile of implanted cochlea.

Learning Objective: To 1) investigate the anatomical integrity of the regions of stria vascularis in implanted cochlea of human temporal bone specimens and compare with non-implanted contralateral controls, and 2) study the CD68 immunoreactivity and investigate the correlation with preserved SV integrity.

Desired Result: This study will contribute to our understanding of the role of macrophages in the integrity of stria vascularis and cochlear homeostasis. It will further support future studies investigating the immune response to cochlear trauma and the role of SV in cochlear implant performance and hearing preservation.

Level of Evidence – Level III – cohort and case-control studies

Indicate IRB or IACUC: The studies involving human participants were reviewed and approved by the University of California at Los Angeles Institutional Review Board (IRB# 22-001587). Appropriate informed consent for inclusion in the study was obtained from each temporal bone donor.

Efficacy of Abdominal Fat Grafting in Reducing Postoperative CSF Leak in Retrosigmoid Approach to Vestibular Schwannoma Resection

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Georgios A. Zenonos, MD; Paul A. Gardner, MD
Andrew A. McCall, MD

Objective: To investigate the efficacy of abdominal fat grafting in reducing postoperative cerebrospinal fluid (CSF) leak rates in patients undergoing retrosigmoid approach to vestibular schwannoma resection.

Study Design: Retrospective case series

Setting: Tertiary referral center

Patients: 94 consecutive patients undergoing retrosigmoid approach to vestibular schwannoma resection

Interventions: Variables included demographics, degree of mastoid pneumatization, use of endoscope, and abdominal fat grafting.

Main Outcome Measures: CSF leak rate

Results: 94 patients were included (50.0% female, mean age 53 years) who underwent 100 total surgeries (6 patients underwent bilateral or staged procedures). There was an 8.0% CSF leak rate (8/100) in the postoperative period. All 8 patients underwent lumbar drain placement and 4 (50.0%) required surgical intervention. There was no statistically significant difference in CSF leak rate in those who underwent abdominal fat grafting (4/49, 8.2%) versus those who did not (4/51, 7.8%) (p=0.95). Similarly, use of endoscope was not associated with decreased CSF leak rate (p=0.77). CSF leak rate was significantly higher in patients with preoperative computed tomography imaging showing pneumatized cells within 1 cm of posterior internal auditory canal (IAC) (6/33, 18.2%) than those without (1/57, 1.8%) (p=0.005), though did not differ based on overall mastoid pneumatization (p=0.38).

Conclusions: Retrosigmoid approach to vestibular schwannoma resection poses an inherent risk of exposing mastoid air cells, creating an outflow tract for CSF leak. Extra care should be taken in patients with pneumatization within 1 cm of the posterior IAC since risk of CSF leak is elevated in patients with this anatomic configuration.

Professional Practice Gap & Educational Need: CSF leak is among the most frequent postoperative complications following vestibular schwannoma surgery, significantly increasing the risk of meningitis and need to return to operating room. Though abdominal fat grafting has been increasingly utilized over the past several decades, there is a paucity of data in the literature evaluating its efficacy in reducing rates of postoperative CSF leak in vestibular schwannoma resection.

Learning Objective: To critically examine imaging and intraoperative factors that may impact postoperative rates of CSF leak in vestibular schwannoma patients undergoing surgical resection.

Desired Result: To show a significant or not-significant difference in rates of CSF leak and complications in vestibular schwannoma patients as they relate to mastoid pneumatization and use of abdominal fat grafting in closure.

Level of Evidence – Level IV

Indicate IRB or IACUC : Approved, University of Pittsburgh IRB STUDY22100002

Histiocytosis of the Temporal Bone in Children – A Systematic Review

Olivia E. Speed, MD; Kaersti Rickels, BS; Soroush Farsi, BS,
John Dornhoffer, MD; Robert Saadi, MD

Objective: Langerhans Histiocytosis (LH) is a rare disease characterized by clonal histiocyte proliferation that may involve the temporal bone. Our goal was to review the literature to better understand the diagnostic characteristics and management of histiocytosis of the temporal bone in pediatric populations.

Data Source: Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Protocol, PubMed and MED-LINE Databases were queried for articles published from 2003 to 2023 describing LH with temporal bone involvement. The keywords used included synonyms for "Langerhans Cell Histiocytosis", "Temporal Bone", and "Pediatrics" in the title/abstract.

Study Selection: Titles and abstracts of 1,493 articles were screened and 23 articles met inclusion criteria. 156 pediatric patient cases were analyzed from the 23 articles collected (9 case series, and 14 case reports).

Results: The average age of patients included was 5.31 years. Most common clinical manifestations of these patients were postauricular mass (62%), otorrhea (21%), and otalgia (10.8%). Other presentations included cervical pain, balance disturbances, and hearing loss. The most common radiological finding on Head CT was a lytic or destructive osseous lesion. Initial management ranged from solely chemotherapy, radiotherapy, local resection or a combination of surgical resection and chemotherapy or radiotherapy.

Conclusions: Langerhans Histiocytosis involving the temporal bone is a rare manifestation of this disease with little consensus on management, especially in pediatric populations. It is integral that Otolaryngologists remain vigilant in identifying and diagnosing this condition as presentation may mimic more common middle ear pathology, and the utility of surgical management is unclear.

Professional Practice Gap & Educational Need: There is incomplete knowledge on the management of LH involving the temporal bone in the pediatric populations.

Learning Objective: The audience will better understand information in the literature regarding the treatment and management of LH in the pediatric population.

Desired Result: To better understand the diagnostic characteristics and management of histiocytosis of the temporal bone in pediatric populations.

Level of Evidence – Level III; Systematic Review

Indicate IRB or IACUC : Exempt

Changing Management of Intravestibular Schwannomas in the Era of Cochlear Implantation for Single-Sided Deafness

Emma Hershey, BA; Lisa Chionis, BA; Ruby Kazemi, BA
Carla Valenzuela, MD, MSCI; Emily Z. Stucken, MD

Objective: Intralabyrinthine schwannomas (ILSs) are a rare cause of deafness. Patients with ILS confined to the semicircular canals and the vestibule (intravestibular schwannomas) are potential candidates for a cochlear implant for hearing rehabilitation, a new option for patients with unilateral hearing loss since the 2019 FDA approval of CI for single-sided deafness (SSD). In this report, we describe a new management approach for ILSs causing hearing loss.

Study Design: Retrospective case series.

Setting: Academic tertiary medical center.

Patients: Adults (≥18 years) who underwent simultaneous ILS resection and CI between January 2019 and June 2023 (n=3).

Interventions: Transmastoid labyrinthectomy with simultaneous cochlear implantation.

Main Outcome Measures: Hearing performance with cochlear implantation measured as CNC Word Recognition scores and AzBio Sentence scores.

Results: Three patients with ILS confined to the semicircular canals and vestibule underwent simultaneous tumor resection via labyrinthectomy with CI placement. In all cases, complete tumor resection and full CI insertion were achieved. No patients experienced postoperative complications. Patients 1 and 2 underwent six- and nine-month post-activation testing, respectively, with CNC scores 64-80% and AzBio 81-99% in the implanted ears. Patient 3 deferred six-month audiometry.

Conclusions: Patients with ILS confined to the vestibule and semicircular canals can be considered for simultaneous tumor resection and CI placement.

Professional Practice Gap & Educational Need: Since FDA approval of CI for SSD, physicians can offer patients with ILS and SSD cochlear implant and simultaneous tumor resection. However, CI performance outcomes for patients following ILS resection has not been well documented in the literature.

Learning Objective: To evaluate the feasibility of simultaneous ILS resection and CI placement as well as the CI performance outcomes of patients undergoing this intervention.

Desired Result: To better understand which patients might benefit from this intervention and to provide CI performance outcomes to help physicians counsel patients on their expected hearing outcomes following surgery.

Level of Evidence – Level V

Indicate IRB or IACUC : HUM00235247 – University of Michigan

Effects of Vaccine Hesitancy on Rates of Otologic and Neurotologic Symptoms Following COVID-19 Infection

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Peter Dixon, MD; Jeffrey P. Harris, MD, PhD

Objective: We aim to compare rates of otologic and neurotologic symptoms following COVID-19 infection between vaccinated (VP) and unvaccinated participants (UVP).

Study Design: Retrospective review

Setting: Single tertiary care institution

Patients: Patients included in this study were ≥18 years of age and had tested positive for COVID-19 infection between January 2020 and September 2022

Interventions: Diagnostic

Main Outcome Measures: Rationale for unvaccinated status were examined, and demographic and symptom data were compared between VP and UVP.

Results: Of 3,563 participants who tested positive for COVID-19, 60% were male, 84% were white, and mean age was 59. A total of 299 (8%) were unvaccinated at time of infection, with most common reasons cited being side effect concerns (68%), vaccine safety concerns (61%), and vaccine efficacy concerns (35%). UVP at time of infection were more likely to be female (17% vs. 6%, $p<0.001$), Hispanic (15% vs. 9%, $p<0.001$), or in the 25-34 age range (20%, $p=0.007$). UVP were more likely to experience migraine (10% vs. 2.5%, $p<0.001$), changes in hearing (14% vs. 3%, $p<0.001$), aural fullness (20% vs. 6%, $p<0.001$), tinnitus (21% vs. 5%, $p<0.001$), and otalgia (11% vs. 3%, $p<0.001$). UVP participants were less likely to experience dizziness (3% vs. 6%, $p<0.001$) or headache (15% vs 53%, $p<0.001$) immediately following COVID-19 infection than VP.

Conclusions: These findings guide our understanding of vaccine hesitancy and indicate that COVID-19 vaccines may protect against some otologic symptoms. Future studies are indicated to expand upon this conclusion.

Professional Practice Gap & Educational Need: There is a paucity of literature investigating whether COVID-19 infection can elicit otologic and neurotologic symptoms.

Learning Objective: A better understanding of the otologic symptoms that present upon COVID-19 infection can inform and guide providers in adjusting screening protocols and educating their patients appropriately.

Desired Result: Audience members will conclude the session with the ability to name commonly reported concerns regarding the COVID-19 vaccines among the unvaccinated population and be able to name otologic and neurotologic symptoms that may be more prevalent among the UVP than VP following COVID-19 infection.

Level of Evidence – Level IV

Indicate IRB or IACUC : UCSD- Clinical & Translational Research Institute (CTRI) – PID 4325

Longitudinal Impact of Cochleovestibular Schwannoma on Vestibular Dysfunction in Neurofibromatosis Type 2

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Maxwell Laws, MD; Ihika Rampalli, BS; Prashant Chittiboina, MD
H. Jeffrey Kim, MD

Objective: To determine the longitudinal impact of cochleovestibular schwannoma (CVS) growth on audiovestibular outcomes in patients with neurofibromatosis type 2 (NF2).

Study Design: Prospective natural history study of NF2.

Setting: Quaternary research center.

Patients: Patients (n=72,40 females) with mean age 28.9(8-75) years, treatment naïve CVS (n=128) were included in the study from 06/2008 to 04/2023. Mean follow-up was 2.45(0-8.45) years.

Interventions: Comprehensive audiovestibular test battery including audiometry, vestibular ocular reflex (VOR) via sinusoindal harmonic accerlation (SHA) on rotational chair and caloric testing was conducted at each visit. Volumetric MRI imaging was obtained at each visit.

Main Outcome Measures: Analysis was performed using a linear mixed-effects model to investigate relationships between tumor characteristics, audiovestibular variables, and self-reported functional measures. Statistical significance was denoted for p-values < 0.05.

Results: Initial and final tumor volumes (mm^3) for right (1700.82±3716.192 vs. 2443.59±4208.71) and left (1323.55±2095.49 vs. 2261.38±3340) CVS were calculated, respectively. Specific growth rates (SGR) were calculated for right ($3.87year^{1}$±2.30), left ($4.21year^{-1}$±2.45) and total CVS tumor volume ($5.05year^{-1}$±2.29). Increases in total CVS tumor volume significantly correlated ($p<0.05$) with decreases in high velocity step acceleration peak eye velocity and mid- to high-frequency angular VOR gain (0.02-0.64Hz). There were no statistically significant associations between ipsilateral tumor SGR and audiometric pure-tone averages or caloric peak eye velocity ($p>0.05$).

Conclusions: These findings demonstrate a significant impact of CVS growth on mid- to high-frequency vestibular function in patients with NF2. This study provides the first longitudinal analysis of association between vestibular dysfunction in NF2 and CVS tumor growth patterns.

Professional Practice Gap & Educational Need: Patients with NF2 frequently develop significant disequilibrium, however, the mechanisms remain poorly understood. The potential mechanisms underlying the disequilibrium could be attributed to vestibular nerve dysfunction, ascending/descending neural tract injury and/or peripheral neuropathy. Prior studies have described vestibular dysfunction in this patient population. Here, we provide the first study investigating the association of CVS tumor characteristics with audiovestibular parameters and patient-reported functional measures. Further studies may elucidate a role of vestibular testing in predicting tumor growth characteristics and functional outcomes in these patients.

Learning Objective: To determine the longitudinal, objective audiovestibular outcomes with functional outcomes in patients with NF2 to enhance clinical decision making with regards to the management of CVS in this patient population.

Desired Result: This study will contribute to our understanding of the impact CVS tumor size, progression, and location on various outcome measures regarding hearing, balance, and quality of life outcomes.

Level of Evidence: III

Indicate IRB or IACUC : NIH IRB (NCT00598351), Bethesda, MD 20892

Understanding Long-Term Audiological Trends in Post-Lingual Cochlear Implant Recipients

Khaled A. Altartoor, MD; Kaitlyn A. Brooks, MD
Joseph S. Schertzer, MD; Esther X. Vivas, MD

Objective: To explore trends in audiological outcomes in post-lingual adults with cochlear implants (CIs).

Study Design: Retrospective cohort study.

Setting: Single institution tertiary care center.

Patients: Patients aged ≥ 18 years with at least a 3-year follow-up after CIs.

Interventions: Time after CI activation.

Main Outcome Measures: Primary outcomes: Trends in audiological outcomes compared to the first-year post CI including AzBio in Quiet, AzBio in Noise, CNC Wordlist in Quiet, and SRT. Secondary outcomes: Pure-tone averages (PTAs) for each ear were calculated as the mean of the air conduction thresholds at frequencies of 500, 1000, 2000, and 4000 Hz. Linear mixed-effects models were employed adjusting for age, race, and sex.

Results: Of the 163 patients, 25 (15%) had bilateral CI implants. The median (IQR) age at cochlear implantation was 66 years (54 – 73), with 65% being female, and 67% being White. The median follow-up duration was 3.07 years (IQR: 1.72 – 17.15 years). Compared to the first year post-CI activation, the second (β= 9.72, [95% CI: 0.96, 18.49]) and third (β= 13.23, [95% CI: 1.58, 24.88]) years post CI were significantly associated with improvements in AzBio in Quiet. The remaining associations were not statistically significant ($p>0.05$).

Conclusions: Patients with post-lingual CI displayed an improvement in audiologic outcomes after their first year, especially in speech perception. Further studies are required to better understand these relationships.

Professional Practice Gap & Educational Need: In the first year following a cochlear implant, prior research has shown audiological benefits, but long-term trends have not been well studied. Our findings provide healthcare professionals and researchers with a quantification of the expected improvements over time to better understand the progression course. We further highlight the importance of thorough care in adults with CI over a longer period.

Learning Objective: To understand the trend of audiological outcomes in adult post-lingual cochlear implant recipients after the first year of CI.

Desired Result: This aids healthcare providers in comprehending how adult patients' hearing benefits change over time following cochlear implantation, and improves their understanding of long-term care in adults with CI.

