PROGRAM, ABSTRACTS & MORE

from the

AMERICAN NEUROTOLOGY SOCIETY

61st Annual Spring Meeting

April 24-26, 2026

Sheraton Phoenix Downtown
Phoenix Convention Center
Phoenix, AZ

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AMERICAN NEUROTOLOGY SOCIETY
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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.

61ST ANNUAL ANS SPRING PROGRAM OBJECTIVES & EDUCATIONAL ACTIVITY DETAILS

This activity is designed for physicians, nurses, etc. 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 the opportunity to demonstrate the application of core principles and new information to clinical decision making.

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

Clinicians caring for patients with disorders of the ear and skull base face rapidly evolving technologies, expanding diagnostic frameworks, and increasing clinical complexity. Practice gaps include variability in the adoption of new technologies, uncertainty in managing complex and multidisciplinary conditions, inconsistent approaches to rare or high-risk pathology, and challenges translating evolving evidence into patient-centered care. This activity addresses these gaps by examining areas where traditional paradigms are being challenged and where updated clinical judgment is required to optimize outcomes. The scope of the gaps addressed by the following activities is indicated:

Scientific Sessions:

1. **Technologic Advances in Cochlear Implants**: This activity addresses gaps in clinical knowledge and practice related to the adoption and optimization of emerging cochlear implant technologies, including variability in surgical techniques, limited real-time intraoperative feedback, challenges in electrode placement and programming in complex anatomy, and uncertainty regarding device configuration, safety, and patient-centered outcomes.
2. **Vestibular Schwannoma Management: Contemporary Perspectives:** This activity addresses gaps in clinical understanding and decision-making in vestibular schwannoma management, including uncertainty in tumor growth behavior across age groups, variability in hearing preservation outcomes after treatment, limited integration of disease-specific quality-of-life measures into management decisions, evolving roles of advanced imaging for prognostication, and emerging medical therapies for NF2-associated disease. Collectively, these gaps contribute to variability in treatment selection, counseling, and long-term patient-centered outcomes.
3. **Systemic Influences on Vestibular and Auditory Function:** This activity addresses gaps in the recognition, evaluation, and management of vestibular and auditory dysfunction arising from systemic, inflammatory, autonomic, metabolic, post-infectious, and treatment-related conditions. Limited awareness of these systemic influences and their underlying mechanisms contributes to diagnostic uncertainty, fragmented care, and variability in patient outcomes.
4. **Evolving Treatment Strategies at the Lateral Skull Base:** This activity addresses evolving gaps in the application of novel immunologic, endovascular, and surgical approaches to lateral skull base disease, challenging traditional treatment paradigms and necessitating updated clinical judgment.
5. **When the Ear Reflects the Body: Insights in Neurotology:** This activity addresses gaps in recognizing and integrating otologic findings as manifestations of broader neurologic, systemic, and physiologic disease processes. Limited understanding of how auditory and vestibular symptoms relate to central nervous system pathology, sleep disorders, cardiovascular and autonomic function, and evolving diagnostic technologies can lead to incomplete evaluation, diagnostic uncertainty, and fragmented patient care.

Panel Sessions:

1. **Panel** on "Clinical Curveballs: Complications and Tough Calls": This activity will address gaps in the recognition, prevention, and management of complications and complex clinical scenarios in neurotology,

where low-frequency but high-impact events, anatomic variability, and disease complexity contribute to diagnostic uncertainty, intraoperative challenges, and variability in patient outcomes.

2. **Panel** on "Converging Pathways: Reconciling Training Gaps and Practice Realities in Otologic & Skull Base Care" : This activity will address gaps between contemporary training experiences and real-world practice demands in adult and pediatric otologic and skull base care, which contribute to variability in clinical preparedness, decision-making, and delivery of complex patient-centered care across diverse practice settings.
3. **Panel** on "Master Techniques in Vestibular Schwannoma Surgery: Special Video Session": This activity will address gaps in exposure to expert-level surgical decision-making and technical execution in vestibular schwannoma surgery, where variability in approach selection, intraoperative strategy, and management of critical neurovascular structures can significantly impact patient outcomes.

Additional Lectures:

1. **William E. Hitselberger Lecture** titled, "Surgery of the Cerebellopontine Angle: Climbing a Gentle Learning Curve": This activity will address the evolution of cerebellopontine angle surgery through surgical judgment, anatomy, and technique refinement, highlighting how experience informs safe operative decision-making. Attendees will gain practical guidance on managing complexity and progressing along a thoughtful learning curve in CPA surgery.
2. **William F. House Lecture** titled, "Fear not the Face: From "Oh No" to "On It!!" Advances in Facial Reanimation Over the Decades": This activity will address gaps in the evaluation and management of facial nerve paralysis, including evolving surgical and non-surgical facial reanimation strategies, where variability in technique selection and timing can significantly impact functional, aesthetic, and quality-of-life outcomes.
3. **ANS research grant presentation**: In this activity, Dr. Alex Chern, recipient of a 2024 ANS research grant will present his research findings in a presentation titled, "Toward a Profile Instrument for Musical Enjoyment in Individuals with Hearing Loss".

Why do these issues exist? Is there a deficit in provider's knowledge or skill? Is there a deficit in health care system process or outcomes?

These issues exist due to a combination of gaps in provider knowledge and skills related to rapidly evolving technologies, disease mechanisms, and treatment strategies, as well as healthcare system limitations that hinder consistent adoption of best practices and multidisciplinary care. Together, these deficits contribute to variability in clinical decision-making, patient counseling, and outcomes in otologic, neurotologic, and skull base disorders.

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

- **Competence**: This activity will improve learners' competence by enhancing their ability to apply current evidence, emerging technologies, and evolving clinical frameworks to the diagnosis and management of otologic, neurotologic, and skull base disorders. Through expert lectures, abstract presentations, and case-based discussions, learners will strengthen clinical reasoning related to complex decision-making, multidisciplinary care, and patient-specific treatment selection across adult and pediatric populations.

- **Performance**: This activity will improve learners' performance by translating updated knowledge into practical diagnostic, surgical, and management skills, including operative planning, intraoperative decision-making, complication management, and use of advanced technologies. Video-based sessions and expert panel discussions will reinforce best practices, technical nuances, and risk-mitigation strategies that learners can directly incorporate into their clinical workflows.

- **Patient Outcomes**: This activity will improve patient outcomes by promoting more accurate diagnosis, consistent application of evidence-based care, improved surgical judgment, and enhanced patient counseling. By addressing variability in practice and strengthening multidisciplinary, patient-centered approaches, learners will be better equipped to optimize functional outcomes, reduce complications, and improve quality of life for patients with disorders of the ear and lateral skull base.

How do you anticipate this activity improving health care systems?

This activity improves health care systems by promoting evidence-based, multidisciplinary care, reducing practice variability, enhancing coordination across specialties, and supporting efficient adoption of emerging technologies to improve patient safety and outcomes.

How do you anticipate this activity impacting the health of patients and their communities?

This activity is expected to improve patient and community health by enabling earlier diagnosis, safer and more consistent care, improved functional outcomes, and reduced downstream morbidity associated with hearing, balance, and neurologic disorders.

State the learning objectives for this activity:

1. Integrate emerging cochlear implant technologies into clinical decision-making to optimize patient selection, auditory outcomes, and postoperative management.
2. Apply contemporary, evidence-based strategies to individualized vestibular schwannoma management, incorporating patient, tumor, and treatment-specific factors.
3. Recognize and evaluate systemic conditions that influence vestibular and auditory function and incorporate multidisciplinary management approaches into patient care.
4. Assess evolving surgical and non-surgical treatment strategies for lateral skull base pathology to optimize functional and disease-specific outcomes.
5. Identify otologic manifestations of systemic and neurologic disease and integrate targeted diagnostic strategies into comprehensive patient evaluation.
6. Analyze complex otologic and skull base cases to identify complications, underlying causes, and effective management strategies.
7. Evaluate gaps between training experiences and real-world practice in otologic and skull base care and identify strategies to bridge these gaps.
8. Apply expert surgical techniques and decision-making principles in vestibular schwannoma surgery through analysis of operative video cases.
9. Apply contemporary facial reanimation strategies to optimize functional and patient-centered outcomes in facial nerve disorders.
10. Interpret psychometric validation research findings and consider the application of patient-reported outcome measures in individuals with hearing loss.
11. Apply principles of surgical judgment and anatomical understanding to safely manage cerebellopontine angle pathology along the CPA learning curve.

CONTINUING MEDICAL EDUCATION CREDIT

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 the American Neurotology 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 **9.0** *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

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 and MOC points from the American Board of Otolaryngology – Head and Neck Surgery.

By attending this activity, you give us permission to share your CME data with our CME accredited provider/partner, the American College of Surgeons and the Accreditation Council for Continuing Medical Education.