Level of Evidence - Level IV – Retrospective cohort

Indicate IRB or IACUC : Emory University IRB #00107266

The Association Between Hearing Loss and Depression in a Large Electronic Health Record System

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Justin S. Golub, MD, MS

Objective: To determine if there is an association between hearing loss (HL) and depressive disorders within a large bi-institutional electronic health record system.

Study Design: Cross-sectional epidemiologic study

Setting: Tertiary care academic practices

Patients: Data was collected from the electronic health records (EHR) of two academic medical centers (n=23,448) for participants ≥18 years old who underwent audiometry from 2020 to mid-2023.

Main Outcome Measures: (1) Major depressive disorder, defined by ICD-10 code; (2) persistent mood disorder (including persistent depressive disorder/dysthymia), defined by ICD-10 code; (3) antidepressant medication use, defined by medication lists.

Methods: The exposure was HL measured by clinical audiometry and defined as the 4-frequency pure tone average (PTA) from the better ear. Odds ratios were computed from logistic regressions between HL and each of the three outcome variables. Multivariable regressions controlled for age, gender, cardiovascular risks, and site.

Results: The mean age (SD) was 61 (18.2) years and 13,809 participants (58.9%) were women. Controlling for covariates, for every 10-dB worsening in hearing by PTA, the odds of major depressive disorder increased by 1.04 times (95% CI=1.01-1.07, p=0.021). Similarly, for every 10-dB worsening in hearing by PTA, the odds of antidepressant medication use increased by 1.04 times (95% CI=1.01-1.06, p=0.002). Odds ratios for persistent mood disorder were non-significant.

Conclusions: In a large academic EHR, HL is associated with major depressive disorder and antidepressant medication use. Modern EHR systems provide a platform to study associations between HL and morbidities.

Professional Practice Gap & Educational Need: Despite the growing research supporting associations between HL and psychiatric comorbidities such as depression, there is room for improvements in the screening, identification, and management of these concurrent conditions.

Learning Objective: Participants will appreciate the unique considerations when using EHRs to study HL and psychiatric morbidities. EHRs may include a wider range of diagnosed psychiatric conditions for study, such as persistent mood disorders, than most national cohorts.

Desired Result: Participants will better understand both the utility and limitations of leveraging EHRs in epidemiologic study of HL and psychiatric conditions.

Level of Evidence: IV

Indicate IRB or IACUC: Columbia IRB AAAT8194 (approved September 2023), AAAU7114 (approved June 2023)

How Does the Duration of Hearing Loss Impact Long-Term Cochlear Implant Outcomes?

Khaled A. Altartoor, MD; Kaitlyn A. Brooks, MD
Joseph S. Schertzer, MD; Esther X. Vivas, MD

Objective: To investigate how the duration of pre-implantation hearing loss affects audiological outcomes after unilateral cochlear implant (CI) activation in adults with post-lingual hearing loss.

Study Design: Retrospective cohort

Setting: Single institution tertiary care center

Patients: Patients 18 years and older who have undergone unilateral CI

Interventions: Hearing loss duration was defined as the time from the onset of hearing loss to CI activation.

Main Outcome Measures: Primary outcomes: SRT, AzBio in Quiet, AzBio in Noise, and CNC Wordlist in quiet scores post-activation. Secondary outcomes: Pure-tone averages (PTAs) for each ear were calculated as the mean of the air conduction thresholds at frequencies of 500, 1000, 2000, and 4000 Hz. Mixed effects models were employed to analyze the effect of the duration of hearing loss on audiometric outcomes, adjusting for age, sex, and race, and accounting for serial audiometric evaluations for each individual.

Results: Among the 135 included patients, the median (IQR) age at CI was 66 (57.5 to 73) years, with the majority being female (65%) and White (76%). The median follow-up time was 5.14 (IQR: 2.96-8.02) years. In multivariable mixed-effects models, a one-year increase in the duration of hearing loss was significantly associated with worse AzBio in Quiet scores (β= -0.44, [95% CI: -0.81, -0.06]). The remaining relationships were not statistically significant ($p>0.05$).

Conclusions: This study supports previous studies showing that longer duration of hearing loss is associated with worse CI outcomes. Early intervention may yield better audiological outcomes, particularly in speech discrimination.

Professional Practice Gap & Educational Need: This study revealed discrepancies in clinical procedures regarding the scheduling of cochlear implants in adults with post-lingual hearing loss. Understanding how the length of pre-implantation hearing loss affects audiological outcomes may assist doctors in decision-making for better speech discrimination.

Learning Objective: To determine how the duration of hearing loss before cochlear implantation impacts speech discrimination and overall audiological outcomes in adults with post-lingual hearing loss.

Desired Result: This study may help physicians timing their cochlear implantation recommendations, leading to more personalized care and better hearing outcomes for patients.

Level of Evidence - Level IV – Retrospective cohort

Indicate IRB or IACUC : Emory University IRB #00107266

Factors Associated with Missed Post-Implantation Appointments Among Adult Cochlear Implant Users

Amritpal Singh, BS; Hasan Abdulbaki, BA; Lourdes Kaufman, BA
Rebecca Lewis, AuD, PhD; Nicole T. Jiam, MD

Objective: Although peak performances are achieved within one-year after cochlear implant (CI) surgery, post-implantation aural rehabilitation is not standardized among patients. Barriers to access for post-implantation appointments could have detrimental effects on patient outcomes. Thus, the study objective is to identify factors associated with missed post-implantation appointments among adult CI users.

Study Design: Retrospective cohort study.

Setting: Academic tertiary healthcare center.

Patients: Patients aged 18 or older, scheduled for the initial five post-implantation appointments within the first year of CI surgery between 2021-2023.

Results: Between 2021-2023, 97 out of the 491 implanted patients missed at least one of the follow-up appointments. 59% of these patients were 50 years of age or older, 61% were of Hispanic origin and 54% were single or divorced. 62% of the missed appointments occurred after the 1-month post-implantation appointment. Younger adult patients (ages 25-49) were more likely to make up a missed appointment (41%) compared to older adults (ages 50-75, 21%; ages >75, 28%) ($p=0.04$). While no gender differences were observed, Hispanics had a significantly lower appointment make-up rate (62%, $p=0.048$) compared to non-Hispanic patients. Multiple no shows (>1) for the same follow-up appointment was significantly higher among single or divorced patients ($p = 0.05$).

Conclusions: CI implant patients who are older, or of Hispanic origin and lack social support are more susceptible to missing appointments, especially after the 1-month post-implantation visit. Aural rehabilitation strategies that acknowledge and address these sociodemographic disparities may lead to improvements in post-implantation outcomes for CI users.

Professional Practice Gap & Educational Need: Follow-up care for adult cochlear implant patients is notably inconsistent among vulnerable populations. Understanding factors associated with and the broader implications of missed appointments can lead to development of targeted interventions aimed at improving post-implantation outcomes.

Learning Objective: By the end of this presentation, the audience will be able to identify factors contributing to missed follow-up appointments among adult cochlear implant patients.

Desired Result: Physicians, audiologists, and policymakers could collaborate to develop interventions aimed at addressing post-implantation non-adherence in cochlear implant users.

Level of Evidence - Level V

Indicate IRB or IACUC : Approved by the Institutional Review Board at the University of California, San Francisco (#23-39849).

Hearing Loss Prevalence and Disparities Among Older Adults in the United States, 2017-2020

Samantha J. Terhaar, MD; Febronia Mansour
Alexandra E. Quimby, MD, MPH

Objective: Recent estimates of hearing loss prevalence among older adults in the U.S. are based on self-reports; objective data are derived from earlier (≤2010) cycles of the National Health and Nutrition Examination Survey (NHANES). We seek to provide an updated estimate of hearing loss prevalence among older adults in the U.S. and assess differences across socioeconomic groups.

Study Design: Cross-sectional study using data from the 2017-March 2020 (pre-pandemic) cycle of NHANES, a nationally-representative study of non-institutionalized civilian U.S. population.

Setting: Household interviews and mobile examination sites.

Patients: Adults aged ≥ 70 years and older.

Interventions: Hearing loss was defined as an air-conduction 4-frequency pure-tone average (PTA) (0.5, 1, 2, and 4 kHz) of >25 dB in both ears. Sampling weights were applied to account for the complex sampling design and achieve nationally-representative estimates. Total population estimates were derived from 2017 U.S. Census data.

Main Outcome Measures: Prevalence estimates and odds ratios of hearing loss comparing categories of race/ethnicity, gender, and education level.

Results: An estimated 64.8% of Americans aged 70 years and older (21 million Americans) suffer bilateral hearing loss. Non-Hispanic Blacks and Hispanics other than Mexican Americans had lower odds of hearing loss compared to non-Hispanic Whites (OR 0.49[0.32–0.74] and 0.67[0.47–0.96], respectively); women had lower odds than men (OR 0.60[0.43–0.84]); and odds were higher among those with education levels of <9th grade compared to college graduates (OR 3.11[1.23–7.85]).

Conclusions: Among older adults in the U.S., population-level differences exist in hearing loss prevalence across socioeconomic groups.

Professional Practice Gap & Educational Need: Increase provider knowledge of the population-level burden of hearing loss as well as provide a population-level of understanding to the disparities that exist within the prevalence of hearing loss within the U.S.

Learning Objective: Examine updated estimates of prevalence of hearing loss and differences across socioeconomic groups in the U.S.

Desired Result: Demonstrate the magnitude of the problem and the presence of population-level disparities

Level of Evidence: Level I

Indicate IRB or IACUC: Exempt.

Metastasis to the External Auditory Canal: A Systematic Review

Madison V. Epperson, MD; Arushi Mahajan, BS
Christopher M. Welch, MD, PhD

Objective: To systematically review the literature and better understand the behavior, diagnosis, management, and mortality of distant metastasis to the external auditory canal (EAC).

Data sources: PubMed/Medline, EMBASE, Web of Science

Study selection: Studies through June 2023 describing patients with metastasis to the EAC were included. The non-English literature was excluded.

Data extraction: Study design, age, sex, pathology, primary site, staging, sites of temporal bone metastasis, time to EAC metastasis from diagnosis of primary malignancy, time from diagnosis of EAC metastasis to death, otologic symptoms, exam and imaging findings, and management.

Data synthesis: Data were synthesized qualitatively with means calculated when applicable. 32 studies met criteria, totaling 37 patients with metastasis to the EAC. The mean age at presentation was 58, 73% male. The most common pathologies were adenocarcinoma (37.8%), acute myelogenous leukemia (8.1%), and renal cell carcinoma (8.1%). Sites of the primary malignancy were hematologic (10.8%), breast (8.1%), esophagus (8.1%), renal (8.1%), and prostate (8.1%). Within the temporal bone, 73% had isolated metastasis to the EAC. Time to EAC metastasis from diagnosis of the primary was 25.6 months. Metastasis to the EAC was the first presentation of malignancy in 21.6% of patients. The average time to death was 5.8 months. Symptoms included hearing loss (59.5%), otalgia (27.0%), otorrhagia (24.3%), facial paralysis (21.6%), otorrhea (16.2%), and aural fullness (13.5%). On imaging, bony erosion was present in 50% of cases. Treatment was primarily palliative with excision and radiation.

Conclusions: EAC metastasis has distinct characteristics and behavior. Early biopsy to establish a diagnosis and allow for appropriate intervention is critical.

Professional Practice Gap & Educational Need: Characteristics of metastasis to the EAC are not well defined. Literature to date consists of case reports and a few limited case series describing temporal bone metastasis as one entity (EAC, middle ear, squamous portion, petrous apex, facial nerve, internal auditory canal). However, given the inherent external nature of the EAC, metastasis may more readily present to the Otolaryngologist with otologic symptoms and otoscopic findings, mandating increased awareness and knowledge of this uncommon, but life-altering pathology.

Learning Objective:

1) Identify characteristics of EAC metastasis: common pathologic subtypes and sites of the primary malignancy

2) Understand presenting otologic symptoms, examination, and imaging findings seen in EAC metastasis

3) Recognize palliative treatment strategies and prognosis of EAC metastasis

Desired Result: Individuals should recognize that metastasis to the EAC must remain on the differential when evaluating an EAC mass, particularly in middle-aged individuals with no history of chronic ear disease. Presentation pattern is distinct from other sites of temporal bone metastasis. Over 20% of patients may not have a history of malignancy. Early biopsy to establish a diagnosis and allow for appropriate intervention is crucial.

Level of Evidence – N/A- Systematic Review

Indicate IRB or IACUC : Exempt

Electrode Array Position within the Scala Tympani Correlates with Hearing Preservation

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Matthew Shew, MD; Cameron C. Wick, MD; Jacques Herzog, MD
Craig A. Buchman, MD; Nedim Durakovic, MD

Objective: The objective of this study was to evaluate the relationship between electrode array position within the scala tympani (ST) and acoustic hearing preservation (HP) after cochlear implantation. We hypothesized that a perimodiolar position along the cochlear floor may result in improved hearing preservation (HP) by allowing unimpeded vibration of the basilar membrane and organ of Corti.

Study Design: Retrospective cohort study.

Setting: Tertiary academic center.

Patients: Adults undergoing cochlear implantation between July 2016 and September 2020 with preoperative low frequency (125, 250 & 500 Hz) pure tone average (LFPTA) of less than 80 dB, postoperative CT demonstrating all electrode contacts within ST, and 1-month postoperative audiograms available for review.

Interventions: Cochlear implantation with a slim modiolar electrode array and postoperative CT.

Main Outcome Measures: Postoperative preservation of acoustic hearing.

Results: Ninety-five patients met inclusion and exclusion criteria, and hearing was preserved in 25 (26%). Electrode arrays located near the modiolus and cochlear floor demonstrated improved HP compared to those in an anti-modiolar position and in closer proximity to the basilar membrane ($r2=0.31$, $p<0.01$ and $r2=0.32$, $p<0.01$ respectively) with an apparent dose-response relationship.

Conclusions: There continues to be significant variability in HP, even when electrode array design and surgical techniques appear to be optimized. Electrode array positioning within the scala tympani may be one of the factors contributing to variability in HP. For well-placed arrays, biological factors will also play a role in long-term hearing preservation.

Professional Practice Gap & Educational Need: Despite advancements in electrode array design and atraumatic insertion techniques, significant variability remains in our ability to preserve acoustic hearing.

Learning Objective: Understand the role of electrode array positioning in hearing preservation.

Desired Result: Draw attention to a previously unrecognized factor in hearing preservation.

Level of Evidence - III

Indicate IRB or IACUC : IRB Approved, Washington University School of Medicine. IRB# 202011178

Hearing Preservation Outcomes for Patients with Small Sporadic Vestibular Schwannomas Who Elect to Undergo Microsurgical Resection

Pawina Jiramongkolchai, MD; Alexandra Vacaru, BS
Marc S. Schwartz, MD; Rick A. Friedman, MD, PhD

Objective: To evaluate hearing preservation (HP) outcomes for patients with small sporadic vestibular schwannomas (VS) who elect to undergo microsurgical resection.

Study Design: Retrospective cohort study.

Setting: Tertiary single-academic institution.

Patients: Individuals 18 years or older with sporadic VS who underwent microsurgical resection from 2018 to 2022.

Interventions: Microsurgical resection via a retrosigmoid (RS) or middle cranial fossa (MCF) approach.

Main Outcome Measures: Post-operative HP (WRS≥50%). Secondary outcome measures included facial nerve function and Penn Acoustic Neuroma Quality-of-Life (PANQOL) scores.

Results:
Of the 203 patients (n=128 females) who elected to undergo microsurgical resection, 164 (81%) and 39 (19%) underwent MCF and RS, respectively. The median tumor size was 10 mm (range 2 to 15) and the median age was 49 years (range 18-75). Overall, 123 (61%) patients retained hearing post-operatively. When HP was stratified by approach, post-operative WRS were statistically significantly better for patients who underwent a MCF approach compared to the RS approach (80% vs. 64%, respectively; p=0.04). At time of last follow-up, 95% of patients maintained a House-Brackmann 1 or 2, and there was no statistically significant difference in facial nerve outcomes between the two approaches (p=0.4). HP patients had significantly improved overall PANQOL scores compared to those without HP (p=0.02).