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 of all other authors/contributors.

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.

Conflict of Interest: Circumstances create a conflict of interest when an individual has an opportunity to affect CME content about products or services of an 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 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 CME evaluation.

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

OTOLOGY & NEUROTOLOGY JOURNAL & MANUSCRIPT REQUIREMENTS

PUBLICATION STATEMENT: The material in this abstract 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 this abstract *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 2026 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 prohibiting the author from presenting at a COSM society meeting for up to three years. A duplicate submission to AOS or another participating COSM Society will disqualify your abstract immediately.

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***On a rare occasion, submission of your manuscript to an alternative Journal may be considered.** *Requests will be considered individually, and no assurances of approval can be offered a priori. The intent of this exception is to allow authors to submit an abstract and present highly meritorious work to the ANS membership yet ultimately publish the work in a journal that is deemed critical for the ongoing success of the work (e.g. compete for federal funding support).*

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. 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 podium presentation

FUTURE MEETING DATES

ANS 61st Annual Fall Meeting
"FAB FRIDAY" is October 16, 2026
Los Angeles, CA
JW Marriott Los Angeles
Study Group Call for Papers begins May 1-June 15, 2026

ANS 62nd Annual Spring Meeting
April 9-10, 2027
Sheraton Grand Seattle/Convention Center
Seattle, Washington

The Abstract deadline for the ANS 62nd Annual Spring Meeting is Thursday, October 22, 2026, at 11:59 PM PT.
Abstract Instructions and submission form will be available on the website after September 1st.

ADMINISTRATIVE OFFICE

Kristen Bordignon & Douglas Gossard, Administrative Team
ANS Administrative Office
5830 1st St. North
St. Petersburg, FL 33703
Ph: 217-638-0801; Fax: 727-800-9428
Email: administrator@americanneurtologysociety.com
Website: www.americanneurtologysociety.com

THE AMERICAN NEUROTOLOGY SOCIETY WOULD LIKE TO THANK THE FOLLOWING MEMBERS FOR THEIR CONTRIBUTION TO THE 2026 ANS SCIENTIFIC PROGRAM

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Anne K. Maxwell, MD
Kevin A. Peng, MD

PROGRAM MODERATORS

(in order of appearance)
Daniel Jethanamest, MD, MS & Emily Kay-Rivest, MD, MSc, Session A
Aaron K. Remenschneider, MD, MPH, ANS Research grant
Soha Ghossaini, MD & Nathan D. Cass, MD, Session B
Colin L.W. Driscoll, MD, Panel Moderator
Hamed Sajjadi, MD & Nofrat Schwartz, MD, Session C
Neil S. Patel, MD & Mallory J. Raymond, MD, Session D
Oliver F. Adunka, MD, Panel Moderator
Nicholas L. Deep, MD & Alicia M. Quesnel, MD, Session E
Seilesh C. Babu, MD, Panel Moderator

AMERICAN NEUROTOLOGY SOCIETY
61st Annual Spring Meeting
SCIENTIFIC PROGRAM
April 25-26, 2026
Phoenix, AZ
(ANS Posters will be displayed on Friday & Saturday)

SATURDAY APRIL 25, 2026

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

1:30 **SCIENTIFIC SESSION**
OPENING REMARKS BY THE PRESIDENT - *Colin L.W. Driscoll, MD*
(Open to registered Members and Non-members – Badge required for admittance)

1:32 **THE PRESIDENT'S SPOTLIGHT**

1:39 **7th ANNUAL NOEL L. COHEN AWARD FOR SIGNIFICANT CONTRIBUTIONS TO OTOLOGY AND NEUROTOLOGY**
Presented by Colin L.W. Driscoll, MD, President

1:44 **INTRODUCTION OF WILLIAM E. HITSELBERGER MEMORIAL LECTURE**
Colin L.W. Driscoll, MD

1:46 **WILLIAM E. HITSELBERGER MEMORIAL LECTURE**
Surgery of the Cerebellopontine Angle - Climbing a Gentle Learning Curve
Michael J. Link, MD
Charles B. and Ann L. Johnson Professor of Neurosurgery
Professor, Depts. of Neurologic Surgery and Otorhinolaryngology
Mayo Clinic - Rochester, Minnesota

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

2:11 **SESSION A - ELECTRICAL AND TECHNOLOGIC ADVANCES IN COCHLEAR IMPLANTS**
Daniel Jethanamest, MD, MS & Emily Kay-Rivest, MD, MSc, Moderators

Early Clinical Outcomes of a Fully Implantable Cochlear Implant: A U.S. Multicenter Trial
Theodore R. McRackan, MD, MSCR
Abraham Jacobs, MD
Jack Shohet, MD
Wayne Berryhill, MD
Sammy Gao, BS
Envoy Acclaim Clinical Trial Consortium
Colin L.W. Driscoll, MD

Complication Rates and Efficiency of Robotic Assisted versus Manual Insertion Cochlear Implantation
Dhruv K. Patel, BS
John J. Sykes, MD
Kenneth R. Feehs, MD
Eric M. Kraus, MD, MS
Pedrom C. Sioshansi, MD, MS
Michele M. Gandolfi, MD, MS

HERBERT SILVERSTEIN AWARD FOR RESEARCH EXCELLENCE IN OTOLOGY/NEUROTOLOGY

Apical Electrode Placement to Optimize Cochlear Implant Performance in Patients with an Ossified Cochlea and Incomplete Electrode Array Insertion
Justin Cottrell, MD
Emily R. Spitzer, Aud
David M. Landsberger, PhD
William Shapiro, AuD
Rebecca Piper, AuD
Sean McMenomey, MD
J. Thomas Roland Jr, MD

Cochlear Implant Mapping Without a Target: Basal Deactivation and the Role of Electrophysiologic-Guided Alignment
Amit Walia, MD, MSCI
Matthew A. Shew, MD
Amanda Ortmann, PhD
Nedim Durakovic, MD
Shannon Lefler, AuD
Jacques A. Herzog, MD
Craig A. Buchman, MD

Auto-Stopping Electrocochleography-Guided Cochlear Implant Insertion: First-in-Human Feasibility Study
Maxwell Bergman, MD
Naina Miranda
Isaac Swink
Rachel Scheperle, AuD
Marlan R. Hansen, MD
Alexander Claussen, MD

Off-the-Ear vs Behind-the-Ear Cochlear Implant Processors: Comparative Analysis of Skin Complications and Retention Outcomes in a Large Institutional Cohort
Maani M. Archang, MD, PhD
Karl R. Khandalavala, MD
Brian A. Neff, MD
Aniket A. Saoji, PhD
Matthew L. Carlson, MD, MBA

Colin L.W. Driscoll, MD
James R. Dornhoffer, MD

2:45 **DISCUSSION/Q&A WITH MODERATORS**

2:50 **INTRODUCTION - ANS RESEARCH GRANT PRESENTATION**
Aaron K. Remenschneider, MD, MPH - Chair, ANS Research Committee

2:52 **ANS RESEARCH GRANT PRESENTATION**
Toward a Profile Instrument for Musical Enjoyment in Individuals with Hearing Loss
Alexander Chern, MD
University of Pennsylvania
ANS Research Grant recipient 2024

3:00 **DISCUSSION WITH MODERATOR**

3:02 **BREAK WITH EXHIBITORS**

3:33 **SESSION B - VESTIBULAR SCHWANNOMA MANAGEMENT: CONTEMPORARY PERSPECTIVES**
Soha Ghossaini, MD & Nathan D. Cass, MD, Moderators

Vestibular Schwannoma Growth Patterns in Patients Aged 70 and Older
Kathy Le, MD
Akshay Prabhakar, BSA
Justina R. Varghese, BA
Jeffrey Vrabec, MD

Rate of Hearing Preservation After Stereotactic Radiosurgery for Treatment of Vestibular Schwannoma: Analysis of Patients with 100% Word Recognition Scores
Karl R. Khandalavala, MD
Hernan Vargas
John P. Marinelli, MD
Christine M. Lohse, MS
Michael J. Link, MD
Matthew L. Carlson, MD, MBA

ANS TRAINEE AWARD
A National Cross-sectional Assessment of the Mayo Clinic Vestibular Schwannoma Quality of Life (VSQOL) Index by Tumor Management Strategy
Madison V. Epperson, MD
Christine M. Lohse, MS
Michael J. Link, MD
Matthew L. Carlson, MD, MBA

Emerging Non-Conventional Imaging Modalities Characterizing Vestibular Schwannoma Prognosis: A Scoping Review
Nader G. Zalaquett, MD
John P. Marinelli, MD

Karl R. Khandalavala, MD
Christine M. Lohse, MS
Matthew L. Carlson, MD, MBA

Response of NF2-Related Schwannomatosis (NF2) Associated Vestibular Schwannomas to Losartan: A Case Series
Sophie Jabban, BA
Spencer Frome, MA
Maya Hatley, BA
Kaleb Yohay, MD
J. Thomas Roland Jr, MD
Devorah Segal, MD, PhD

4:02 **DISCUSSION/Q&A WITH MODERATORS**

4:07 **PANEL**
"MASTER" TECHNIQUES IN VESTIBULAR SCHWANNOMA SURGERY: SPECIAL VIDEO SESSION
Colin L.W. Driscoll, MD, Moderator
Richard K. Gurgel, MD, MSCI
Theodore R. McRackan, MD, MSCR
Jay T. Rubinstein, MD, PhD
Erika A. Woodson, MD

4:57 **CLOSING REMARKS** – *Colin L.W. Driscoll, MD*

5:00 **ADJOURN**

SUNDAY APRIL 26, 2026

7:00 **BUSINESS MEETING/COMMITTEE REPORTS**
(All welcome)

7:30 **SCIENTIFIC SESSION**
OPENING REMARKS BY THE PRESIDENT – *Colin L.W. Driscoll, MD*
(Open to registered Members and Non-members – Badge required for admittance)

7:33 **SESSION C - SYSTEMIC INFLUENCES ON VESTIBULAR AND AUDITORY FUNCTION**
Hamed Sajjadi, MD & Nofrat Schwartz, MD, Moderators

Long COVID Is Associated with Increased Odds of Neurotologic Manifestations: A National Database Study
Anvitha R. Metpally, BS
Taral K. Jella, BS
Tara Menon, BS
Eric Oliver, MD

Hearing and Vestibular Deficits Following the Use of Teprotumumab: Preliminary Findings
Samuel Johnson, BS

Lydia Granados, BS
Claudia Prospero-Ponce, MD
Tamis Bright, MD
Amanda Chiao, AuD, PhD

Increased Risk of Inner Ear Disease in Patients with Inflammatory Bowel Disease – A National Database Study
Aaron Tucker, BA
Yashnoor Sandhu, BS
Aashish Batheja, MPH
Daniel H. Coelho, MD

NICHOLAS TOROK VESTIBULAR AWARD
Increased Adrenergic Receptor Expression in Meniere's Disease
Adam Y. Xiao, MD, PhD
Achilles Kanaris, BS
Masanori Ishii, MD
Ivan A. Lopez, PhD
Gail Ishiyama, MD
Akira Ishiyama, MD

VeDA VESTIBULAR RESEARCH AWARD
Visual Vertigo in Vestibular Migraine
Alexandra T. Bourdillon, MD
Jason W. Allen MD PhD
Jeffrey D. Sharon MD

8:02 **DISCUSSION/Q&A WITH MODERATORS**

8:07 **INTRODUCTION OF WILLIAM F. HOUSE MEMORIAL LECTURE**
Colin L.W. Driscoll, MD

8:09 **WILLIAM F. HOUSE MEMORIAL LECTURE**
Fear not the Face: From "Oh No" to "On It!!" Advances in Facial Reanimation Over the Decades
Tessa Hadlock, MD
Professor, Harvard Medical School
Director, Hadlock Facial Plastic Surgery / Facial Nerve Center

8:29 **DISCUSSION/Q&A**

8:34 **SESSION D - EVOLVING TREATMENT STRATEGIES AT THE LATERAL SKULL BASE**
Neil S. Patel, MD & Mallory J. Raymond, MD, Moderators

NEUROTOLOGY FELLOW AWARD
MICHAEL E. GLASSCOCK SCIENTIFIC MERIT AWARD
Neoadjuvant Immune Checkpoint Inhibitor Therapy in Temporal Bone Squamous Cell Carcinoma
Kaitlyn A. Brooks, MD
Nathan R. Lindquist, MD
Meera Patel, MD MHS

Neil D. Gross, MD
Marc-Elie Nader, MD
Neal S. Akhave, MD
Paul W. Gidley, MD
The Glasscock Award is given to the highest scoring blinded abstract.

Intratympanic Embolization for Management of Glomus Tumors: A Case Series
Benjamin T. Ostrander, MD
Catherine L. Kennedy, MD
Monika Manchanda, MD
Ramachandra Tummala, MD
Tina Huang, MD

Short-and Long-Term Outcomes of Sigmoid Sinus Wall Resurfacing versus Compression Surgery for Venous Pulsatile Tinnitus: A 313-Case Cohort
Yue-Lin Hsieh, MD, PhD
Wuqing Wang, MD, PhD
Jiake Zhong, MD

Thread-Guided Eustachian Tube Obturator for Patulous Symptoms
Peter G. Volsky, MD
Benjamin VanTasel, DO
Aaron Snow, MD (Presenter)

8:57 **DISCUSSION/Q&A WITH MODERATORS**

9:02 **INTRODUCTION of PANEL**
Colin L.W. Driscoll, MD

9:04 **PANEL**
CONVERGING PATHWAYS: RECONCILING TRAINING GAPS AND PRACTICE REALITIES IN OTOLOGIC & SKULL BASE CARE
Oliver F. Adunka, MD, Moderator
Samantha Anne, MD, MS
Jacqueline Weinstein, MD
Doug Backous, MD
Jacques Herzog, MD
Rick Nelson, MD, PhD

9:54 **MID-MORNING BREAK**

10:20 **SESSION E - WHEN THE EAR REFLECTS THE BODY: SYSTEMIC AND DIAGNOSTIC INSIGHTS IN NEUROTOLOGY**
Nicholas L. Deep, MD & Alicia M. Quesnel, MD, Moderators

Cochlear Implantation in Asymmetric Hearing Loss: A Scoping Review of Functional and Quality-of-Life Gains
Warren L. Luo, BS
Emily Clementi, BA
Ruth K. Mizu, MD

J. Dixon Johns, MD
Alexandra Arambula, MD
Sarah Mowry, MD
Michael Hoa, MD

ANS TRAINEE AWARD

Beta-2 Transferrin May Not Be Specific for Presence of Cerebrospinal Fluid in Middle Ear Fluid
Anthony Thai, MD
Sasha Vasilijic, PhD
Lindsay S. Moore, MD
Peter J. Kullar, MD
Alan G. Cheng, MD
Iram N. Ahmad, MD
Douglas R. Sidell, MD
Karthik Balakrishnan, MD, MPH
Kay W. Chang, MD
Jennifer Y. Lee, MD
Konstantina M. Stankovic, MD, PhD
Jennifer C. Alyono, MD, MS

Assessment of MRI-Derived Synthetic CT for Otologic Surgical Planning
Sammy Gao, BS
Yubo Fan, PhD
Kaiwen Chen, BS
Benoit M. Dawant, PhD
Robert F. Labadie, MD, PhD
Jack H. Noble, PhD

The Impact of Obstructive Sleep Apnea Diagnosis and Treatment on Spontaneous CSF Leaks: A Multi-Institutional Database Study
Adam S. Vesole, MD
Michael J. Ruckenstein, MD
Tiffany P. Hwa, MD

Hearing Loss Is Associated with Longitudinal Accumulation of Regional Brain Amyloid in the NOMEM Cohort
S. Dillon Powell, ME
Froogh Aziz, MS
Patrick J. Lao, PhD
Adam M. Brickman, PhD
Mark A. Eckert, PhD
José A. Luchsinger, MD
Justin S. Golub, MD, MS

Cardiovascular Effects of Transcutaneous Auricular Nerve Stimulation in Rats
Allison Oliva, MD
Bharadwaj Nandakumar, PhD
Lohane Moreira Da Costa
Patrick Ganzer, PhD
Vivek Kanumuri, MD

10:54 **DISCUSSION/Q&A WITH MODERATORS**

10:59 **INTRODUCTION of PANEL** – *Colin L.W. Driscoll, MD*

11:01 **PANEL**

CLINICAL CURVEBALLS: COMPLICATIONS AND TOUGH CALLS

Seilesh C. Babu, MD, Moderator
Maura K. Cosetti, MD
Hamid Djalilian, MD
Prof Thomas Lenarz, MD, PhD
Michael J. Link, MD
Neil S. Patel, MD

11:56 **INTRODUCTION OF INCOMING PRESIDENT**

David S. Haynes, MD, MMHC

CLOSING REMARKS

Colin L.W. Driscoll, MD

12:00 **ADJOURN**

SELECTED ABSTRACTS

ORAL PRESENTATIONS

IN ORDER OF PRESENTATION

61st Annual Spring Meeting
AMERICAN NEUROTOLOGY SOCIETY

April 24-26, 2026
Sheraton Phoenix Hotel
Phoenix Convention Center
Phoenix, AZ

ANS Oral presentations are on Saturday/Sunday
ANS Posters will be displayed on Friday/Saturday

Early Clinical Outcomes of a Fully Implantable Cochlear Implant:
A U.S. Multicenter Trial

Theodore R. McRackan MD, MSCR; Abraham Jacobs, MD; Jack Shohet, MD; Wanye Berryhill, MD
Sammy Gao, BS; Envoy Acclaim Clinical Trial Consortium, Colin L.W. Driscoll, MD

Objective: While cochlear implant (CI) effectiveness is well established, traditional CIs require external components that necessitate regular charging and are highly visible. Successful development of fully implantable CIs has been a long-standing goal for industry, clinicians and patients. The current study describes the preliminary outcomes of a US-based prospective clinical trial for a fully implantable CI.