Conclusions:
For patients who elect to undergo microsurgical resection for small VS for hearing preservation, the MCF approach offers improved HP outcomes compared to the RS approach and is associated with excellent facial nerve outcomes, suggesting that the MCF approach should be offered to appropriate candidates.

Professional Practice Gap & Educational Need: There is no consensus regarding the best surgical approach for patients with small vestibular schwannomas with serviceable hearing.

Learning Objective: To understand differences in surgical and patient outcomes between hearing preservation techniques for VS.

Desired Result: To help better counsel patients regarding surgical options for small sporadic vestibular schwannomas.

Level of Evidence – Level V

Indicate IRB or IACUC : IRB #180978

Assessment of Satisfaction and Decisional Regret in Patients Undergoing Middle Fossa Craniotomies for Small Sporadic Vestibular Schwannomas

Pawina Jiramongkolchai, MD; Alexandra Vacaru, BS
Marc S. Schwartz, MD; Rick A. Friedman, MD, PhD

Objective: To evaluate patient satisfaction and decisional regret following middle cranial fossa (MCF) approach for removal of small sporadic vestibular schwannomas (VS).

Study Design: Retrospective cohort study.

Setting: Tertiary single-academic institution.

Patients: Individuals 18 years or older with small sporadic VS who underwent MCF from 2018 to 2022.

Interventions: Middle cranial fossa approach for resection of VS.

Main Outcome Measures: Patient satisfaction, using a patient satisfaction survey, and patient regret using the Ottawa decisional regret scale. Secondary outcomes included length of surgery, duration of hospital stay, post-operative hearing preservation (WRS≥50%) and facial nerve function.

Results:
Eighty-three patients completed the patient satisfaction and Ottawa decisional regret surveys. Overall, 88% (n=73) of patients were satisfied with their choice of surgery with 93% (n=77) of patients agreeing that surgery was the right decision, and 86% (n=71) of patients reporting that they would make the same choice of surgery again. Only 6% (n=5) of patients regretted their decision to have surgery. The median duration of surgery was 3.3 hours (range 1.9-5) and median length of hospital stay was 3 days (range 2-8). At the last follow-up, 98% (n=81) of patients maintained a House-Brackmann score of 1 or 2 and hearing was preserved in 65% (n=54) of patients. There was no significant difference in overall decisional regret scores based on hearing preservation status or gender ($p>0.05$).

Conclusions:
For patients with small sporadic VS who elect to undergo MCF, there is high satisfaction and low decisional regret as well as excellent surgical outcomes.

Professional Practice Gap & Educational Need: Management of small sporadic vestibular schwannomas remains controversial with no consensus regarding best practice. The middle cranial fossa (MCF) approach provides excellent exposure of the internal auditory canal for tumor removal while offering possibility of hearing preservation. Studies on MCF outcomes have historically focused on objective outcome measures, such as facial nerve function and hearing preservation. However, there is a need to better understand patient decision making and satisfaction, which, to date, have been understudied.

Learning Objective: To understand patient satisfaction and impact of decision making on overall experience for those patients who elect to undergo MCF approach for removal of their sporadic VS.

Desired Result: To help better counsel patients regarding options for management of sporadic small vestibular schwannomas.

Level of Evidence – Level V

Indicate IRB or IACUC : IRB #180978

Comparison of Unilateral Cochlear Implantation Outcomes in Single Sided Deafness and Asymmetric Hearing Loss

Rohit Chatterjee, BS; Gabriel G. Sobczak, MD
Rick F. Nelson, MD, PhD

Objective: To compare hearing outcomes after unilateral cochlear implantation (CI) in single sided deafness (SSD) and in asymmetric hearing loss (AHL) listeners

Study Design: Retrospective cohort study

Setting: Single institution, quaternary care center

Patients: Adult (n=49) and pediatric (n=22) patients from 2015-2022 who had SSD (n=37) and AHL (n=34) and who received unilateral cochlear implantation

Interventions: None

Main Outcome Measures: Pre- and post-operative AzBio scores, ipsilateral pure tone average (PTA), contralateral PTA, type of hearing loss (HL), duration of HL, duration of hearing aid (HA) use, DSM-5 diagnosis, device non-use

Results: Postoperative AzBio scores were significantly increased from preoperative levels across both SSD and AHL groups and all follow-up periods. Within the first 3 months of device use, on average 75.3% and 72.6% of total AzBio score increase were achieved for SSD and AHL groups, respectively. Patients with SSD had significantly shorter duration of hearing loss compared to AHL [4 years (range 0.25 – 15) vs. 16 years (range 1 – 64), $P<0.001$]. The SSD group had 24% device non-users while the AHL group had 12% non-users. Prevalence of DSM-5 diagnosis was 24% and 47% for SSD and AHL groups, respectively. DSM-5 diagnosis and age do not predict non-use based on linear modeling or ANOVA testing.

Conclusions: After unilateral CI, patients with SSD have similar improvements in word recognition and communication when compared to patients with AHL. Across type of HL and age groups, primary benefits of CI were achieved within the first three months post-operatively. Patients with AHL have a higher prevalence of DSM-5 diagnosis compared to the general population, but this did not correlate with device non-use.

Professional Practice Gap & Educational Need: Understanding key factors that impact hearing outcomes after cochlear implantation in the unique listening populations of SSD and AHL and how these may drive the need to develop novel aural rehabilitation programs after unilateral CI.

Learning Objective:

1. SSD shows similar improvements to AzBio when compared to AHL
2. Primary benefit of CI improved in the first 3 months for both SSD and AHL
3. There is a higher prevalence of non-use in patients with SSD vs. AHL
4. DSM-5 diagnosis or age does not correlate to device non-use

Desired Result: Improve patient outcomes and understand how factors impact cochlear implantation efficacy

Level of Evidence – Level III

Indicate IRB or IACUC : Exempt

The Prevalence and Prognosis of Positive Autoimmune Laboratory Markers in Idiopathic Sudden Sensorineural Hearing: A National Database Study

Adam S. Vesole, MD; Joseph T. Breen, MD.

Objective: To identify the prevalence of positive autoimmune laboratory markers in idiopathic sudden sensorineural hearing loss (iSSNHL) and its impact on hearing prognosis.

Study Design: Retrospective cohort database study

Setting: A collaborative national database (TriNetX) sourced from 79 large healthcare organizations in the United States.

Patients: Adults (≥18 years old) diagnosed with iSSNHL (ICD-10 H91.2) treated with systemic steroids.

Interventions: Autoimmune laboratory markers and salvage intratympanic (IT) steroids for SSNHL (CPT 69801).

Main Outcome Measures: 1) Positivity of autoimmune laboratory markers—Rheumatoid factor (RF), ANCA, DNA double strand Antibody (Ab), Sjogren Syndrome A and B Abs, SCL-70 Ab, Cardiolipin IgG Ab, Jo-1 Ab, ANA, Mitochondria Ab; 2) Percent of patients that underwent salvage IT steroids, utilized as a proxy for hearing outcomes.

Results: Subjects with iSSNHL (n=1,036) were approximately 6 times more likely to be positive for at least one autoimmune laboratory marker compared to subjects without iSSNHL (n=76,750; 4.4% vs. 0.7%, p=<0.0001). Of those with iSSNHL who received systemic steroid treatment, subjects with positive autoimmune markers (n=919) underwent salvage IT steroids at a similar rate to those with negative autoimmune markers (n=41,747; 14.5% vs. 13.2%, p=0.25). However, subjects with positive autoimmune markers underwent slightly more instances of IT steroids compared to those with negative autoimmune markers (0.38 vs. 0.30 injections/person, p=0.034).

Conclusions: Patients with iSSNHL have a significantly higher prevalence of positive autoimmune laboratory markers compared to the general population, however the presence of these markers does not predict treatment response or prognosis. Specifically, autoimmune markers did not predict the need for salvage IT steroids in iSSNHL. Although subjects with positive autoimmune markers underwent marginally more injections per person, this is unlikely to be clinically significant. Autoimmune laboratory testing may be useful in iSSNHL patients with additional symptoms suspicious for an autoimmune disorder. A generalized screening is not recommended as it is unlikely alter management or prognosis.

Professional Practice Gap & Educational Need: Previous studies have demonstrated an association between iSSNHL and systemic autoimmune disorders, however current AAO-HNS clinical practice guidelines recommend against obtaining routine laboratory tests in the workup of iSSNHL given the lack of treatment benefit with positive test results. There has been no large national database study analyzing the prevalence of positive autoimmune markers and its impact on iSSNHL prognosis.

Learning Objective: 1) Demonstrate the prevalence of positive autoimmune markers in iSSNHL compared to the general population. 2) Evaluate the impact of positive autoimmune markers on iSSNHL hearing prognosis and whether generalized autoimmune laboratory testing is appropriate.

Desired Result: Attendees will understand that generalized autoimmune marker testing in iSSNHL will not likely change prognosis or management. However, testing could be considered in select iSSNHL patients with other systemic autoimmune symptoms to aide in diagnosis given the higher prevalence of positive markers in iSSNHL.

Level of Evidence - IV

Indicate IRB or IACUC : Exempt

Characterizing the Predictive Power of Reported Auditory Symptom Resolution in the Immediate Post-Operative Period for Superior Canal Dehiscence Syndrome

Oren Wei, BS; Desi P. Schoo, MD; Jenny X. Chen, MD, EdM
Alexander Chern, MD; John P. Carey, MD

Objective: To determine if auditory symptom relief in the immediate post-operative period predicts longer-term relief for patients with superior canal dehiscence syndrome (SCDS).

Study Design: Retrospective case series.

Setting: Tertiary referral center.

Patients: Adults who underwent unilateral SCDS surgery between June 2021 and June 2023.

Interventions: Surgery for SCDS.

Main Outcome Measures: Patient-reported symptoms collected from pre-operative, immediate post-operative (<24 hours), and longer-term postoperative (12 weeks) clinical notes. Postoperative symptoms were categorized as no improvement from pre-operation, some relief, significant relief, and complete relief.

Results: Fifty-six patients (40 female, average age 49 years) underwent unilateral SCDS surgery (37 left, 19 right). Forty-seven (83.9%) approaches were middle fossa and 9 (16.1%) were transmastoid. Auditory symptoms of autophony, somatosounds, and pulsatile tinnitus were reported by 98.2%, 96.4%, and 73.2% of patients, respectively. For autophony, 52 (94.5%) patients reported significant or complete symptomatic relief at 12 weeks. Of these, 100% reported at least some relief within 24 hours of surgery. One patient reported no improvement of their autophony within 24 hours and subsequently no relief at 12 weeks. Patients who reported significant or complete relief within 24 hours were more likely to report significant or complete relief at 12 weeks (OR: 32.7, 95% CI: 2.3-471.0, p=0.005). Somatosounds showed a similar response rate at 12 weeks (96.3%) with all patients reporting improvement at 24 hours. Pulsatile tinnitus responses suggested delayed improvement with 70.7% reporting significant or complete relief at 12 weeks, 44.8% of whom reported improvement at 24 hours.

Conclusions: Auditory symptom improvement in the immediate post-operative period strongly predicts longer-term auditory symptom relief.

Professional Practice Gap & Educational Need: Superior semicircular canal surgery is considered the definitive treatment for patients with SCDS; however, some report persistent symptoms postoperatively. Determining the timeline for perioperative symptom response and its association with long-term symptom control may allow surgeons to prognosticate outcomes.

Learning Objective: To provide insights into how reported symptom resolution in the perioperative period may predict long-term symptom response for SCDS patients.

Desired Result: Participants will gain an understanding of the relationship between immediate post-operative and long-term symptom outcomes in SCDS patients.

Level of Evidence - V

Indicate IRB or IACUC : Johns Hopkins University School of Medicine Institutional Review Board (IRB00324480)

Effects on Hearing of Ventriculoperitoneal Shunt Placement in Patients with Normal Pressure Hydrocephalus: A Prospective Cohort Study

Emily Wang, MD; Rosaly Goyette; André Turmel, MD; Paule Lessard-Bonaventure, MD
Louis Verret, MD; Yannick Nadeau, MD; Sylvie Nadeau, MD

Background : Normal pressure hydrocephalus (NPH) is defined by a triad of dementia, gait disturbance and urinary incontinence. Treatment usually implies surgery for ventriculoperitoneal shunt placement. Complaint of subjective hearing loss is a frequent complication following ventriculoperitoneal shunt for NPH. It is seldom documented with audiometric testing.

Objective: We aim to determine the incidence of hearing loss after ventriculoperitoneal shunt placement in patients with normal pressure hydrocephalus

Study Design: Prospective cohort study

Setting: Tertiary academic reference center, ambulatory setting

Patients: patients aged from 65 to 85 years old with normal pressure hydrocephalus

Interventions: ventriculoperitoneal shunt placement

Main Outcome Measures: audiograms before the surgery and at 3 months post-operatively

Results: Preliminary data in our consecutive series of 10 patients that underwent ventriculoperitoneal shunt placement showed that all patients had hearing loss on preoperative audiogram. 60% are female and the mean age is 74 years old. Two patients complained of worsening hearing loss and one complained of aural plenitude. One patient developed significant asymmetrical hearing loss on post-operative audiogram three months following shunt placement. Loss of 35 dB was noted in the right ear for 250 Hz, 20 dB at 500 Hz, and 15 dB at 8000 Hz. Interaural difference of 40 dB at 250 Hz and 25 dB at 500 Hz. The left ear was stable. Nine other patients did not show significant hearing loss on post-operative audiometric testing.

Conclusions: Persistent and severe hearing loss seems to be under-documented in this at-risk population.

Professional Practice Gap & Educational Need: There is a limited number of case reports and case series documenting hearing loss following ventriculoperitoneal shunt placement. Audiograms are not routinely performed post-operatively for these patients.

Learning Objective: To describe the impact of procedures causing variation in cerebrospinal fluid pressure like ventriculoperitoneal shunt placement on hearing.

Desired Result: Integrate audiometric testing and otologic follow-up as part of a comprehensive management of patients undergoing shunt placement for normal pressure hydrocephalus. To raise awareness for providers of otologic service on the possible impact of shunt placement on hearing.

Level of Evidence – Level III

Indicate IRB or IACUC : Approved IRB00001242, CHU de Québec-Université Laval

Vestibular Migraine Among Dizzy Patients: A Single Institution Study

Mustafa G. Bulbul, MD, MPH; Benjamin Clark, BS
Dominic Coutinho, BS; Brian M. Kellermeyer, MD

Objective: To facilitate the diagnosis of vestibular migraine (VM) among new patients presenting with dizziness to Otolaryngology (as per criteria of the Barany and International Headache Society) and estimate prevalence of VM and other causes of dizziness in our clinic.

Study Design: Retrospective cohort study

Setting: Tertiary academic center

Patients: Adults (≥18 years old) presenting with a complaint of dizziness.

Intervention: We designed a survey to be provided to new patients presenting with a complaint of dizziness.

Main Outcome Measures: Prevalence of VM and other causes of dizziness amongst all dizzy patients presenting to our clinic, proportion of VM patients meeting diagnostic criteria.

Results: Eighty-nine patients were included in our study. Benign paroxysmal positional vertigo (BPPV) accounted for 22.5%, Meniere's for 14.6%, VM for 13.5% and vestibular neuritis for 9% of patients with dizziness. Of the patients with VM, 4 patients met the criteria for VM and 2 for probable VM; the remaining 6 patients did not meet the full criteria but were not better accounted for by another diagnosis. Of the BPPV patients, 7 reported migraines with symptoms and 4 associated symptoms with vertigo. Interestingly, 4 patients were diagnosed with cerebrovascular accident which was confirmed on imaging.