Study design: Prospective United States-based multicenter FDA clinical trial of a newly developed fully implantable CI.

Setting: Tertiary CI centers

Patients: The initial phase included 10 adults with bilateral, post-lingual hearing loss with prior use of a hearing aid. Exclusion criteria included having a prior CI, retrocochlear pathology, and single-sided deafness.

Interventions: Cochlear implantation with a novel device

Results: At the time of the abstract deadline, trial participants in the initial cohort met 3-month FDA outcome criteria enabling full study expansion. Complete pre-CI to 6-month post-CI outcomes will be presented at the annual meeting, but reporting is currently locked by the FDA. Specific trial outcomes will include pre-CI to 6-month aided thresholds and CNC phoneme/word, AzBio Quiet and Noise (+10 SNR), CIQOL-35 Profile domain (and global), and SSQ subscale (and total) scores. There were no Serious Adverse Events or Unanticipated Adverse Device Effects reported.

Conclusion: The development of fully implantable CI technology represents an important and exciting moment in the history of cochlear implantation. However, safety, performance and real-world considerations (e.g., battery life) must reach an acceptable standard for these technologies to be broadly adopted. These positive early outcomes for the initial phase of this trial set the stage for full FDA trial expansion and future adoption and implementation of fully implantable CIs.

Note: These results will also be presented at the ACIA annual meeting, which occurs after the ANS Spring meeting. Dual submission to ACIA and ANS has been approved by the ANS president.*

Learning Objective: Attendees will understand the technology associated with a novel fully implantable cochlear implant as well as the 6-month results and complication profile.

Desired Result: Provide initial insight into the outcomes from a fully implantable cochlear implant.

Level of Evidence – Level III

Indicate IRB or IACUC: IRB #140843

Complication Rates and Efficiency of Robotic Assisted Versus Manual Insertion Cochlear Implantation

Dhruv K. Patel, BS; John J. Sykes, MD; Kenneth R. Feehs, MD; Eric M. Kraus, MD, MS
Pedrom C. Sioshansi, MD, MS; Michele M. Gandolfi, MD, MS

Objective: To compare postoperative complication rates and operative efficiency between robotic-assisted and manual insertion cochlear implantation (CI) and to identify predictive factors influencing ability to utilize robotic insertion systems.

Study Design: Retrospective cohort study.

Setting: Tertiary academic center.

Patients: Adult patients (≥18 years old) undergoing CI between December 2023 to September 2025. Patients undergoing reimplantation or concurrent otologic procedures were excluded.

Interventions: CI performed either manually or with robotic assistance using the IotaSOFT Insertion System.

Main Outcome Measures: 1) Postoperative complication rates. 2) Mean operative time. 3) Intraoperative robot-to-manual conversion or partial-manual completion rates.

Results: One hundred and fifty patients underwent CI, 57 robotic-assisted and 93 manual. Mean age at CI (65 ± 17.1 vs 64 ± 15.9 years, $p=0.5$), history of prior otologic surgery ($p=0.2$), and comorbid otologic pathology ($p=0.3$) were comparable. Manual cases included a higher proportion of male patients (67%, $p<0.001$) and former or current smokers (56%, $p=0.027$). Intraoperative robotic complications occurred in 22 (38.6%) cases, with 9 (15.8%) requiring robot-to-manual conversion and 13 (22.8%) requiring partial-manual insertion of the final 1-2mm of the electrode array. Among the converted cases, 5 (55.6%) had preoperative temporal bone CT findings of mastoid opacification and/or labyrinthitis ossificans. Anatomic restrictions (n=4) were the most common intraoperative cause for conversion. No statistically significant differences were observed in postoperative complication rates between robotic-assisted and manual cases ($p>0.05$ for all) during the <3 month or >3 month follow up period. The most frequently observed complications included dizziness (39% vs 31%, $p=0.4$) and tinnitus (30% vs 20%, $p=0.2$). Mean operative time was significantly longer for robotic-assisted cases compared to manual cases (191.8 vs 170.1 minutes, $p<0.001$). Among robot-assisted cases, mean operative times did not improve over time (>6 months vs 6-12 months vs >12 months, $p=0.22$).

Conclusions: Robotic-assisted CI demonstrated a comparable postoperative safety profile to manual insertion CI, with no significant differences in short- or long-term complication rates, despite longer operative times. Although intraoperative robotic insertion complications were uncommon, robot-to-manual conversion was associated with CT temporal bone findings of mastoid opacification or labyrinthitis ossificans and intraoperative anatomic restrictions, suggesting potential imaging and procedural predictors of robotic difficulty.

Learning Objective: To evaluate differences in postoperative complications between robotic-assisted and manual insertion CI and identify imaging and intraoperative predictors of robotic-assisted insertion difficulty.

Desired Result: To demonstrate that robotic-assisted insertion CI provides comparable complication rates to manual insertion CI, with potential for improved preoperative surgical selection based on image findings and anatomy.

Level of Evidence - Level IV.

Indicate IRB or IACUC: Wake Forest University School of Medicine, IRB00137017.

HERBERT SILVERSTEIN AWARD FOR RESEARCH EXCELLENCE IN OTOLOGY/NEUROTOLOGY

Apical Electrode Placement to Optimize Cochlear Implant Performance in Patients with an Ossified Cochlea and Incomplete Electrode Array Insertion

Justin Cottrell, MD; Emily R. Spitzer, Aud; David M. Landsberger, PhD; William Shapiro, AuD
Rebecca Piper, AuD; Sean McMenomey, MD; J. Thomas Roland Jr, MD

Objective: The placement of a standard electrode array with an additional electrode placed into the cochlear apex has previously been shown to facilitate current shifts towards the apex during standard cochlear implantation. Within patients with an ossified cochlea, a similar technique may also allow for current to be shifted through areas of ossification that can't be reached with an electrode. This study describes the surgical technique, outcomes, and programming parameters associated with apical ground electrode placement to steer current in patients with cochlear ossification and incomplete electrode array insertion.

Study Design: Retrospective case series.

Setting: Tertiary referral centers in the United States and Uganda.

Patients: Seven patients (ages 3–43 years) with partial or complete cochlear ossification who underwent cochlear implantation with incomplete standard electrode array insertion and placement of an apical electrode between 2020 and 2024.

Interventions: Standard cochlear implant electrode array insertion supplemented by an apical cochleostomy and placement of the ground electrode (ECE1) into the cochlear apex. Post-operative CI programming incorporated both standard and apical stimulation maps to evaluate perceptual benefit.

Main Outcome Measures: Intraoperative imaging and objective measures of intracochlear current spread, postoperative speech perception scores, patient-reported map preference, and surgical complications.

Results: Seven patients were included for study, with insertion depths of the standard array ranging from 11–18 electrodes. No intra- or postoperative complications occurred. TIM heatmaps demonstrated variable current shifts depending on apical electrode placement accuracy. Patients with demonstrable intracochlear current shifts showed greater subjective preference for apical-grounded programs. Speech outcomes varied with the degree of ossification.

Conclusions: Apical electrode placement can be safely performed in ossified cochleae and may expand intracochlear stimulation when standard insertions are incomplete. Although benefit is variable and technique-dependent, intraoperative confirmation tools such as TIM may optimize apical electrode positioning and associated incorporation the apical ground in programming maps.

Professional Practice Gap & Educational Need: Cochlear ossification presents a challenge to the implant surgeon. Performance in patients with complete ossification, or incomplete electrode insertion can be poor. Investigation into alternative means of completing surgery to improve post-operative performance is required..

Learning Objective: To understand how placement of an apical ground electrode, in addition to standard electrode insertion, may help improve post-operative CI performance in patients with cochlear ossification.

Desired Result: Surgeons add additional tools that can be used at their disposal to help patients with cochlear ossification.

Level of Evidence - Level IV

Indicate IRB or IACUC: IRB# i25-00378

Cochlear Implant Mapping Without a Target: Basal Deactivation and the Role of Electrophysiologic-Guided Alignment

Amit Walia, MD, MSCI; Matthew A. Shew, MD; Amanda Ortmann, PhD
Nedim Durakovic, MD; Shannon Lefler, AuD; Jacques A. Herzog, MD; Craig A. Buchman, MD

Objective: To evaluate how basal electrode deactivation at cochlear implant (CI) activation affects speech performance and to quantify the impact of tonotopic electrophysiologic mismatch on outcomes.

Study Design: Retrospective cohort

Setting: Tertiary referral center

Patients: 147 postlingually deafened adults received perimodiolar arrays (CI632). In 69 (47%), the frequency allocation table (FAT) was modified at activation, most often deactivating the two most basal electrodes due to absent thresholds and reallocating the 188–7,938 Hz range across remaining electrodes. In other cases, FAT modifications maintained full frequency coverage. Intraoperative intracochlear electrocochleography (ECochG) estimated frequency–place maps (250–4,000 Hz), providing a physiologic tonotopic reference for FAT alignment. ECochG–FAT mismatch was defined as the log-frequency deviation between ECochG tonotopic peaks and assigned FAT center frequencies.

Main Outcome Measures: Speech-perception scores (CNC) at 3, 6, and 12 months.

Results: Mixed-effects modeling showed slower early and overall improvement among patients with basal deactivation. At 3 months, CNC improvement was 11.7 points lower in this group (β=–11.7; 95% CI:–21.4 to –2.0). Significant time effects at 6 months (β=4.4; 95% CI:0.4–8.6) and 12 months (β=9.2; 95% CI:4.5–14.0) indicated continued gains in both groups. The group × time interaction (β=–8.6; 95% CI:–14.9 to –2.3) confirmed slower improvement and persistently lower performance with basal deactivation. Greater ECochG–FAT mismatch correlated with poorer 12-month CNC (r=–0.41; 95% CI:–0.62 to –0.09).

Conclusions: Routine CI programming often lacks a patient-specific tonotopic reference. Without such a physiologic target, basal deactivation can distort place-frequency alignment and hinder speech outcomes. ECochG-guided mapping may provide a physiologic framework to standardize programming and improve performance by aligning stimulation with native cochlear tonotopy.

Learning Objective: Participants will recognize that current cochlear implant programming lacks a defined target and that commonly employed modifications, such as basal electrode deactivation, can substantially alter cochlear place–frequency alignment and delay optimal speech outcomes. A defined target, whether anatomic (e.g., Greenwood or Stakhovskaya) or electrophysiologic, provides a necessary framework for consistent, outcome-driven mapping.

Desired Result: Attendees will be able to apply the concept of ECochG-based tonotopic mapping as a physiologic target strategy to achieve individualized frequency–place alignment, improving programming consistency and patient speech-perception outcomes.

Level of Evidence - IV

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

Auto-Stopping Electrocochleography-Guided Cochlear Implant Insertion First-in-Human Feasibility Study

Maxwell Bergman, MD; Naina Miranda; Isaac Swink; Rachel Scheperle, AuD; Marlan R. Hansen, MD; Alexander Claussen, MD

Objective: To assess the feasibility and real-time performance of an auto-stopping, electrocochleography (ECochG)-guided cochlear implant insertion system in human surgery

Study Design: Prospective feasibility study

Setting: Tertiary academic medical center

Patients: Nine cochlear implant recipients undergoing hearing-preservation surgery

Interventions: Nine electrode array insertions were performed using the Advanced Bionics AIM ECochG module with the iotaMotion iotaSOFT Insertion System. A range of ECochG detection settings was evaluated, including drop thresholds of 2, 4, and 6 dB, with consistent frequency monitoring at 250, 500, 1,000, and 2,000 Hz.

Main Outcome Measures: Comparison of automated versus manual surgeon reaction times during ECochG "drop" events and verification of system responsiveness

Results: Nine implantations were performed: four cases used standard manual foot-pedal control; four used automated ECochG-triggered stops; one patient was excluded for technical issues during ECochG recording. Reaction-time comparisons were obtained in cases where both manual and automated stops occurred after verified ECochG amplitude decreases. Across eight analyzable cases and 25 total drop events, the automated system halted forward motion 321-883 ms faster than the surgeon, consistent with prior testing.

Conclusions: This study confirms that the robotic-assisted system achieved reliable, real-time ECochG-triggered auto-stops during human CI insertion. The findings reaffirm the system's faster reaction time compared with human performance, consistent with prior benchtop observations. By automating ECochG-guided stopping, this approach helps overcome human-factor limitations such as high mental workload during active ECochG monitoring, allowing the surgeon to focus on other critical aspects of the procedure. Future studies should further optimize "drop" thresholds and evaluate the impact of this technology on hearing preservation outcomes.

Learning Objective: To understand how auto-stopping ECochG-guided insertion can compares with manual surgeon reaction times to potentially reduce human-factor limitations during cochlear implantation

Desired Result: To highlight the clinical feasibility of automated ECochG-guided insertion systems and their potential to enhance hearing-preservation outcomes through improved reaction-time performance

Level of Evidence - Level IV (first-in-human feasibility study)

Indicate IRB or IACUC: IRB Approved – University of Iowa (IRB #202408621)

Off-the-Ear vs Behind-the-Ear Cochlear Implant Processors: Comparative Analysis of Skin Complications and Retention Outcomes in a Large Institutional Cohort

Maani M. Archang, MD, PhD; Karl R. Khandalavala, MD; Brian A. Neff, MD; Aniket A. Saoji, PhD
Matthew L. Carlson, MD, MBA; Colin L.W. Driscoll, MD; James R. Dornhoffer, MD

Objective: To evaluate whether off-the-ear cochlear (OTE) implant processors, increasingly used for cosmetic and comfort benefits, are associated with higher rates of skin complications or retention difficulties compared with traditional behind-the-ear (BTE) processors

Study Design: Retrospective single institution review

Setting: Tertiary academic medical center

Patients: CI recipients who were provided OTE processors as primary processor or as backup between 2017 and 2024

Interventions: Cochlear implantation

Main Outcome Measures: Skin complication (pain, erythema, ulceration, infection), device retention difficulty, OTE failure

Results: 393 implants (331 patients) including 331 off-the-ear (OTE) and 62 behind-the-ear (BTE) processors used by patients as their primary processor after implantation were included. OTE processors demonstrated significantly higher rates of skin complications than BTE (28.7% [95/331] vs 11.3% [7/62]; p = 0.004). Minor skin issues were more frequent in OTE (25.4% [84/331] vs 9.7% [6/62]; p = 0.006), while major complications were rare (3.3% [11/331] vs 0% [0/62]; p = 0.225). Most skin complications were resolved by decreasing magnet strength, padding, and break from device with magnet reduction. Eleven OTE implants (3.3%) required switching to a BTE processor due to skin complications and two were explanted due to severity of skin complications resulting in device exposure. Retention issues were more frequent among OTE vs BTE (14.5% [48/331] vs 8.1% [5/62]; p = 0.173). All retention difficulties of BTE processors were resolved by increasing magnet strength or using retention devices. Of OTE processors with retention difficulties, 10.4% (5/48) switched to a BTE device.

Conclusions: OTE processors were associated with higher rates of skin and retention complications compared with BTE designs, though most issues were resolved with conservative measures, and severe complications such as ulceration, skin breakdown, and CI exposure were rare. These findings highlight the need to for counseling patients on balancing comfort and cosmetic advantages of OTE processors against their higher risk of complications.

Learning Objective: To understand the relative rates and management of skin and retention complications between off-the-ear and behind-the-ear cochlear implant processors, enabling clinicians to better counsel patients on device selection and long-term care.

Desired Result: Participants will be able to incorporate complication risk profiles into patient counseling and device selection, and adjust follow-up strategies to optimize long-term comfort, retention, and skin health.

Level of Evidence - IV

Indicate IRB or IACUC: 22-000183

Vestibular Schwannoma Growth Patterns in Patients Aged 70 and Older

Kathy Le, MD; Akshay Prabhakar, BSA; Justina R. Varghese, BA; Jeffrey Vrabec, MD

Objective: To characterize the growth behavior of vestibular schwannomas (VS) in adults aged 70 years and older and to evaluate factors impacting tumor growth rate.

Study Design: Retrospective cohort study

Setting: Tertiary-care academic medical center

Patients: Adults with a diagnosis of VS (ICD-10 D33.3) who were age ≥ 70 years at any point during surveillance between 01/01/2021 to 10/16/2025 with ≥ 2 MRI scans at our institution with reported VS size. Patients with prior microsurgery or stereotactic radiosurgery were excluded.

Interventions: Serial diagnostic MRI surveillance. Tumor growth rate was calculated as the difference between final and initial tumor size divided by total follow-up duration (mm/year). Tumor size change was categorized as regression (< -2 mm/year), growth (> +2 mm/year), or stable (-2 to +2 mm/year).