Conclusions: Surveys assist in identifying the different causes of dizziness and may help prevent important misses like cerebrovascular accidents. Even though 13.5% were diagnosed with VM, only 6/12 patients met the full criteria for probable VM or VM. Criteria for VM are strict and may miss a significant number of patients eligible for treatment.

Professional Practice Gap & Educational Need: VM is the most common cause of episodic dizziness, affecting around 2.7% of US adults. The diagnostic criteria for VM were first published in 2012 by Barany society and International Headache Society with a recent update in 2021 that was essentially with no changes. Previous studies have shown the criteria to be stringent and highly likely to exclude VM patients that might benefit from treatment. In a busy Otolaryngology practice, it might be hard to elicit all the symptoms needed for the diagnosis, thus we developed a survey to better capture patient complaints and accurately estimate the prevalence of VM in our clinic.

Learning Objective: Surveys are important adjuncts in identifying the diagnosis in dizzy patients. VM is hard to diagnose and is likely underdiagnosed due to stringent criteria which probably needs revised.

Desired Result: Adoption of surveys in Otolaryngology clinics for dizzy patients. Revision of VM diagnostic criteria.

Level of Evidence – Level III

Indicate IRB or IACUC: IRB approval was obtained (WVU Protocol #2106339604 September 29, 2021)

Surgical Characteristics, Complications and Outcomes with an Active Transcutaneous Bone Implant: A Systematic Review

Alma Jukic, BA; Christopher C. Munhall, MD; Shawn M. Stevens, MD

Objective: An active transcutaneous bone conduction device (BCD) was approved in 2019 in the US. This systematic review sought to evaluate early outcomes of Osia-2 implantation.

Data Sources: PubMed, Scopus, Cochrane CENTRAL, and CINAHL were queried using the search terms: active transcutaneous hearing device, bone conduction implant, hearing loss, conductive hearing loss, Osia, bone-anchored hearing aid through April 2023.

Study Selection: Studies were included if they described audiometric, surgical characteristics/complications, or adverse events associated with this BCD. Exclusion criteria included: non-English studies, nonhuman studies, reviews/meta-analyses, case reports, database studies.

Data Extraction: PRISMA guidelines were used to extract data from 18 studies. ROBINS-I tool was utilized to assess the risk of bias across seven domains: bias due to confounding, bias due to the selection of participants into the study, bias due to classification of interventions, bias from missing data, bias in outcome measurements, and bias in the selection of reported results.

Data Synthesis: A total of 836 studies were screened, and 18 met inclusion criteria. 336 patients were included. The average age was 37.9 years. 79.5% of patients had MHL/CHL and 19.5% had SSD/SHL. Mean operative time was 71.6 minutes. Mean PTA gain from unaided conditions was 35.4 dB. Mean PTA gain at high frequency (6k Hz and above) from aided conditions was 16.1 dB. Mean improvement in speech recognition thresholds was 19.1 dB from unaided conditions. Adverse events/complications occurred in 20.1% of cases. The global rate of postop infections for the included cohort was 5%. 2% of patients had magnet retention issues, while 1.65% of cases were complicated by hematomas.

Conclusions: Initial results of this new BCD show a low rate of postoperative complications, relatively short surgical time, and greater hearing restoration at higher frequencies.

Professional Practice Gap & Educational Need: Currently, there is no systematic review that describes the surgical characteristics and adverse events associated with this active, transcutaneous device. A need remains for synthesis of the available literature for the Osia-2 implant system.

Learning Objective: To review the various surgical characteristics**,** adverse events**,** and audiologic outcomes to help improve our current understanding of active**,** transcutaneous devices with piezoelectric technology**.**

Desired Result: Describe patient demographics, indications, operative findings, complications and audiometric outcomes associated with the Osia-2 implant.

Level of Evidence – III

Indicate IRB or IACUC: Exempt.

Outcomes after Microsurgery and Stereotactic Radiation for Vestibular Schwannoma: A Retrospective Multinational Database Analysis

Heather J. Smith, BM; Jason L. Steele, BS; Mana Espahbodi, MD
Neil S. Patel, MD; Richard K. Gurgel, MD, MSCI

Objective: To compare outcomes in patients with sporadic vestibular schwannoma (VS) treated with microsurgery and stereotactic radiotherapy (SRT) using a multinational database.

Study Design: Retrospective cohort

Setting: Patient data were identified from TriNetX, a global health research database with data from 117 million patients across 79 participating healthcare organizations. 95% of data used in this study were from 2005-2023.

Patients: Adults with benign neoplasm of cranial nerve (ICD-10 D33.3), used as an approximation for VS, with CPT codes for skull base microsurgery or SRT, without a diagnosis of neurofibromatosis type 2.

Interventions: Microsurgical resection and SRT

Main Outcome Measures: Risks of repeat treatment with microsurgery or SRT, tinnitus, dizziness, cranial nerve 3-7 dysfunction, meningitis, and hearing rehabilitation surgery

Results: 5,032 adults were identified who underwent microsurgery for initial treatment of VS (mean age at surgery 51.8 ± 13.9 years), and 1,541 patients initially treated with SRT (mean age at SRT 62.0 ± 13.2 years). Of the surgical cohort, 5.0% underwent repeat microsurgery (median time to treatment 68 days) and 3.1% underwent salvage SRT (median time 1.1 years). Of the SRT cohort, 2.1% had subsequent microsurgery (median time 2.8 years), while 2.2% had repeat SRT (median time 1.6 years). When matched for age, patients who underwent surgery had a higher risk of subsequent surgery than SRT patients (RR: 1.80, 95% CI: 1.15-2.81), but risk differences for subsequent SRT and for any further treatment were not significant. Patients treated with surgery were at higher risk than age-matched SRT patients for facial paralysis (RR: 4.32, 95% CI: 3.47-5.37), meningitis (RR: 5.23, 95% CI: 2.90-9.43), and cranial nerve 3-6 dysfunction (RR: 1.49, 95% CI: 1.04-2.14). SRT patients were at higher risk for tinnitus (RR: 0.77, 95% CI: 0.66-0.90). There was no significant difference between risk of dizziness between surgical and SRT treated cohorts.

Conclusions: Failure rates after treatment of sporadic VS in adults were less than 10%. Surgery-treated patients were at a higher risk than SRT-treated patients for complications including facial nerve dysfunction; this finding may be confounded by tumor size. SRT patients were at higher risk of tinnitus than surgery patients.

Professional Practice Gap & Educational Need: The decision of whether to surgically resect, radiate, or observe a VS is complex, and post-treatment outcomes are not fully understood. A better understanding of the risks of repeat treatments and other complications is necessary to guide decision-making.

Learning Objective: To examine risks of repeat treatments and other complications after VS treatment.

Desired Result: Attendees will have a better understanding of post-treatment outcomes in adults with sporadic VS.

Level of Evidence: Level IV

Indicate IRB or IACUC: Exempt

Treatment Outcomes in Patients with Neurofibromatosis Type 2-Associated Vestibular Schwannoma: A Retrospective Analysis using a Multinational Database

Heather J. Smith, BM; Jason L. Steele, BS; Mana Espahbodi, MD
Neil S. Patel, MD; Richard K. Gurgel, MD, MSCI

Objective: To compare outcomes in patients with neurofibromatosis type 2 (NF2)-associated vestibular schwannoma (VS) treated with microsurgery, stereotactic radiotherapy (SRT), and bevacizumab.

Study Design: Retrospective cohort

Setting: Patient data were identified from TriNetX, a global health research database with data from 117 million patients across 79 participating healthcare organizations. 95% of data included in this study were from 2009-2023.

Patients: Adults with ICD-10 and CPT codes for NF2, skull base microsurgical excision, SRT, and bevacizumab.

Interventions: Microsurgical excision, SRT, and bevacizumab

Main Outcome Measures: Rates of initial and repeat VS treatment, absolute and relative risks of tinnitus, dizziness, and cranial nerve 3-7 dysfunction.

Results: 3,530 adults with NF2 were identified (mean age at diagnosis 41.5±19.5 years, 55% female, 67% white). Of these, 8.13% underwent microsurgery and 1.36% underwent SRT for initial treatment of VS. Rates of subsequent VS treatment after initial surgery or SRT were 18.47% and 12.50%, respectively. These rates were higher than that of an age-matched cohort of sporadic VS patients (RR 2.40, 95% CI: 1.84-3.11 and RR 2.92, 95% CI: 1.33-6.40). Of 229 NF2 patients started on bevacizumab prior to any VS treatment, 4.8% subsequently underwent microsurgery and 1.3% underwent SRT. When compared with a cohort of 3,277 patients never on bevacizumab, 7.8% of those on bevacizumab underwent microsurgery and 1.7% underwent SRT, but the differences between these two cohorts were not statistically significant.

Conclusions: NF2 patients with VS were at higher risk than sporadic VS patients of repeat treatment. The rate of repeat treatment after surgery likely reflects a shift toward function preservation and subtotal tumor resection. Given that the rate of retreatment after SRT is higher than that for sporadic tumors, it remains likely that NF2-related VS are more radioresistant. The effect of bevacizumab on VS progression in NF2 patients remains unclear. Limitations of this study include small sample size of patients treated with bevacizumab and coding limitations.

Professional Practice Gap & Educational Need: A better understanding of the post-treatment outcomes of NF2-related VS is needed to guide decision-making. The use of bevacizumab in NF2 patients is promising, but its effect on tumor growth and need for treatment is not yet fully understood.

Learning Objective: To examine risks of repeat treatments and other complications after treatment of VS with observation, microsurgery, radiation, and/or bevacizumab in adults with NF2.

Desired Result: Attendees will have a better understanding of post-treatment outcomes in adults with NF2-related VS.

Level of Evidence: Level IV

Indicate IRB or IACUC: Exempt

National Practice Patterns in Repair of Lateral Skull Base CSF Leak: Analysis of the NSQIP Database

Matthew D. Adams, MD; Ryan M. Kong, MD; Matthew B. Hanson, MD

Objective: To examine current surgical practice patterns and outcomes in the management of lateral skull base CSF leaks in the United States.

Study Design: Retrospective cohort study.

Setting: Multiple institutions participating in the American College of Surgeon's National Surgical Quality Improvement Program (ACS-NSQIP).

Patients: The ACS-NSQIP database from 2005 to 2020 was queried for patients undergoing middle cranial fossa (MCF) or transmastoid (TM) repair of lateral skull base CSF leak.

Interventions: Lateral skull base CSF leak repair via middle cranial fossa MCF or TM approach.

Main Outcome Measures: Patient demographics, medical co-morbidities, operating time, complications.

Results: A total of 462 patients were identified, 354 (76.6%) underwent MCF repair and 108 (23.4%) underwent TM repair. The MCF and TM groups had significant differences in race/ethnicity ($p<0.001$), but no other significant differences in demographics or medical co-morbidities. The MCF group had higher rates of ASA class >2 [219 (61.9%) vs 45 (41.7%); $p<0.001$] and lower average operative time [175 (std 111.8) vs 208.1 (std 145.9) minutes; $p=0.016$)] compared to the TM group. Higher rates of any adverse event were observed in the MCF group [66 (18.6%) vs 11 (10.2%); $p=0.039$], as well as rates of severe complications [59 (16.7%) vs 9 (8.3%); $p=0.031$). Multivariate analysis demonstrated similar odds ratios between the MCF and TM groups for any adverse event [0.53 (0.26-1.09); $p=0.083$] and severe complications [0.46 (0.21-1.00); $p=0.050$)].

Conclusions: MCF repair of lateral skull base CSF leak is more common than TM, and with lower average operating time. However, MCF repair is associated with higher rates of complication.

Professional Practice Gap & Educational Need: The choice of surgical approach to lateral skull base repair is nuanced, with contributions from both patient factors and surgeon preference. Our study reports current practice trends and surgical outcomes that may help inform surgeons to educate patients and contribute to future investigation.

Learning Objective: To understand current practice trends as well as surgical outcomes and complications in patients undergoing repair of lateral skull base CSF leak.

Desired Result: Change physician knowledge regarding practice patterns and encourage surgical quality improvement in repair of lateral skull base CSF leak.

Level of Evidence – Level III

Indicate IRB or IACUC: Exempt

Geographic Distribution of US Veterans with Severe Hearing Loss and Associated Treatment

Sarah E. Loheide, BS; Andrew Nicholson, MSPH; Scott E Sherman, MD
Joshua Chodosh, MD; David R. Friedmann, MD

Objective: The VA is the largest health care system in the US and offers comprehensive hearing services. In this study, we map and analyze geographic variations in treatment among US Veterans with severe hearing loss.

Study Design: Retrospective cohort

Setting: Tertiary referral centers

Patients: US Veterans with severe or worse hearing loss (four frequency pure tone average > 70 dB HL) and bilateral speech recognition scores < 50% between 2015-2019.

Interventions: Therapeutic

Main Outcome Measures: Primary outcome of this study is the geographic distribution of Veterans with severe hearing loss and treatment received (hearing aids or cochlear implants) while accounting for rural status, Veterans Integrated Services Networks (VISN) classification and distance to VA CI facilities. VA Audiometric Repository data was analyzed using Geographic Information System (GIS) software.

Results: 34,793 US Veterans were included and 1,112 received CI. Significantly more CI recipients lived in urban areas compared to rural ($X^2 = 6.04$, $p = 0.0487$). There was no significant difference between patients with and without CI in driving time or distance to primary care center ($t = -1.28$, $p = 0.1994$ and $t = -1.06$, $p = 0.2889$ respectively). Capitol Health Care Network (VISN 5) had the greatest proportion of SHL patients receiving CI (6.6%) and NY/NJ Health Care Network (VISN 3) had the lowest (1.1%).

Conclusions: While Veterans in this cohort resided predominantly in urban areas, the proportion receiving CI was similar across rural classifications. Variations in CI frequency by VISN may reflect differences in access rather than burden of disease. This highlights how geography may influence practice variations in treatment.

Professional Practice Gap & Educational Need: US Veteran hearing healthcare accessibility

Learning Objective: Convey the geographic distribution of US Veterans with severe hearing loss and the rates of cochlear implantation within this population using variables that relate to patient access to hearing health care.

Desired Result: Identify geographic patterns that influence Veteran access to treatment modalities for severe hearing loss and highlight any potential gaps in care.

Level of Evidence – Level III

Indicate IRB or IACUC : New York Harbor VA Health Care System #1575049-13. Approved on 10/1/2018

Performance Following Cochlear Reimplantation Utilizing a Different Manufacturer

Justin Cottrell, MD; Emily Spitzer, AuD; Bruce Gantz, MD
Jacques Herzog, MD; Craig Buchman, MD; Susan Waltzman, PhD
J. Thomas Roland Jr., MD

Objective: To better understand cochlear implant (CI) performance following reimplantation with a different device manufacturer.

Study Design: Multicenter retrospective case review

Setting: Tertiary referral centers

Patients: Patients greater than four years of age who received a CI and subsequently underwent CI re-implantation with a different manufacturer over a 20-year period.

Interventions: *NA*

Main Outcome Measures: Difference in the best CNC score obtained with the primary CI, compared to the most recent CNC score obtained following reimplantation.

Results: The best average CNC score achieved by adult patients following primary cochlear implantation was 46.2% (n=16), measured an average of 14 months (range: 3 -36 months) post-operatively. When looking at the most recent CNC score of adult patients prior to undergoing reimplantation, the average CNC score dropped to 19.2% (n=17). Following reimplantation, the average 3–6 month CNC score was 48.3% (n=12), with most recent average CNC score being 44.4% (n=17) measured an average of 19 months (range: 3 – 46 months) post-operatively. There was no statistically significant difference ($p=0.321$; $t(11)=0.48$) identified in performance between the best CNC score achieved by adult patients following primary cochlear implantation, and the most recent score achieved following reimplantation (n=12). Analysis of pre- and post-revision speech performance was not possible in pediatric patients (<18yo) due to differences in tests administered.

Conclusions: Cochlear reimplantation with a different manufacturer is a viable option for patients when CI reimplantation is considered.

Professional Practice Gap & Educational Need: Studies looking at re-implantation outcomes demonstrate that most patients achieve similar or improved performance following revision surgery. Although the majority of patients choose a new device from the same manufacturer, a subset of patients may choose a different device manufacturer for a variety of reasons. Factors that may affect post-implantation speech performance following manufacturer change are not well characterized in the reimplantation literature.

Learning Objective: To understand speech performance outcomes and considerations when completing cochlear reimplantation with a different manufacturer.

Desired Result: Improved patient communication and surgical decision making when faced with cochlear implant failure and indication for reimplantation.

Level of Evidence – Level III

Indicate IRB or IACUC : IRB # s22-01390 at NYU Langone Health

An Investigation of Robotic Assisted vs Manual Cochlear Implant Insertion Forces

Nathan C. Kemper, MD; Allan M. Henslee, PhD; Marlan R. Hansen, MD

Hypothesis: We hypothesize that robotic insertion (either skull-mounted or handheld) of a cochlear implant (CI) electrode array will decrease the maximum insertion force and variation compared to manual insertion.

Background: Although advances in CI technology have established "hearing preservation" techniques to reduce intracochlear trauma, outcome variability remains high. To address this issue, a robotics-assisted insertion system was designed to aid the surgeon in inserting CI electrode arrays with consistent speeds. This study evaluates whether robotic skull-mounted vs. handheld vs. manual insertion techniques affect the maximum insertion force and variability.

Methods: Three surgeons with varying otologic surgical experience were tasked with manual (n=18) and fixated robotic assisted CI insertions (n=18) in a standardized 3D-printed synthetic cochlea. Insertion forces were characterized with a load cell detecting both maximum insertion force (mN) and force variation (mN/sec). A third sample using a handheld robotic insertion is being collected currently.

Results: The robotic assisted system showed a statistically significant reduction in the insertion force variation of 24.3 mN vs 109.5 mN ($p<0.001$) at 0.1 mm/sec, and 32.1 mN/sec vs 105.0 mN/sec ($p= 0.007$) at 1.0 mm/sec. Similarly, it showed a statistically significant reduction in the maximum insertion force of 32.1 mN vs 64.9 mN ($p=0.049$) at 0.1 mm/sec, and 32.9 mN vs 48.0 mN ($p= 0.046$) at 1.0 mm/sec.

Conclusions: These results indicate a significant reduction in maximum force and force variation with a robotic insertion versus current manual insertions. Robotics-assisted results may indicate the ability to improve patient outcomes with hearing preservation techniques.

Professional Practice Gap & Educational Need: Current manual CI implantation techniques can result in high maximum insertion forces and variations due to human kinematics and tremor, despite experience. We seek to demonstrate how the implementation of a fixated or handheld robotic device vs. manual insertion technique can significantly decrease insertion forces.

Learning Objective: To demonstrate an atraumatic robotic CI implantation technique, significantly decreasing both maximum insertion force and force variation.

Desired Result: Increase participant understanding of novel "trauma reduction" implantation techniques with a robotic system to decrease cochlear trauma.

Level of Evidence - Level V

Indicate IRB or IACUC : Exempt

Accuracy of Trans-Impedance Matrix for Cochlear Implantation in Patients with Abnormal Anatomy: Characterizing Patterns and Sensitivity

Justin Cottrell, MD; Arianna Winchester, MD; Daniel Jethanamest, MD
Mario Svirsky, PhD; William Shapiro, AuD
Sean McMenomey, MD; J. Thomas Roland Jr., MD

Objective: To assess false positive and negative rates of trans-impedance matrix (TIM) heatmap interpretation within patients at risk of labyrinthine abnormality, to better understand characteristic TIM heatmap patterns, and potential limitations.

Study Design: Single center retrospective case review

Setting: Tertiary referral center

Patients: Patients >6 months of age at risk for labyrinthine abnormality that underwent cochlear implantation and had both TIM testing and post-operative x-ray available.

Interventions: *NA*

Main Outcome Measures: TIM heatmap assessment was compared to post-operative x-ray assessment to determine the false positive and negative rates of TIM.

Results: Seventy-seven patients were evaluated. Twenty-five percent (n=19) of patients had a concern for an abnormal TIM pattern, which were further analyzed and separated into eleven novel and mutually defined objective categories. Overall, 9% (n=6) of electrodes were malpositioned on intra-operative x-ray, of which 50% (n=3) were under inserted, 17% (n=1) were over inserted, 17% (n=1) demonstrated a tip foldover, and 17% (n=1) demonstrated a coiled electrode. The false positive TIM rate was 18% (n=14), and false negative TIM rate was 3% (n=2) for the entire cohort.

A newly defined skip heat pattern was identified in patients with IP2/Mondini malformation and interscalar septum width <0.5mm at the cochlear pars ascendens.

Conclusions: Sensitivity for tip foldover remained high. Detection of under and over insertion was low, and false positive rate was moderate. Novel objective patterns for TIM heatmap characterization is provided to facilitate comparative research moving forward. In doing so, a newly described pattern termed skip heat with potential anatomic explanation and clinical relevance is highlighted.

Professional Practice Gap & Educational Need: Trans-impedance matrix (TIM) technology has demonstrated high sensitivity and specificity for detection of electrode malposition within the normal cochlea, and is used as a sole modality of electrode placement confirmation at some centers. The effect of labyrinthine abnormality on TIM performance is poorly understood and is important for ensuring optimal placement in this patient cohort.

Learning Objective: To better understand TIM heatmap interpretation in patients at risk of labyrinthine abnormality.

Desired Result: Improved understanding of the strengths and limitations of TIM heatmap technology to optimize cochlear implant electrode placement.

Level of Evidence – Level III

Indicate IRB or IACUC : IRB S23-00953 at NYU Langone Health

Exploring Meniere's Disease Treatment Patterns Among Neurotologists

Karen Tawk, MD; Joshua K. Kim, BS; Harrison W. Lin, MD
Mehdi Abouzari, MD, PhD; Hamid R. Djalilian, MD

Objective: To document current treatment practices for Meniere's disease (MD) among members of the American Neurotology Society (ANS).

Methods: An online survey was conducted among 304 ANS members to capture their treatment patterns in caring for MD patients.

Results: Sixty-two (20%) surveys were completed by ANS members. Among these respondents, 52% worked in academic practices while 34% practiced in private settings. Notably, 57% had over a decade of clinical experience and 47% managed large cohorts of patients (>50 cases) annually. As a first-line treatment approach for MD, 97% recommended MD diet and lifestyle modifications, while 50% opted for migraine diet and lifestyle modifications, and 39% prescribed diuretics. As for second-line treatments, diuretics (47%), intratympanic (IT) steroids (32%), betahistine (29%), and migraine prophylactic medications (28%) were the prominent choices. For MD cases unresponsive to medication, 70% of respondents chose IT steroids, while other choices included migraine diet and lifestyle modifications (45%) and migraine prophylactic medications (32%). If surgical management failed, 57% opted for reoperation with a different surgical approach. When confronted with bilateral MD, respondents recommended MD diet and lifestyle modifications (95%), diuretics (53%), and migraine diet and lifestyle modifications (52%) as the first-line treatment, with IT steroid as the preferred second-line option (40%). Finally, when one side was deaf due to MD and the other developed MD, 52% advocated for migraine diet and lifestyle modifications and 26% suggested migraine prophylactic medications as the first-line approach.

Conclusion: The current patterns of care for MD from a sample of ANS members reveal an increasing trend in the use of migraine diet and lifestyle modifications and prophylactic medications. These findings will guide the development of a new comprehensive treatment algorithm for MD patients.

Define Professional Practice Gap & Educational Need: The pathophysiology and management of MD have remained a subject of debate. Previous studies have highlighted the challenges in treating MD patients due to the absence of a definitive treatment algorithm. Consequently, there is a need to capture the current treatment patterns among experts in the field of neurotology to develop a definitive treatment approach.

Learning Objective: To propose a treatment algorithm for MD patients based on the practice patterns among ANS members, particularly considering evolving pathophysiological theories. This implies the development of a more comprehensive management approach for MD patients while staying informed of the latest recommendations.

Desired Result: Informing neurotologists of current treatment practice patterns for MD among members of the ANS that could guide the development of a treatment algorithm to improve the management of patients with MD.

Level of Evidence – Not applicable.

Indicate IRB or IACUC: Not applicable.

Intracochlear Electrocochleography Estimates Favorability of Intrascalar Position with the Slim Modiolar Electrode

Jordan J. Varghese, MD; Tim Holden, BSE; Matthew A. Shew, MD
Cameron C. Wick, MD; Jacques A. Herzog, MD;
Nedim Durakovic, MD; Craig A. Buchman, MD

Objective: To evaluate the degree that intracochlear electrocochleography (ECochG) estimates favorable intrascalar position of the slim modiolar electrode (SME) on postoperative computed tomography (CT).

Study Design: Prospective cohort.

Setting: Tertiary referral center.

Patients: Sixteen adult cochlear implant (CI) recipients implanted with the SME from July 2022 to September 2023.

Interventions: Intraoperative ECochG monitoring with tone-bursts presented from 250 Hz to 2 kHz at 108 to 114 dB HL and intracochlear recordings off the SME. A fast Fourier transform (FFT) allowed for frequency-specific evaluation of ECochG response and patterns were identified based on tonotopic expectations.

Main Outcome Measures: Postoperative CT was used for intracochlear measurements. An unfavorable position was indicated by proximity to the basilar membrane (i.e., high vertical displacement) and an anti-modiolar position (i.e., high lateral displacement). The middle third of the array had the greatest variability in intrascalar position at a clinically critical portion of the cochlea.

Results: Seven patients had tonotopic ECochG patterns and nine had non-tonotopic patterns. Independent sample t-test evaluated the difference in intrascalar position for the middle third of the SME. Non-tonotopic cases (mean lateral displacement=0.51, SD=0.08) were positioned more anti-modiolar compared to tonotopic cases (mean=0.41, SD=0.06; mean difference=0.10, 95%CI: 0.02 to 0.17). Non-tonotopic cases (mean vertical displacement=0.56, SD=0.08) were closer to the basilar membrane compared to tonotopic cases (mean=0.47, SD=0.08; mean difference=0.09, 95%CI: 0.01 to 0.18).

Conclusions: Intracochlear ECochG provides insight into intrascalar SME position. Early findings suggest that tonotopic ECochG indicates the array is closer to the modiolus and the cochlear floor.

Professional Practice Gap & Educational Need: Variability in intracochlear position contributes to CI performance outcomes. Given the microscopic and delicate anatomy of the cochlea, malposition of the internal array during insertion is a valid concern and there is minimal feedback available to the surgeon about final array position. Intraoperative ECochG provides real-time feedback that gives an "electrophysiologic window" into CI seating within the cochlea. This study prospectively evaluated the degree by which ECochG patterns predict position of the internal array on postoperative imaging.

Learning Objective: To better understand the utility of intracochlear ECochG on estimating SME position in real-time.

Desired Result: Clinical practitioners and researchers will gain deeper understanding of the unique value and feasibility of ECochG during cochlear implantation for predicting clinical outcomes and providing real-time surgical feedback. This knowledge could be an important factor to guide future decisions regarding the utility of electrophysiology monitoring programs with ECochG at CI centers.

Level of Evidence – Level III

Indicate IRB or IACUC: Washington University in St. Louis IRB #202007087 (Initial approval on 08/06/2020; Continuing review approved on 05/16/2023)

Big Data Analysis of Surgical Outcomes Between Microsurgery and Stereotactic Radiosurgery for Patients with Acoustic Neuroma

Robert E. Africa, MD; Brian J. McKinnon, MD, MPH, MBA

Objective: To evaluate the functional outcomes, debilitation, and risks between microsurgery and stereotactic radiosurgery (SRS) in a large multicenter database.

Study Design: Retrospective cohort study with deidentified data

Setting: 79 healthcare centers in the U.S. TriNetX Database

Patients: 712 patients who were diagnosed with acoustic neuroma

Interventions: Microsurgery vs SRS

Main Outcome Measures: The differences in functional outcomes, debilitation, and risks including dysarthria, dysphagia, the need for facial nerve reanimation, re-intervention with the other treatment, the need for physical/occupational therapy, and tinnitus. All outcomes were measured at 6 months, 1 year, 3 years, 5 years, and 10 years posttreatment as relative risks (RR).

Results: Propensity score matching created two statistically similar cohorts with either intervention. Primary microsurgery was associated with a higher rate of functional impairments at 6 months including dysphagia (RR: 3.4; 95% CI: 1.71-6.78), facial nerve reanimation (RR: 2.7; 95% CI: 1.33-5.50), and the need for physical therapy/occupational therapy (RR: 13.5; 95% CI: 7.27-25.07). The rate of tinnitus after microsurgery was initially higher up to 1 year (RR: 1.3; 95% CI: 1.03-1.65), but at 3 years the rate was similar with SRS (RR: 1.18; 95% CI: 0.96-1.45). Microsurgery after SRS was significant at 5 years (RR: 0.05; 95% CI: 0.003-0.81). Radiation after microsurgery was significant after 10 years (RR: 2.7; 95% CI: 1.33-5.50). Dysarthria was similar (RR: 1.1; 95% CI: 0.47-2.56).

Conclusions: Microsurgery is associated with higher rates of functional outcomes and debilitation than SRS. The rate of re-intervention with microsurgery after SRS was earlier than radiation after microsurgery.

Professional Practice Gap & Educational Need: Large data analysis of patients from multiple healthcare centers can provide important information regarding outcomes, risks, and complications for two major procedures treating acoustic neuroma. An evaluation of when re-intervention was performed after initial treatment with the alternative procedure may help in planning and determining salvage treatment.

Learning Objective: To temporally demonstrate the differences in outcomes and risks between microsurgery and SRS, and to determine the need for the other major treatment option as salvage therapy.

Desired Result: Recognition of the higher debilitation of patients undergoing microsurgery in a large database. Understand that patients may require microsurgery after primary SRS treatment earlier than the need for salvage radiation after primary microsurgery.

Level of Evidence - III

Indicate IRB or IACUC: Exempt

5 Principles for Reliable 3D Printing of Temporal Bones

Michelle K. Higgins, MD, PhD

Hypothesis: Design methodology can optimize 3D printable temporal bone surgical simulators.

Background: 3D printed synthetic temporal bones are important educational tools for teaching ear anatomy and safe surgery. Creators of these simulators increasingly strive to produce them on consumer-grade machines using material extrusion with goals for validity and low cost per unit. A design perspective and iterative process that respects additive manufacturing constraints can provide relevant advantages for more users when creating new temporal bone datasets.

Methods: Test cases of open-access 3D human temporal bones from the OpenEar Library were iteratively adapted for 3D printing. Methodology from process design, design for six sigma, human-centered design, and open education were systematically applied until five key principles were distilled. Reliable 3D files are safe to manufacture, fit the intended usage context (education or research), maintain accuracy (anatomy, color, haptic feedback), minimize waste (material, production time, post-processing steps), and are freely open (to retain, reuse, revise, remix, and redistribute copies).