Main Outcome Measures: Tumor characteristics; tumor growth rate and behavior; associations between growth rate and tumor and patient variables

Results: Among the 44 patients who met criteria, 43% were male and 57% were female. Median age at diagnosis was 72 (range 58–87). Median initial tumor diameter was 7 mm (range 1.6–20) and median follow-up time was 1.9 years (IQR 0.8–4.5). During surveillance, 4/44 tumors (9%) spontaneously regressed, 8/44 (18%) grew, and 32/44 (73%) were stable. Tumor growth rate declined significantly with greater age at diagnosis (Spearman $\rho = -0.35$, $p = 0.018$). Tumor size at diagnosis was not correlated with growth rate (Spearman $\rho = -0.02$, $p=0.89$).

Conclusions: In patients aged ≥70 years, VS were predominantly stable; spontaneous regression was observed as well during surveillance. Growth rates declined significantly with age. These findings support conservative, imaging-based observation particularly in older patients and support prospective studies to refine age-informed surveillance intervals and identify biologic drivers of age-related growth attenuation.

Learning Objective: Identify tumor behavior patterns (regression, stability, growth) of vestibular schwannomas in patients ≥ 70 years under MRI surveillance and understand the association of age on tumor growth rate to inform management.

Desired Result: For clinicians to apply age-informed, conservative surveillance strategies for older adults with vestibular schwannoma.

Level of Evidence - Level IV

Indicate IRB or IACUC: IRB #41019 Houston Methodist Research Institute, 8/15/2025

Rate of Hearing Preservation After Stereotactic Radiosurgery for Treatment of Vestibular Schwannoma: Analysis of Patients with 100% Word Recognition Scores

Karl R. Khandalavala, MD; Hernan Vargas; John P. Marinelli, MD; Christine M. Lohse, MS
Michael J. Link, MD; Matthew L. Carlson, MD, MBA

Objective: To evaluate hearing outcomes after treatment with stereotactic radiosurgery (SRS) for sporadic vestibular schwannoma (VS) among patients with baseline 100% word recognition scores (WRS).

Study Design: Historical cohort.

Setting: Tertiary academic medical center.

Patients: Patients with 100% WRS on audiometric testing at initial treatment with SRS.

Interventions: Gamma Knife SRS.

Main Outcome Measures: Rate of maintaining serviceable hearing (SH), defined as American Academy of Otolaryngology-Head and Neck Surgery hearing class A or B.

Results: In total, 125 patients had 100% WRS at SRS for sporadic VS. Median age at SRS was 56 years (IQR 51-62), 75 (60%) of patients were women, and median pure tone average (PTA) at SRS was 20 dB HL (IQR 13-31). Sixty-eight patients progressed to non-SH at a median of 3.4 years after SRS (IQR 1.0-8.6). Rates of maintaining SH (95% CI, number still at risk) at 1, 3, 5, 7, and 10 years after SRS were 88% (82-94, 101), 75% (68-84, 81), 61% (53-71, 55), 58% (49-68, 43), and 44% (35-56, 26), respectively. Each 10-dB HL increase in PTA at SRS was associated with a 52% increased risk of progression to non-SH (hazard ratio 1.52, 95% CI 1.24-1.87, $p<0.001$).

Conclusions: Despite having 100% pre-treatment WRS, most patients with sporadic VS treated with SRS experienced clinically significant hearing decline over time. Even among this cohort of patients with excellent baseline hearing, at 10 years after treatment, only 44% of patients maintained SH.

Learning Objective: To describe the rate of hearing preservation among patients with perfect baseline hearing who undergo radiosurgical treatment for sporadic vestibular schwannoma.

Desired Result: The audience will understand the rates of hearing deterioration following radiosurgery for sporadic vestibular schwannoma, particularly in the context of published rates of hearing preservation among patients undergoing continued observation with a wait-and-scan approach.

Level of Evidence – Level IV

Indicate IRB or IACUC: IRB approved 9/22/2016 (IRB ID: 23-001641)

ANS TRAINEE AWARD

A National Cross-Sectional Assessment of the Mayo Clinic Vestibular Schwannoma Quality of Life (VSQOL) Index by Tumor Management Strategy

Madison V. Epperson, MD; Christine M. Lohse, MS; Michael J. Link, MD; Matthew L. Carlson, MD, MBA

Objective: To evaluate differences in disease-specific quality of life (QOL) among patients with sporadic vestibular schwannoma (VS) by tumor management strategy using recently validated Mayo Clinic Vestibular Schwannoma Quality of Life (VSQOL) Index relative to established minimal important difference (MID) thresholds.

Study Design: Cross-sectional cohort

Setting: Acoustic Neuroma Association and tertiary care center.

Patients: Adults who completed the VSQOL Index between February 2023-August 2025.

Interventions: Microsurgery, radiation, or observation.

Main Outcome Measures: VSQOL Index scores for the Hearing Problems; Dizziness and Imbalance; Pain, Discomfort, and Tinnitus; Problems with Face or Eyes; Impact on Physical, Emotional, and Social Well-being; Difficulty with Thinking and Memory; Global QOL; and Satisfaction or Regret domains were compared by tumor management strategy adjusting for age, sex, and tumor size at diagnosis. Scores range from 0-100; higher scores indicate better QOL.

Results: 652 patients were included: 333 (51%) treated with microsurgery, 175 (27%) treated with radiation, and 144 (22%) managed with observation. Mean (SD) time of survey was 6.2 (2.7) years from treatment. Global QOL adjusted mean scores (95% CI) differed significantly ($p<0.001$) by group: 70 (67-72) for microsurgery, 73 (70-77) for radiation, and 79 (75-83) for observation. Domain scores differed significantly for Hearing Problems ($p<0.001$), Dizziness and Imbalance ($p<0.001$), Problems with Face or Eyes ($p<0.001$), and Difficulty with Thinking and Memory ($p=0.03$). Pairwise comparisons that exceeded at least the lower bound of published MIDs included Global QOL scores (between microsurgery and observation) and Hearing Problems (between microsurgery and observation).

Conclusions: At a mean follow-up of 6.2 years following treatment, several notable statistically and clinically significant differences in QOL were identified among management groups using the recently developed VSQOL Index. These important findings may be used to guide patient counseling regarding management options.

Learning Objective: Understand how application of the VSQOL Index and established MID thresholds enables interpretation of meaningful differences in QOL among VS management approaches.

Desired Result: Empower the clinician to apply disease-specific, patient-reported QOL outcomes to better inform an individualized patient-centric VS management strategy.

Level of Evidence: III

Indicate IRB or IACUC: Approved by the Institutional Review Board (14-009331)

Emerging Non-Conventional Imaging Modalities Characterizing Vestibular Schwannoma Prognosis: A Scoping Review

Nader G. Zalaquett, MD; John P. Marinelli, MD; Karl R. Khandalavala, MD
Christine M. Lohse, MS; Matthew L. Carlson, MD, MBA

Objective: To explore the existing evidence on novel imaging modalities that may aid in prognostication of vestibular schwannoma (VS) across various treatment approaches.

Study Design: Scoping review

Setting: Not applicable

Patients: VS patients

Interventions: Novel imaging techniques

Main Outcome Measures: VS tumor growth and response to treatment

Results: A total of 16 articles were included in this review. Of these, 7 focused on pre-treatment prognosis, 6 evaluated radiosurgery outcomes, 2 examined microsurgery outcomes, and 1 assessed response to bevacizumab. The imaging modalities investigated included radiomics (n=10), positron emission tomography (PET) (n=3), dynamic contrast-enhanced MRI (DCE-MRI) (n=3), and magnetic resonance elastography (MRE) (n=1). Radiomics studies yielded encouraging results, with reported accuracy ranging from 0.52 to 0.88, sensitivity from 0.13 to 0.95, specificity from 0.50 to 0.94, and area under the curve values from 0.65 to 0.99. PET studies identified several promising ligands associated with tumor growth, suggesting a potential role in prognostication. DCE-MRI also demonstrated valuable associations with tumor growth, surgical outcomes, and treatment response to bevacizumab. Lastly, the study on MRE highlighted its ability to predict intraoperative tumor stiffness.

Conclusions: Several emerging imaging modalities hold potential for improving prognostication in VS. Techniques such as radiomics, PET, and DCE-MRI have shown promising results; however, the supporting evidence is still limited and heterogeneous. Further research is necessary to validate these approaches and enhance their clinical utility.

Learning Objective: To understand the potential of novel imaging modalities in predicting VS tumor growth and treatment response across different therapeutic approaches.

Desired Result: Not applicable

Level of Evidence – Level V

Indicate IRB or IACUC: Not applicable

Response of NF2-Related Schwannomatosis (NF2) Associated Vestibular Schwannomas to Losartan: A Case Series

Sophie Jabban, BA; Spencer Frome, MA; Maya Hatley, BA; Kaleb Yohay, MD
J. Thomas Roland Jr, MD; Devorah Segal, MD, PhD

Objective: Given preclinical evidence suggesting the potential efficacy of losartan in modulating vestibular schwannoma (VS) growth and hearing loss, the objective of this study is to identify whether a cohort of NF2 patients with VSs respond to treatment with losartan.