Results: High quality, reliable, ready-to-3D-print open datasets of human temporal bones achieve performance consistency across workflow outcomes. The optimized 3D files reproducibly made over 600 units tested in over 20 materials on five desktop 3D printers with production costs ultimately approaching $4 per unit, printing time averaging 6 hours per 4-color unit, and requiring only 6 minutes human labor per unit.

Conclusions: A set of five design principles can guide decision making for more cost-effective, highly reliable 3D printing that accounts for typical additive manufacturing constraints. Reliable production expands global access to temporal bone surgical simulators for surgical training and education, and rapid testing of biomimetic materials for research.

Professional Practice Gap & Educational Need: Practitioners who utilize synthetic temporal bones can learn how to design for more reliable, sustainable, and accessible production.

Learning Objective: Apply a set of design principles to optimize reliable 3D printing of temporal bone surgical simulators.

Desired Result: Creators of 3D temporal bone models will consider designing for typical constraints of additive manufacturing to achieve wider access and utilization of their work.

Level of Evidence - Level V

Indicate IRB or IACUC: Not applicable

Do Measurements of Vestibular Schwannoma Volume or Linear Dimension Better Predict Postoperative Outcomes?

Heather J. Smith, BM; Jason L. Steele, BS; Nicole Ewer, BS; Mana Espahbodi, MD
Neil S. Patel, MD; Richard H. Wiggins, 3rd, MD; Richard K. Gurgel, MD, MSCI

Objective: To examine the relationship between vestibular schwannoma (VS) volume, greatest linear dimension, and outcomes after microsurgical resection.

Study Design: Retrospective chart review

Setting: Tertiary academic referral center

Patients: Patients with histologically-confirmed VS who underwent microsurgical resection between 2016 and 2018.

Interventions: Microsurgical resection of VS

Main Outcome Measures: Preoperative greatest linear dimension in the axial plane and tumor volume (total and anterior to a line drawn through the midpoint of the internal auditory canal) measured using manual three-dimensional volumetric analysis of heavily-weighted T2 MRI images; preoperative and postoperative House-Brackmann (HB) facial nerve function, divided into the following groups: HB 1-2 or HB ≥ 3; postoperative complications.

Results: 105 subjects were identified who underwent VS resection (55.2% female, 90.5% white, mean age at surgery 46.3 ± 14.1). Median tumor volume was 0.61 cm^3 (interquartile range [IQR] 0.12-4.48), and median greatest linear dimension was 1.56 cm (IQR 0.91-2.63). Twenty subjects (19%) experienced postoperative complications; 12 of these were cerebrospinal fluid (CSF) leaks. Nearly all (99.0%) patients had HB 1-2 facial nerve function preoperatively; 63.1% and 67.6% of patients had HB 1-2 facial nerve function immediately postoperatively and at the last follow-up (median follow-up 12.0 (IQR 2.25-37.00) months), respectively. On univariate logistic regression analysis, tumor volume was associated with immediate postoperative facial nerve function (OR 1.19, 95% CI 1.07-1.31), and facial nerve function at last follow-up (OR 1.12, 95% CI 1.03-1.21), but was not associated with incidence of CSF leak. Greatest linear dimension and anterior tumor volume were also associated with immediate and last follow-up postoperative facial nerve function on univariate analyses. On multivariate binary logistic regression including greatest linear dimension and anterior tumor volume, tumor volume was not associated with immediate postoperative facial nerve function, but remained associated with facial nerve function at last follow-up (OR 1.31, 95% CI 1.02-1.69). Greatest linear dimension was not associated with facial nerve function at either timepoint on multivariate analysis.

Conclusions: Larger VS tumor volumes were significantly associated with HB 3-6 facial nerve function at last follow up after microsurgical resection, but greatest linear dimension of the tumor was not. Tumor volumes were not associated with CSF leak.

Professional Practice Gap & Educational Need: Associations between VS diameter and postoperative facial nerve outcomes have been frequently reported in the literature. There is limited data available regarding VS tumor volume and postoperative outcomes. Using volumetric analysis to accurately measure tumor volume may help inform decision-making and patient counseling.

Learning Objective: To explore the associations between VS volume, diameter, and postoperative outcomes.

Desired Result: Attendees will have a better understanding of volumetric tumor analysis and its utility in predicting postoperative outcomes.

Level of Evidence: IV

Indicate IRB or IACUC: IRB_00045048; University of Utah

Does Preoperative Hearing Predict Postoperative Facial Function for Patients with Large Vestibular Schwannomas?

Cody M. Anderson, MD; Nicole Ewer, BS; Heather J. Smith, BM
Jason L. Steele, BS; Mana Espahbodi, MD; Neil S. Patel, MD
Richard K. Gurgel, MD, MSCI

Objective: It is rare for patients with large vestibular schwannomas (VS) to have functional hearing before surgery. Numerous studies have examined factors that contribute to postoperative facial (CNVII) function. In patients with large tumors, could preoperative hearing status provide insight into tumor adherence to both the facial and vestibulocochlear nerves? The objective of this study is to evaluate the effect on preoperative hearing on postoperative CNVII function following microsurgical resection for patients with large VS.

Study Design: Retrospective chart review

Setting: Tertiary care center

Patients: From 2016-2018, a total of 36 subjects underwent microsurgery for resection of large (greater than or equal to 2.3cm greatest linear dimension or 1.5cm in the cerebellopontine angle [CPA]) VS.

Interventions: Microsurgical resection of VS

Main Outcome Measures: Postoperative CN VII Function

Results: Median age at time of surgery was 46 (IQR 34.25-59.75) years; 45% of subjects were male. Median (IQR) tumor greatest linear dimension and volume were 2.84 (2.3-3.3) cm and 6.06 (3.55-11.82) cm^3, respectively. Preoperative facial nerve function was House-Brackmann (HB) 1 in 94%. Most (83.3%) tumors were resected via a translabyrinthine approach; the remaining 16.7% were resected via a retrosigmoid approach. Gross total resection was achieved in 86.1%. Median (IQR) duration of follow up from time of surgery was 15.22 (8.25-48.59) months. At time of last follow up, 50% of subjects had HB 1-2 facial nerve function (38.9% had HB 1 function, 11.1% HB 2 function); 50% had HB 3-6 facial nerve function (25% had HB 3 function, 13.9% HB 4 function, 5.6% HB 5 function, and 5.6% HB 6 function). Preoperative word recognition score (WRS) was associated with postoperative facial nerve function at the last follow up visit. Median (IQR) preoperative WRS was 80 (45.75-94.50)% in patients with postoperative HB 1-2 function, and 36 (0-77.75)% with postoperative HB 3-6; on logistic regression decreased preoperative WRS is associated an with increased odds of HB 3-6 function postoperatively (odd ratio 0.980, 95% confidence interval 0.961-0.999). In this select population of patients with large tumors, patient age, tumor volume, approach, extent of resection, and preoperative pure tone average were not associated with immediate or long-term postoperative CNVII function on logistic regression analysis ($p>0.05$).

Conclusions: Preoperative word recognition score was associated with postoperative facial nerve function in microsurgical resection of vestibular schwannoma greater than or equal to 2.3cm, which suggests CNVIII neural integrity of the eight nerve may be a proxy for CNVII neural integrity.

Professional Practice Gap & Educational Need: Predictive tools and counseling patients regarding expected CNVII function after microsurgical resection of a vestibular schwannoma is critical. The utility of preoperative audiometric data in predicting postoperative facial nerve function has not been well described.

Learning Objective: To elucidate if preoperative hearing can assist with predicting postoperative CN VII function after microsurgical resection of VS greater than or equal to 2.3cm.

Desired Result: To increase understanding of risk factors for postoperative facial nerve function in the resection of VS greater than or equal to 15 mm in the CPA.

Level of Evidence – Level IV

Indicate IRB or IACUC : IRB_00045048, AM Tracking trends in the management of vestibular schwannoma. University of Utah.

RECIPIENTS OF ANS AWARDS

THE ANS RESEARCH GRANT AWARD
Up to three $25,000 annual awards; established in 2014/15
Funding provided by the American Neurotology Society

The purpose of the American Neurotology Society (ANS) Research Grant is to encourage and support academic research in sciences related to the investigation of otology and neurotology. Appropriate areas of research include diagnosis, management, and pathogenesis of diseases of the ear and/or skull base. Grants that focus on addressing clinical gaps are especially encouraged. Grants may involve cell/molecular studies, animal research, or human subjects research. The maximum award request is $25,000 per year (US dollars) and is annually renewable on a competitive basis. ANS may distribute up to three $25,000 grants each funding cycle. Indirect costs (overhead) are not allowed. **Grants are available to physician investigators in the United States and Canada only.** We particularly encourage those individuals without a history of K08, R03, R21, or R01 funding to apply.

Christine T. Dinh, MD - 2015
"Cochlear Irradiation and Dosimetry: Apoptosis, Necrosis, and Hearing Loss"
University of Miami - Miami, FL

Harrison Lin, MD - 2016
"Chronic Implantation of the Facial Nerve for Selective Facial Muscle Contraction"
University of California - Irvine, Orange, CA

Michael S. Harris, MD -2017
"Verbal Memory as Outcome Predictor in Adults Receiving Cochlear Implants"
Medical College of Wisconsin - Milwaukee, WI

Ksenia A. Aaron, MD - 2018
"Modelling and Restoring Hearing and Vestibular Deficit of Non-Syndromic Deafness"
University of California - Los Angeles, CA

Dunia Abdul-Aziz, MD - 2019
"Targeting Epigenetic Modifying Enzymes for Hair Cell Regeneration"
Massachusetts Eye & Ear - Boston, MA

Douglas Bennion, MD and **Megan (Foggia) Jensen, MD** - 2020
"Durable Zwitterionic Thin Film Coatings for Cochlear Implant Biomaterials"
University of Iowa - Iowa City, IA

Courtney C.J. Voelker, MD, PhD – 2020
"In Vivo Neuronal Mapping of the Auditory Pathway in Pediatric Patients with Congenital Unilateral Sensorineural Hearing Loss and those with Normal Hearing"
University of Southern California - Los Angeles, CA

Tatiana Correa, MD, MPH - 2020
"Comparison of Surgical Routes for Localized Inner Ear Viral Vector-Mediated Gene Therapy in the Guinea Pig Using Helper-Dependent Adenovirus Type 5"
University of Iowa - Iowa City, IA

Ashley Kita, MD - 2021
"Prolonged Elution of Cytokines for Inner Ear Rehabilitation"
University of California (UCLA) - Los Angeles, CA

Bing Teh, MBBS, PhD - 2021
"The Impact of Vestibular Dose on Post Gamma Knife Balance Function"
Columbia and Cornell Universities - New York, NY

Aida Nourbakhsh, MD, PhD – 2022
"Molecular Mechanisms of Hypofractionation and Radiation Resistance in Vestibular Schwannoma."
University of Miami – Miami, FL

Vivian F. Kaul, MD – 2022
"Improving Patient Satisfaction and Quality of Life Outcomes for Cochlear Implant Patients Through an Interactive Web and Mobile-Based Patient Education Platform"
Ohio State University - Columbus, OH

Amit Walia, MD – 2022
"Predicting Performance in Background Noise for Cochlear Implant Recipients using Electrocochleography"
Washington University - St. Louis, MO

Nir Ben-Shlomo, MD -2023
"*Sustained Drug Release of Dexamethasone and Neurotrophic Agents from Zwitterionic Thin Film Coatings for Decreased Inflammation and Improved Spiral Ganglion Neuron Survival following Cochlear Implantation*."
University of Iowa, Iowa City, IA

Janet Choi, MD - 2023
"*Big Data to Personalized Hearing Health: Developing an Open Database for Hearing Devices and a Matching System*"
University of Southern California, Los Angeles, CA

Adam C. Kaufman, MD, PhD – 2023
"The Role of Sweet Taste Receptors in Middle Ear Mucosal Defense."
University of Maryland, Baltimore, MD

Yin Ren, MD, PhD - 2023
"*Extracellular Matrix Remodeling and Tumor Inflammation Markers in Aggressive Vestibular Schwannomas*"
Ohio State University, Columbus, OH

Many thanks to the ANS Research Committee, led by Dr. Ronna Hertzano.

Ronna Hertzano MD, PhD
Aaron K. Remenschneider, MD *(Chair-Elect)*
Christine T. Dinh, MD
Courtney C.J. Voelker, MD, PhD
Samuel Gubbels, MD
Theodore R. McRackan, MD
Jason A. Brant, MD
Andrew A. McCall, MD
Rick F. Nelson, MD, PhD
Ana H. Kim, MD
Michael Hoa, MD *(D/I Committee Chair-Elect)*

ADVANCING DIVERSITY, EQUITY, INCLUSION, AND ACCESSIBILITY (DEIA)
IN OTOLOGY AND NEUROTOLOGY GRANT

In an effort to incorporate, recognize, and foster diversity, equity, inclusion, and accessibility within Otology and Neurotology, the ANS seeks to fund proposals that address these concepts in the areas of patient care, education, research, and membership. As it relates to the mission of the ANS, these endeavors will contribute to a better understanding of our increasingly intersectional organization and patient populations and allow for initial steps towards improving alignment of our membership with the needs of our clinical populations. This is particularly important as one focus is to translate knowledge to quality care for our patients.

Applications will be accepted and reviewed at the same time as the ANS Research grant applications. Up to $10,000 is allocated for this grant mechanism annually.

Applicants may be any member of the ANS in good standing at the time of the application and award. In addition, an applicant who is not a member of the ANS may be sponsored by an ANS member in good standing.

HOUSE/HITSELBERGER
LIFETIME ACHIEVEMENT AWARD

In honor of the 50th anniversary of the American Neurotology Society, 1965 - 2015, the House/Hitselberger Lifetime Achievement Award was established to honor the legacy of two giants in the field of neurotology, Dr. William F. House and Dr. William E. Hitselberger. The award recognized those individuals who have demonstrated superb surgical skills and patient care, a commitment toward education and cumulative scientific contributions that have profoundly impacted the field of neurotology.

These awards were presented to nine neurotologists from the USA and Europe at the 50th Annual Fall meeting in Dallas, TX on September 26, 2015.

Derald E. Brackmann, MD
House Ear Clinic - Los Angeles, CA

Prof. Ugo Fisch, MD
Fisch International Microsurgery Foundation
Zurich, Switzerland

Emilio García-Ibáñez, MD
Instituto De Otologia Garcia-Ibanez - Barcelona, Spain

Michael E. Glasscock, III, MD
The Otology Group, Nashville, TN
The Glasscock Hearing Center - Houston, TX

Malcolm D. Graham, MD
Emory University - Atlanta, GA

David A. Moffat, PhD, FRCS
Addenbrooks Hospital - Cambridge, UK

Joseph B. Nadol, Jr., MD
Massachusetts Eye & Ear Infirmary - Boston, MA

Prof. Mario Sanna, MD
Gruppo Otologico, Piacenza-Rome, Italy

Prof. Jean-Marc Sterkers, MD
Paris, France

NEW IN 2024

MICHAEL E. GLASSCOCK SCIENTIFIC MERIT AWARD

Award established in 2024.

The American Neurotology Society is pleased to announce the creation of the **Michael E. Glasscock Scientific Merit Award** for the highest scoring abstract submitted for the annual Spring meeting. This Award is being granted in recognition of Dr. Glasscock's lifetime commitment to education, research and the advancement of our field. Beginning in 2024, the primary author who receives the highest composite score for their abstract submitted for consideration at the annual ANS Spring meeting, will be named as the first recipient of the prestigious Michael E Glasscock Scientific Merit Award.

John P. Marinelli, MD - 2024
Cochlear Implantation with Sporadic Inner Ear Schwannomas: An International Multi-Institutional Study of 90 Patients
Mayo Clinic, Rochester MN
San Antonio Military Medical Center, San Antonio, TX

HERBERT SILVERSTEIN AWARD FOR RESEARCH EXCELLENCE IN OTOLOGY/NEUROTOLOGY

Award established in 2024.