Study Design: Single-institution retrospective case series

Setting: Tertiary referral center

Patients: Seven Patients with NF2

Interventions: Losartan

Main Outcome Measures: Change in VS size greater than 20%, in accordance with the Response Evaluation in Neurofibromatosis and Schwannomatosis (REiNS) criteria for evaluating tumor response to medical intervention. Additionally, change in hearing measures according to the 95% critical difference table for WRS score derived from Thornton and Raffin.

Results: This study included 7 patients, with 12 VSs, treated at our institution from 2014-2024. All included patients had been treated with at least one antineoplastic agent prior to initiation of losartan. Prior lines of therapy ranged from 1 to 4 (average: 1.85, SD: 1.07). Treatment duration among patients ranged from 0.67 to 7.00 years (average: 2.74, SD 2.33). Patients were categorized by the indication for losartan treatment, including primary hypertension (n=2), hypertension secondary to antineoplastic therapy (n=3), or hearing loss prevention (n=3). 4 patients were concurrently managed with antineoplastic therapy (bevacizumab, n=3; brigatinib, n=1). 3 of 12 tumors from 2 patients regressed in size over the treatment course. Both patients with responsive tumors were treated concurrently with bevacizumab. 5 of 7 (71.4%) patients exhibited worsened hearing over the treatment course, 2 of 7 (28.6%) exhibited stable hearing, and no patient experienced hearing improvement with losartan.

Conclusions: This case series suggests that losartan may influence tumor size, particularly when used in combination with bevacizumab. This finding warrants further study of losartan as a potential adjunctive treatment of NF2-related vestibular schwannomas. The study is limited by small sample size.

Learning Objective: Understand the role of losartan in treatment of NF2-related vestibular schwannomas and hearing loss.

Desired Result: Assist physicians in selecting optimal targeted therapies for patients with NF2.

Level of Evidence – V

Indicate IRB or IACUC: NYU Grossman School of Medicine: #i23-00840.

Long COVID is Associated with Increased Odds of Neurotologic Manifestations: A National Database Study

Anvitha R. Metpally, BS; Taral K. Jella, BS; Tara Menon, BS; Eric Oliver, MD

Objective: To evaluate whether long COVID-19, compared to acute COVID-19, is associated with increased odds of developing new-onset neurotologic effects, particularly sensorineural hearing loss (SNHL), vertigo, and tinnitus.

Study Design: Retrospective cohort study using a large multi-institutional electronic health record network.

Setting: National database (TriNetX) sourced from 84 HCOs in the USA.

Patients: Adults (≥18 years) with confirmed SARS-CoV-2 infection between January 2019 and January 2023 were included. Cohort 1 comprised long COVID-19 (ICD-10 code U09) patients, and Cohort 2 comprised acute COVID-19 patients. Patients with pre-existing otitis media and presbycusis were excluded. Propensity score matching (1:1) for age, sex, and race/ethnicity yielded 98,359 patients per cohort.

Interventions: Analyses were based on diagnostic and clinical records. SNHL was defined by ICD-10 codes H90.3, H90.4, H90.5, and 398.1; vertigo by ICD-10 code H81.4, and tinnitus by ICD-10 code H93.1.

Main Outcome Measures: Incidence of new-onset SNHL, vertigo, or tinnitus within three years after long or acute COVID-19 diagnosis.

Results: After matching, SNHL developed in 3,082 long COVID-19 patients (3.40%) versus 1,591 acute COVID-19 patients (1.67%); vertigo in 121 (0.12%) versus 51 (0.05%); tinnitus in 1,995 (2.15%) versus 931 (0.97%). Long COVID-19 patients had higher odds of SNHL (OR = 2.07; 95% CI 1.95–2.20; $p < 0.0001$), vertigo (OR = 2.38; 95% CI 1.72–3.30; $p < 0.0001$), and tinnitus (OR = 2.26; 95% CI 2.09–2.44; $p < 0.0001$).

Conclusions: Long COVID-19 is associated with significantly increased risk of SNHL, vertigo, and tinnitus compared to matched acute COVID-19 controls.

Learning Objective: Recognize increased neurotological risks in long COVID-19 patients and the need for vigilant monitoring.

Desired Result: Enhanced awareness of the association between long COVID-19 and neurotological effects to improve patient outcomes and reduce long-term disability.

Level of Evidence - Level IV

Indicate IRB or IACUC: Exempt

Hearing and Vestibular Deficits Following the Use of Teprotumumab: Preliminary Findings

Samuel Johnson, BS; Lydia Granados, BS; Claudia Prospero-Ponce, MD
Tamis Bright, MD; Amanda Chiao, AuD, PhD

Objective: To determine the oto-vestibulotoxic effects of Teprotumumab on hearing and the vestibular function in adults who were prescribed Teprotumumab and as compared to an age-sex matched control group

Study Design: A prospective cohort

Setting: Tertiary referral center

Patients: Adults 18-79 years of age who were prescribed Teprotumumab and age-sex matched adults with no history of Teprotumumab participated. Participants previously diagnosed with hearing or vestibular loss, otologic surgery, and/or neurodegenerative disorders were excluded.

Interventions: Participants in the study group completed a baseline assessment and repeat testing following each Teprotumumab infusion (~ 8 total). The control group received the same battery twice for test-retest reliability.

Main Outcome Measures: An otologic questionnaire was administered per visit to document symptom changes. We hypothesized that the study group would report more otologic symptoms with cumulative infusions. Auditory testing included standard-and-extended high frequency (EHF) audiometry, DPOAEs, and speech perception in noise. We hypothesized that the study group would show reduced: a) standard and EHF-pure-tone average thresholds (PTAs), b) DPOAE amplitudes, and c) speech-in-noise from baseline to the final testing timepoint. Vestibular testing included the video Head Impulse Test (vHIT), dynamic visual acuity (DVA), and standing balance. We hypothesized that vestibular testing would reveal: a) lower vHIT gain, b) increased DVA loss, and c) greater imbalance from baseline to the final testing timepoint. We anticipated that at the conclusion of their treatment, the study group would have greater otologic deficits compared with controls.

Results: Non-parametric repeated measures analyses for the study group (n = 5; mean age = 50.4 years, 3 males) showed an increase in EHF PTAs with cumulative infusions ($p = 0.032$). There was also no significant change to the standard frequencies, DPOAE amplitudes, or speech perception over time (p-values > 0.05). The study group had no significant change to vHIT gains, DVA, or standing balance from baseline to the end of their treatment (p-values > 0.05). Subjectively, a new onset of tinnitus (n= 4/5) or aural fullness (n= 3/5) was most commonly reported following an infusion, and for all who reported otologic symptoms, they had been exposed to at least 3 infusions. Between group analysis indicated that our study group's final EHF PTAs ($U = 0$, $p = 0.012$) and EHF DPOAEs ($U = 1.3$, $p = 0.028$) were significantly poorer than controls (n = 6; mean age = 46.2 years, 4 males), with no other group differences on other audiometric or vestibular measures (all p-values > 0.05).

Conclusions: Preliminary, Teprotumumab likely has ototoxic effects on EHF-thresholds and EHF-DPOAEs, but physiological changes may not be significant enough to impact the traditional speech frequencies. Temporary otologic symptoms are common with cumulative infusions. Teprotumumab does not appear to negatively impact vestibular function. Continued data collection is underway.

Learning Objective: Learners are expected to identify the negative physiological and behavioral implications of Teprotumumab on hearing and vestibular function in adults.

Desired Result: To improve physician knowledge about anticipated ototoxicity for patients taking Teprotumumab and risks.

Level of Evidence – Level IV

Indicate IRB or IACUC: This study is approved by the author's Institutional Review Board (E24130, approval date July 25, 2024).

Increased Risk of Inner Ear Disease in Patients with Inflammatory Bowel Disease
A National Database Study

Aaron Tucker, BA; Yashnoor Sandhu, BS; Aashish Batheja, MPH; Daniel H. Coelho, MD

Objective: Inflammatory bowel disease (IBD) is a systemic rheumatologic condition, previously reported to affect the inner ear, although there is a lack of large-scale research to support this. This study aims (1) to determine the risk of inner ear disease in IBD and its subtypes and (2) to determine whether use of IBD medication modifies the observed effect.

Study Design: Retrospective Cohort Cross-Sectional Analysis.

Setting: Cosmos, an Epic electronic health record database, contains records of >300 million patients from 1,762 hospitals in the US, Canada, Lebanon, and Saudi Arabia.