This annual award is generously supported by Dr. Herbert Silverstein, founder of the Ear Research Foundation, located in Sarasota, FL. Dr. Silverstein has been a member of ANS since 1970.

The **Herbert Silverstein Award for Research Excellence in Otology/Neurotology,** will be awarded annually to a trainee (Otolaryngology resident/Neurotology fellow) or early career clinician (1st five years of practice) for the best research manuscript submission for presentation at the annual ANS Scientific Meeting. The topic should be focused on Meniere's disease, vestibular diseases, cochlear implants, vestibular schwannomas or otosclerosis. The ANS Executive Council shall judge the yearly applications.

Adam Y. Xiao, MD, PhD
Expression of TGFÎ²-1 and CTGF in the Implanted Cochlea and its Implication on New Tissue Formation
UCLA, Los Angeles, CA

RECIPIENTS OF THE NOEL L. COHEN AWARD FOR SIGNIFICANT CONTRIBUTIONS TO OTOLOGY AND NEUROTOLOGY

Through a generous gift from our late colleague, ANS has established the Noel L. Cohen, M.D. Award for Significant Contributions to Otology and Neurotology. The establishment of the award is a fitting tribute to Dr. Cohen — a gifted physician, surgeon, academician, educator, administrator and leader. His contributions brought distinction to Otology & Neurotology, New York University, and our society.

The first recipient of this esteemed award, Dr. Thomas Balkany, was announced at the 55th Annual virtual Fall meeting on Sept 12, 2020.

Thomas J. Balkany, MD – 2020 – Miami, FL, University of Miami Miller School of Medicine

Robert K. Jackler, MD – 2021 – Palo Alto, CA, Stanford University

Bruce J. Gantz, MD – 2022 – Iowa City, IA, University of Iowa

Derald E. Brackmann, MD – 2023 – Los Angeles, CA, House Ear Clinic

NEUROTOLOGY FELLOWSHIP AWARD

First awarded: 1998

Funding provided by: Dr. Derald Brackmann, Dr. Robert Jackler & the American Neurotology Society

Colin L.W. Driscoll, MD - 1998, Palm Beach, FL

Robert M. Owens, MD - 1999, Palm Desert, CA

Katrina R. Stidham, MD - 2000, Orlando, FL

Zoran Becvarovski, MBBS - 2001, Palm Desert, CA

John S. Oghalai, MD - 2002, Boca Raton, FL

Anthony O. Owa, MD - 2002, Boca Raton, FL

Richard J. Kennedy, MD - 2003, Nashville, TN

Ana H. Kim, MD - 2006, Chicago, IL

Marc D. Eisen, MD - 2007, San Diego, CA

Benjamin T. Crane, MD, PhD - 2008, Orlando, FL

R. Mark Wiet, MD - 2008, Orlando, FL

Kevin D. Brown, MD, PhD - 2009, Phoenix, AZ

Jerry W. Lin, MD, PhD - 2009, Phoenix, AZ

John C. Goddard, MD - 2010, Las Vegas, NV

Matthew L. Bush, MD - 2011, Chicago, IL

Felipe Santos, MD - 2011, Chicago, IL

Alicia Quesnel, MD - 2012, San Diego, CA

Mia Miller, MD - 2013, Orlando, FL

Peter L. Santa Maria, MBBS, PhD -2014, Las Vegas, NV

Christine T. Dinh, MD - 2015, Boston, MA

Seth E. Pross, MD - 2016, Chicago, IL

Michael S. Harris, MD – 2017, San Diego, CA

Kathryn Y. Noonan, MD – 2018, National Harbor, MD

Enrique Perez, MD – 2018, National Harbor, MD

Ksenia A. Aaron, MD – 2019, Austin, TX

James G. Naples, MD – 2019, Austin, TX

Matthew G. Crowson, MD, MPA – 2020, Virtual

Kenny F. Lin, MD – 2020, Virtual

Matthew A. Shew, MD – 2021, Virtual

Alexander L. Luryi, MD – 2021, Virtual

Nathan R. Lindquist, MD – 2022, Dallas, TX

Mallory J. Raymond, MD – 2022, Dallas, TX

Pawina Jiramongkolchai, MD - 2023, Boston, MA

Evan Cumpston, MD – 2024, Chicago, IL

ANS TRAINEE AWARD

First awarded: 1990

Funding provided by: Dr. Joseph Touma 1990-99 & the American Neurotology Society

Thomas R. Pasic, MD - 1990, Palm Beach, CA
University of Washington, Seattle, WA

Charles A. Syms III, MD - 1991, Hawaii, HI
USAF Medical Center, Lackland AFB, TX

Eric Tallan, MD - 1992, Palm Desert, CA
Mayo Clinic, Rochester, MN

Mark E. Reiber, MD - 1993, Los Angeles, CA
Vanderbilt University Medical Center, Nashville, TN

Gary B. Coleman, MD - 1994, Palm Beach, FL
University of Michigan, Ann Arbor, MI

Donald D. Robertson, MD - l995, Palm Desert, CA
University of Manitoba, Winnipeg, Manitoba Canada

Greg A. Krempl, MD - l997, Scottsdale, AZ
University of Texas, San Antonio, TX

Bac H. Nguyen, MD - 1998, Palm Beach, FL
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American Neurotology Society Research Grant
Progress Report Date: 2/9/2024
Principal Investigator: Nir Ben-Shlomo, MD
Mentors: Marlan Hansen, C. Allan Guymon, Aliasger Salem
Institution: University of Iowa, Department of Otolaryngology, Head & Neck Surgery,
Project Title: Sustained drug release of dexamethasone and neurotrophic agents from zwitterionic thin film coatings for decreased inflammation and improved spiral ganglion neuron survival following cochlear implantation.

Background: Over the last decades, cochlear implantation has become more common in patients with residual hearing, and preservation of acoustic hearing has become an attainable goal of surgery. Factors that contribute to loss of residual hearing in the perioperative period after cochlear implantation include insertional trauma and a more delayed hearing loss due to continued inflammation from the foreign body response. Both of these mechanisms have been shown to damage spiral ganglion neurons and impact post implantation hearing outcomes. Zwitterionic hydrogel coatings of cochlear implants provide an ultra-low biofouling surface that minimizes adhesion of proteins, cells, and overall dramatically reduces the foreign body response. These coatings also provide a highly lubricious surface that decreases insertional trauma. The aims of this project are to incorporate a drug delivery component of anti-inflammatory (dexamethasone, DEX) and neurotrophic agents such as JNK inhibitor SP600125 and TrkB agonist 7,8 Dihydroxyflavone (7,8 DHF) into the zwitterionic hydrogel coating to provide a sustained drug release to minimize intracochlear inflammation, increase spiral ganglion survival, and ultimately to improve hearing outcomes in CI users.

<u>Specific Aim 1</u>: Engineer zwitterionic thin film hydrogel coatings with controllable, sustained drug delivery systems.

Hypothesis *– We hypothesize that zwitterionic thin film coatings loaded with PCL-DEX and PCL-SP600125 and PCL-7,8DHF microspheres can provide controlled, sustained therapeutic level drug delivery into artificial perilymph for up to 6 months.*

Progress: We have previously demonstrated successful encapsulation of DEX within polycaprolactone (PCL) particles. Multiple attempts were made to encapsulate JNK inhibitor SP600125 as well as 7,8 DHF and selected flavone derivatives (7,8,3' THF and 4',7 DHF, see aim 3.1 below for discussion) within PCL particles, though there were challenges with this approach, likely due to the hydrophobicity of PCL and relative polarity of SP600125 and these flavone derivatives. For this reason, poly(lactic-co-glycolic) acid (PLGA) was chosen as a substitute polymer carrier. Like PCL, PLGA is an FDA approved polymer that has been widely used in medical applications, and similarly dissolves by hydrolysis resulting in release of encapsulated molecules. PLGA is hydrolyzed more rapidly than PCL however, and is expected to dissolve over the course of weeks to months (as compared to months-years for PCL). We continue working on optimizing our protocol for encapsulating the neurotrophic molecules SP600125 and 7,8,3'THF within PCL but in the interim have run release assays for drug encapsulated PLGA microspheres. (**Fig. 1**) These assays have demonstrated successful release of encapsulated agents for at least 6 weeks, and release assays within artificial perilymph are ongoing. Furthermore, drug-loaded PLGA microspheres have been successfully incorporated into zwitterionic hydrogels and release studies from within hydrogel matrices are currently underway.

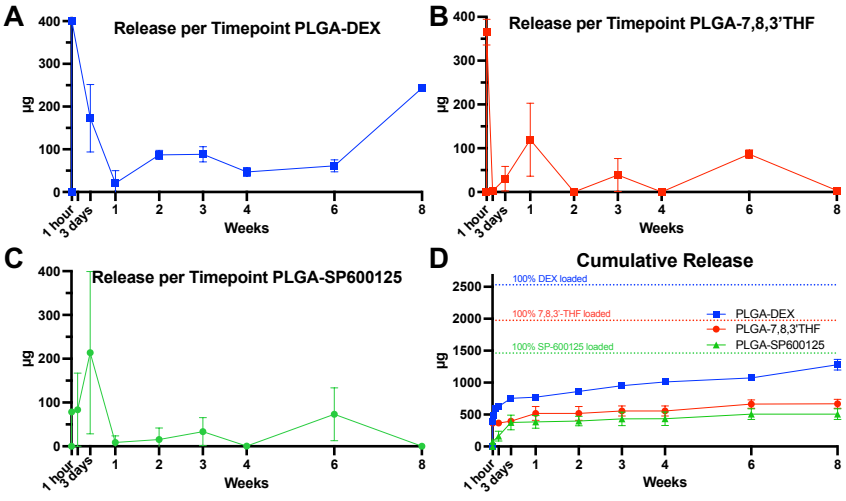


Figure 1: PLGA-encapsulated drug release up to 8 weeks into artificial perilymph. Collections for each species performed in triplicate. µg release per timepoint for dexamethasone **(A)**, 7,8,3'Trihydroxyflavone **(B)**, and SP600125 **(C)**. Cumulative release for each species **(D)** with dashed lines representing total drug loaded into PLGA microspheres.

<u>Specific Aim 2:</u> Understand the impact of sustained local delivery of DEX on cochlear inflammation and fibrosis.

Hypothesis *– We hypothesize that zwitterionic thin film coatings containing PCL-DEX microspheres will significantly reduce long-term cochlear fibrosis in rats after cochlear implantation.*

Progress: We plan to perform the *in vivo* study comparing performance of encapsulated dexamethasone with encapsulated JNK inhibitor SP600125 and neurotrophin 7,8,3' THF within the same animal cohort if possible. For this reason, we have deferred *in vivo* experiments until we have optimized our encapsulation protocol and demonstrated successful *in vitro* release of encapsulated neurotrophic agents.

<u>Specific Aim 3:</u> Investigate the impact of sustained local delivery of neurotrophic agents on spiral ganglion neuron survival

3.1) Measure *in vitro* SGN survival in a hostile environment when exposed to aged microspheres.

Hypothesis *– We hypothesize that neurotrophin-loaded microspheres will significantly improve SGN survival, both freshly synthesized and after 6 months aging in artificial perilymph.*

Progress: Recent literature suggests that other small molecule TrkB agonist derivatives of 7,8 DHF may be more effective at preserving SGN survival than the originally proposed molecule 7,8 DHF. A comparison was carried out across multiple agents at various concentrations to establish the best candidate for encapsulation. As a result of these studies assessing both survival and morphology, a derivative of 7-8 DHF, 7,8,3' Trihydroxyflavone (7,8,3' THF) was found to be significantly more effective at preserving both SGN survival and morphology. (**Fig. 2**) These studies encouraged us to encapsulate 7,8,3' THF as our small molecule neurotrophin of choice for future studies. Experiments with aged PLGA-SP600125 and PLGA-7,8,3' THF microspheres are currently underway.

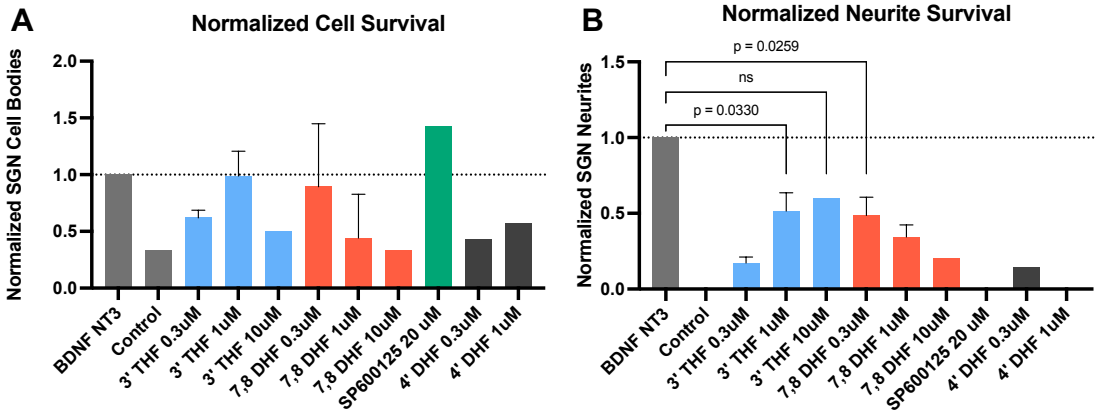


Figure 2 (A) SGN survival from cultures exposed to various concentrations of flavone derivatives as compared to no neurotrophins (control), BDNF and NT-3, **(B)** Number of neurites in culture as compared to BDNF-NT-3. SP600125 demonstrated excellent cell survival but poor neurite growth, resulting in poor cell morphology, as has been previously described. All SGN cultures performed in triplicate. Though 7,8,3'THF and 7,8 DHF performed similarly, 7,8 DHF demonstrated dose dependent toxicity. For this reason, combined with improved SGN morphology, 7,8,3'THF was selected for encapsulation and further study due to greater likelihood of SGN survival with relatively large burst doses inherent to the drug release profiles. BDNF (Brain derived neurotrophic factor); NT-3 (neurotrophin 3); 7,8 DHF (7,8 Dihydroxyflavone), 3' THF (7,8,3' Trihydroxyflavone) 4' DHF (4',7 Dihydroxyflavone)

3.2) Quantify the effect zwitterionic thin film coatings embedded with either PCL-SP600125 or PCL-7, 8DHF microspheres have on *in vivo* SGN survival after cochlear implantation.

Hypothesis *– We hypothesize zwitterionic thin film coatings containing neurotrophin-loaded microspheres will significantly improve SGN survival in rats after cochlear implantation.*

Progress: As described above, we have deferred *In vivo* experiments until we have optimized our encapsulation protocol and demonstrated successful long term *in vitro* performance.

ANS 2023-2024 Research Grant
Progress Report

PI: Janet S. Choi, MD MPH (University of Southern California)
Project Title: Big Data to Personalized Hearing Health: Developing an Open Database for Hearing Devices and a Matching System
Progress Report Date: 2/1/2024

Project Summary: In this proposal, we aim to develop an integrated hearing data processing system connecting a one-page hearing test report to a list of eligible hearing device options. Our proposed algorithm extracts hearing metrics from a hearing test report based on Computer Vision. And we aim to establish an open hearing device database providing a full range of eligible devices and a matching system. This project is designed to provide personalized hearing device options and hearing health navigation support for patients with hearing loss. The anticipated outcomes of the project include a comprehensive, dynamic hearing device database, an algorithm-driven hearing device matching system, and a digital platform that bridges the gap between patients with hearing loss and hearing health technologies.

Specific Aim 1: Optimize an audiogram image recognition algorithm using deep learning and add a QR-code importation feature within an audiometry software.

Progress: Our research team, in collaboration with Co-Investigator Sun, developed an image recognition algorithm to extract air-conduction thresholds from hearing test reports. In a preliminary test of 500 audiograms, our algorithm achieved accuracy rates of 86% for the right ear and 84% for the left ear, respectively. As a subsequent step, we successfully compiled a database of 5,000 unique hearing test reports from a clinical hearing database using AudBase. This collection includes a PDF of the audiogram in four different formats for each report, accompanied by the corresponding raw data of air/bone conduction thresholds, speech reception thresholds, and word recognition scores. These were divided into an 80%/20% split, forming a 'training' set (n=4,000) and a 'hold-out' validation set (n=1,000). The audiogram dataset was annotated with audiometry features found to influence algorithm accuracy, including severity and type of hearing loss, as well as asymmetry. Currently, we are refining the algorithm using the training audiograms, aiming to surpass a >95% accuracy rate for air-conduction threshold extraction. Once this milestone is achieved, our next objective is to enhance the algorithm to additionally recognize bone conduction thresholds.

Specific Aim 2: Establish a web-based open hearing device database and a matching system connecting the extracted hearing metrics to a list of eligible hearing devices.

Our research team has successfully compiled a comprehensive list of hearing devices and their features. This list encompasses conventional hearing aids (14 brands, 210 models), OTC hearing aids (22 brands, 81 models), CROS/Bi-CROS hearing aids (3 brands, 15 models), cochlear implants (3 brands), osseointegrated implants (3 brands, 5 models), and wearable bone conduction hearing aids (3 brands, 3 models). Extracted features for each model include cost, design type, battery type, colors, smartphone streaming, pictures, websites, and FDA information. We have developed a matching algorithm based on the simplified eligibility criteria for each category and are currently validating its accuracy. Additionally, we are optimizing the algorithm to address ambiguities in eligibility, working closely with a team of audiologists and otolaryngologists.

Parallel to this, our research group has conducted sentiment analysis using Natural Language Processing models and thematic qualitative analysis to gauge public attitudes and user experiences regarding OTC hearing aids, based on social media and user reviews. A study analyzing over 8,000 social media mentions of OTC hearing aids over the past three years indicates a generally weakly positive attitude and increasing awareness. However, opinions on their benefits and challenges are mixed. This finding underscores this project's objective to provide more transparent and educational information about hearing devices to the public, especially amidst growing awareness and associated confusion. This manuscript has been submitted is currently under review.

In line with these efforts, we are working with a web-developer to create an online platform that will list all available hearing device options, along with their features and eligibility criteria. The launch of the website is planned for June 2024, and we plan to collaborate with the hearing device industry to keep the platform updated, as outlined in the proposal. This initiative was showcased at the AAO-HNSF Annual Meeting 2023 ENTrepreneur Faceoff event, where our team was honored with the ‘People’s Choice Award’.

Impact: The ANS funding for this project has facilitated support for one PhD student and covered computing costs for Aim 1, as well as funding one medical student, one research assistant, and one web developer for Aim 2. This support has catalyzed the PI's pursuit of industry-based funding for future work, with applications currently under review.

Research Fund of the American Neurotology Society
Progress Report Date: 2/09/23
Principal Investigator: Adam Kaufman, MD, PhD
Project Title: *The Role of Sweet Taste Receptors in in Middle Ear Mucosal Defense*

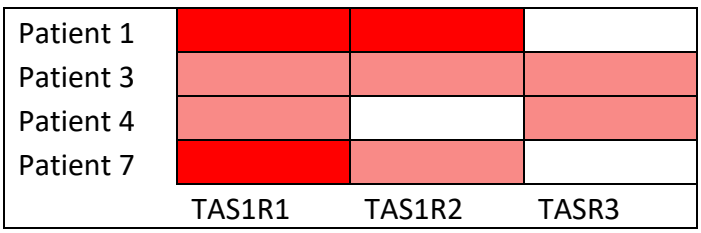
Project Summary:

There are over two million adult visits related to otitis media (OM) yearly in the United States. Untreated OM can lead to serious complications including hearing loss, meningitis, or brain abscesses. Due to the sheer prevalence of the disease, OM is a significant public health concern. To drive the formation of biofilms and the transition from an acute infection to a recalcitrant chronic one, bacteria secrete numerous chemicals known as '**quorum sensing molecules**' (**QSM**) or autoinducers. **Extraoral bitter taste receptors** (**T2Rs**), located in the airway, sinuses, and the middle ear (ME), are able to **bind these chemical messengers** and initiate an innate immune response.

Intriguingly, all **three known sweet taste receptors** (**T1Rs**) have also been found in extraoral locations. Recent work within the upper airway has shown that activation of T1Rs opposes the effects of T2R activation. Within the upper airway, **solitary chemosensory cells** (**SCCs**) are rare cells that help mediate the immune response and **express both T1Rs and T2Rs**. At this time, it is unknown if SCCs exist within the ME.

My prior work has shown T2R expression in the ME and their relationship to OM. There are numerous similarities between the mucosa found in the ME and the sinuses. Based on this, ***my central hypothesis*** is that the ME will also express T1Rs and have SCCs playing a key role in regulating the immune response in the ME. Secondly, I expect ME secretions from patients with chronic suppurative OM will be enriched with bitter compounds like QSMs and have reduced sweet compounds.

Specific Aim 1: Determine the expression pattern of T1Rs within the ME.
Progress: Middle ear mucosal tissue has been collected from healthy control patients. RNA was successfully extracted from the tissue with, so far, 4 samples having adequate RNA quality and integrity to perform RT-PCR. Each sample was completed in duplicate. At least one subclass of sweet taste receptors (TAS1R) were found in every patient sample tested. Dark red indicates that sample was positive for that individual receptor for both testing attempts while light red was positive for an individual receptor for one attempt. A blank cell indicates that the RT-PCR was negative for both testings. The testing will continue with the additional collected samples to increase the N. Next steps are to look at quantity of genomic material to determine if there is a relationship to why there are some negative samples. Further analysis will be necessary to look for a explantion for the variability.



Our department has struggled to find patients with chronic suppurative otitis media without cholesteatoma limiting my ability to see if chronic disease changes the pattern. As the few samples we have are precious, I am holding off on testing them until the process is further perfected. Nonetheless, I am collecting samples from cholesteatoma patients as a backup in case we never have enough patients with pure CSOM to do proper analysis.

Immunohistochemistry on the samples from the control patients was not positive for T1R sweet receptors but they were also not positive for T2R4 (bitter receptor) or beta-tubulin (marker for cilia) which were supposed to act as positive controls. There is potentially some damage occurring to the tissue during collection or processing leading to the loss of the positive controls. Therefore, I am attempting to collect larger samples from the OR which may be more robust. Additionally, I am culturing samples *in vitro* to expand the cells and potentially have them repopulate any proteins lost in sample. Both *in vitro* and *in vivo* samples will continue to be stained.

Specific Aim 2: Determine what small molecules exist within ME fluid in chronic otitis media
Progress: Sponges resting on the middle ear have been collected from control patients however the volume of fluid recovered was below the threshold for mass spectroscopy core facility to perform testing. I am currently increasing the length of time the sponges are exposed to the middle ear with the goal of improving the yield. A last resort will be diluting or combining samples to reach the threshold for analysis as that will significantly cloud the interpretability of the results.

American Neurotology Society Research Grant
Progress Report Date: January 30, 2024
Project Title: Extracellular matrix remodeling and tumor inflammation markers in aggressive vestibular schwannomas
Principal Investigator: Yin Ren, MD PhD
Institution: Department of Otolaryngology-Head & Neck Surgery, The Ohio State University, Columbus OH

Background:

Vestibular schwannoma (VS) is the most common tumor in the cerebellopontine angle (CPA) with an estimated incidence of 1:25,000.[1,2] Despite high perioperative morbidities and variable outcomes, surgical resection remains the only curative treatment for VS as there are no FDA-approved drugs for VS. A subset of VS presents unique challenges even for the experienced skull base surgeon. They are more aggressive and difficult to resect due to the presence of significant fibrosis within the tumor, macrocystic degeneration, and dense peritumoral adhesions to the facial nerve or brainstem. Complete surgical resection is extremely challenging and fraught with substantial morbidities such as deafness, facial paralysis, incomplete tumor resection, and injury to the brainstem.[3-5] The aggressive nature of VS is, at least in part, due to the presence of a pro-inflammatory tumor microenvironment (TME) in the stroma, where there is increased infiltration of tumor-associated macrophages (TAM) and tumor-infiltrating lymphocytes (TIL), upregulation of extracellular matrix (ECM) remodeling, which ultimately contributes to the dysregulation of Schwann cell function and tumor proliferation.[6,7] Although the pro-inflammatory TME is well characterized in desmoplastic tumors such as pancreatic and breast cancer,[8-10] there is a lack of knowledge of the stromal-tumor interaction in aggressive subtypes of VS. Our research group studies VS by utilizing primary patient tumors and genetically defined $NF2^{-/-}$ schwannoma animal models with a focus on improving surgical outcomes. We and others have shown that several matrix metalloproteases that play roles in cancer ECM remodeling are also dysregulated in VS.[5,11,12] **We hypothesize that ECM remodeling and lymphatic dysfunction is associated with dysregulated immune cell trafficking and build-up of TAMs in aggressive VS subtypes.** We will first characterize the expression of markers in ECM remodeling, lymphatic vasculature, and TAM/TIL infiltration in VS stroma and correlate with clinical data (Aim 1). We will further investigate the molecular pathways involved in VS TME reprogramming, cytokine signaling and fibrosis in a $NF2^{-/-}$ driven schwannoma mouse model (Aim 2).

Aim 1. Determine alterations and spatial heterogeneity in the TME of aggressive subtypes of VS. Retrospective analysis of VS for histological markers of fibrosis, tissue hypoxia, ECM remodeling, lymphatic vasculature, and infiltration of innate and adaptive immune cells will be performed. Histological quantification will be done in the tumor periphery, intratumoral and perivascular compartments (Aim 1a). To validate these findings, a prospective VS cohort with intraoperative systematic determination of peritumoral adhesions will be stained for the same panel of markers (Aim 1b).

Progress: We have identified aggressive and non-aggressive VS from our tissue bank. We have coded all the samples and collected relevant demographic variables and clinical information. Aggressive tumors characterized by the presence of cystic change, increased tissue stiffness and presence of adhesions to the brainstem were larger in size than non-aggressive counterparts. Therefore, we have proceeded with our analysis without size-matching. We have optimized and stained tumors for ECM including Masson's trichrome, matrix metalloprotease 9, hyaluronan binding protein (HABP), and subtypes of collagen (I & III), as well as cellular components of the TME including CD4+, CD8+, CD45+, CD80+, CD163+ and activated fibroblasts (a-SMA). There is significant correlation of tumor stiffness and adherence with several of these ECM biomarkers (*Figure 1*). Because of the limited clinical information available regarding the precise location where the tumor pieces were obtained, we were unable to delineate staining variations between the periphery versus the center of the tumor. However, we were able to quantify the relative expression of MMP-9 and CD45 in intratumoral areas immediately adjacent to blood vessels (perivascular

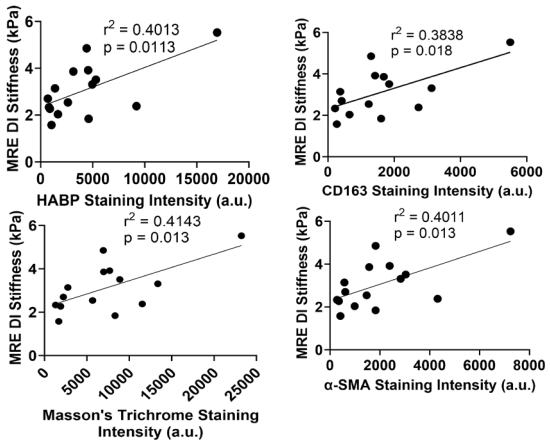


Figure 1. Correlation between tumor stiffness and ECM protein expression in VS

region) versus areas within the tumor but away from nearby blood vessels (parenchymal region). Our preliminary data supports our hypothesis that there is a distinct spatial pattern of ECM protein expression that may correlate with clinical phenotypes in VS. Our next steps are to complete the immunohistochemical staining and quantification of the remaining markers in our cohort.

Aim 2. Identify molecular pathways involved in TME reprogramming and ECM remodeling in a merlin-deficient, NF2$^{-/-}$ driven mouse schwannoma model. To gain mechanistic insight into the association between stromal ECM remodeling, inflammatory cell infiltration and VS progression, we will establish subcutaneous and sciatic nerve NF2$^{-/-}$ mouse schwannoma models and perform comparative Nanostring nCounter transcriptomic profiling versus wild type murine Schwann cells (WT-MSC). Biomarkers that are significantly differentially expressed will be validated in mouse NF2$^{-/-}$ schwannoma cells using qRT-PCR.

Progress: We have successfully established two rodent models of schwannomas for characterizing ECM remodeling, one by injecting NF2$^{-/-}$ mouse schwannoma cells (MD-MSCs) mixed with Matrigel subcutaneously into the flank, and the other by isolating the sciatic nerve and injecting NF2$^{-/-}$ mouse schwannoma cells into the nerve sheath. Tumor draining lymph nodes were also harvested from these mice. We will isolate total tumor RNA and measure the expression of a custom set of genes related to ECM function between sciatic nerve tumors, subcutaneous tumors, and wild-type Schwann cells using a high-throughput, multiplexed transcriptomic profiling platform (Nanostring nCounter). Genes with the highest differential expression (adjusted p-value < 0.05 after Bonferroni correction). To ensure that gene expression alterations were not due to cell culture conditions (*in vitro* vs. *in vivo*), We plan to validate the “hits” by comparing gene expression in MD-MSC and WT-MSC cells *in vitro*.

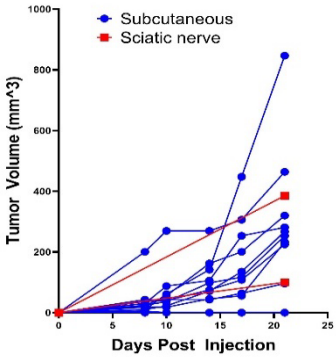


Fig 2. Tumor growth in subcutaneous and sciatic nerve allografts of MD-MSCs.

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2004-07 Karen J. Doyle, MD, PhD

2007-10 Jeffrey T. Vrabec, MD

2010-13 Anil K. Lalwani, MD

2013-16 Moisés A. Arriaga, MD, MBA

2016-19 Bradley W. Kesser, MD

2019-22 Elizabeth H. Toh, MD, MBA

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in Memoriam

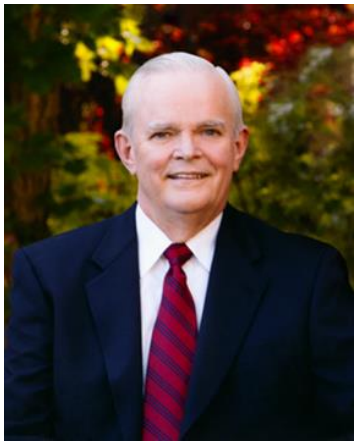
The ANS Administrative office was notified of the following members passing since the last Spring meeting.

Please take a moment of silence to remember these outstanding colleagues & friends.
(in alphabetical order)

Dr. John R. Emmett
Inducted to ANS in 1980
Passed: June 2, 2023

Dr. Cecil Hart
Inducted to ANS in 1968
ANS Secy/Treas, 1971-72
ANS President, 1974-75
Passed: August 21, 2022

Dr. Alexander Luryi
Inducted to ANS in 2023
Passed: September 13, 2023



Dr. James L. Parkin
Inducted to ANS in 1996
Passed: June 18, 2023