Patients: 1,616,041 patients at least 15 years of age searched 1/1/15 to 7/31/25. Patients were grouped according to the presence or absence of IBD, and were further categorized as either Crohn's Disease (ICD-10 code K50) or Ulcerative Colitis (K51).

Interventions: Use of a common IBD medication (sulfasalazine, mesalamine, mycophenolate mofetil, azathioprine, methotrexate, ciprofloxacin).

Main Outcome Measures: Risk ratios with 95% confidence intervals (RR, 95% CI) for sensorineural hearing loss (SNHL) (H90.3-90.5), tinnitus (H93.1), peripheral vertigo (H81.1, H81.3), and Ménière's disease (H81.0).

Results: 21,063 IBD patients were compared to 1,594,978 patients without IBD. IBD patients were older (57 ± 0.26 vs 51 ± 0.03), similar in sex (56.9% vs 55.4%), and more often white (82.7% vs 70.8%). IBD diagnosis was associated with a higher risk of the neurotologic diagnoses studied (10.2% vs 5.9%, RR 3.11, 2.99-3.24). SNHL (5.4% vs 2.8%, RR 3.47, 3.28-3.68), tinnitus (4.4% vs 2.7%, RR 2.93, 2.75-3.13), peripheral vertigo (3.0% vs 1.7%, RR 3.18, 2.94-3.43), and Ménière's disease (0.4% vs 0.21%, RR 1.86, 1.34-2.58) were all significantly associated (all $p<0.0001$). Use of IBD medication mitigated the risk of each diagnosis except SNHL, which remained slightly higher (RR 1.10, 1.03-1.18, $p=.0074$). Unmedicated IBD patients showed consistently higher risks. Similar patterns were observed in Crohn's and Ulcerative Colitis cohorts.

Conclusions: IBD diagnosis was associated with increased risk of neurotologic disease, suggesting a shared autoimmune pathophysiology. Use of IBD medication was a negative effect modifier, though unmedicated IBD patients remained at increased risk. This supports the claim that IBD independently contributes to the development of neurotologic disease.

Learning Objective: Understand the potential systemic autoimmune effect of IBD on the inner ear.

Desired Result: Motivate future research into subpopulations at risk, and promote the early referral of all IBD patients to hearing specialists.

Level of Evidence - Level III

Indicate IRB or IACUC: Exempt

NICHOLAS TOROK VESTIBULAR AWARD

Increased Adrenergic Receptor Expression in Meniere's Disease

Adam Y. Xiao, MD, PhD; Achilles Kanaris, BS; Masanori Ishii, MD
Ivan A. Lopez, PhD; Gail Ishiyama, MD; Akira Ishiyama, MD

Hypothesis: There is increased expression of adrenergic receptors in the vestibular end organs of Meniere's disease.

Background: Meniere's disease (MD) is an inner ear condition characterized by episodic vertigo, hearing loss, tinnitus, and aural fullness. It is believed to be due to an imbalance in inner ear fluid often leading to hydrops; however, the exact mechanism is unclear. Pupillometry data have suggested a role for autonomic dysfunction, specifically sympathetic hyperactivity, but no studies have investigated the molecular pathways involved in this.

Methods: Vestibular end organs from patients undergoing labyrinthectomy for MD (n = 6) as well as control specimens from patients with vestibular schwannoma undergoing translabyrinthine resection were collected and processed for FFPE. RNA in situ hybridization was performed using RNAscope™ Multiplex Fluorescent V2 Assay using probes for β_1-, β_2-, and α_{1a}-adrenergic receptors (AR). Positive and negative control experiments were also performed for quality control. Immunohistochemistry (IHC) was used to characterize protein expression and identify sensory epithelium (Myosin 7a).

Results: There is increased expression of α_{1a}-AR transcripts in MD compared to control. This appears to be concentrated in the sensory epithelium confirmed with Myo7a positivity although expression can be seen in the stroma as well. This was further confirmed with IHC demonstrating robust expression in MD. There is also transcriptional expression of β_2-AR with no difference between the two groups.

Conclusions: There are limited molecular studies investigating the pathogenesis of MD, especially those utilizing surgical tissue. This is the first study to demonstrate increased expression of α_{1a}-AR both at the transcriptional as well as protein level in MD compared to control specimens. These results may explain the mechanism behind sympathetic hyperactivity and guide future therapies.

Learning Objective: To understand the expression pattern of adrenergic receptors in Meniere's disease.

Desired Result: Participants should better appreciate the potential role of autonomic dysfunction and adrenergic receptors in Meniere's disease.

Level of Evidence – Not applicable

Indicate IRB or IACUC: UCLA IRB # 22-001587

VeDA VESTIBULAR RESEARCH AWARD

Visual Vertigo in Vestibular Migraine

Alexandra T. Bourdillon MD; Jason W. Allen MD PhD; Jeffrey D. Sharon MD

Objective: To quantitatively assess visual provocations in vestibular migraine (VM).

Study Design: Cohort Study

Setting: Single-institution

Patients: Prospective cohort of vestibular migraine patients and healthy controls.

Interventions: Visual vertigo (VV) was assessed by having subjects with either VM or healthy controls watch 20 30-second video clips with varying degrees of visual motion stimulation. After each video, subjects selected whether they experienced headache, dizziness, nausea, fogginess, or no symptoms using a 5-button hand-held controller. A second response was captured, reflecting the severity of the symptom (0, 2, 4, 6, or 8).

Main Outcome Measures: The main outcome was a composite score reflecting symptom severity for all 20 videos, comparing individuals with VM to healthy controls. VV symptoms were also correlated to patient-reported outcome measures (PROMs) such as Dizziness Handicap Inventory (DHI), VM-Patient Assessment Tool and Handicap Inventory (VM-PATHI), Headache Impact Test-6 (HIT-6), Visual Vertigo Analogue Scale (VVAS), Cognitive Failures Questionnaire (CFQ), Modified Pain Catastrophizing Score (MPCS), Generalized Anxiety Disorder-7 (GAD-7), and Patient Health Questionnaire-8 (PHQ-8).

Results: The study enrolled 36 participants, including 17 with VM and 19 healthy controls. There was a female majority in both the VM (n=15/17, 88.2%) and control (n=15/19, 78.9%). The VM arm was older compared to the controls (mean age 51±14.5 for VM vs. 39.6±12.9 for controls). VM-PATHI scores were significantly higher in those with VM compared to healthy controls (mean 43.3 ± 15.1 versus 3.4 ± 6.6; U-statistic: 323.0, $p < 0.001$). The rate of VV was significantly higher in the VM arm (71.9% in VM vs. 13.7% in controls, $X^2(4, 705)= 245.6$, $p<0.001$). Composite symptom scores were significantly higher in the VM arm (43.9±13.9 vs. 23.6±6.3 in controls, U=304.0, $p<0.001$). Composite scores were significantly correlated with all PROMs: DHI, VM-PATHI, HIT-6, VVAS, CFQ, MPCS, GAD-7, and PHQ-8 ($p<0.001$ for each). VVAS was the only measure to be significantly associated with composite scores across both arms ($p<0.001$ for VM and $p=0.011$ for controls). Video analysis demonstrated that while some stimuli commonly provoked symptoms in both arms, several video clips were differentially triggering in the VM cohort. Notably, "Sky dive Mont Blanc" provoked symptoms in 93.8% of VM subjects versus 16.7% of controls, and "Mountain biking in the woods" provoked symptoms in 88.2% of VM patients versus 10.5% of controls.

Conclusions: Visual vertigo occurred more frequently in individuals with VM than in healthy controls. Composite symptom severity ratings correlated with other established PROMs (VM-PATHI, DHI, etc.), demonstrating alignment between visual stimulus responses and broader measures of dizziness, headache, and cognitive function.

Professional Practice Gap & Educational Need: While visual vertigo is a known feature of VM, standardized and quantifiable assessments have not been established. Here, we provide a quantitative analysis demonstrating a greater burden of visual vertigo in VM compared to healthy controls.

Learning Objective: Motion-simulating video clips can reliably provoke visual vertigo in individuals with VM and correlate with other measures of disease burden.

Desired Result: Gain understanding about visual vertigo in VM.

Level of Evidence – Level III

Indicate IRB or IACUC: 21 - 35910.

NEUROTOLOGY FELLOW AWARD
MICHAEL E. GLASSCOCK SCIENTIFIC MERIT AWARD

The Glasscock Award is given to the highest scoring blinded abstract.

Neoadjuvant Immune Checkpoint Inhibitor Therapy in Temporal Bone Squamous Cell Carcinoma

Kaitlyn A. Brooks, MD; Nathan R. Lindquist, MD; Meera Patel, MD MHS; Neil D. Gross, MD
Marc-Elie Nader, MD; Neal S. Akhave, MD; Paul W. Gidley, MD

Objective: To present immune checkpoint inhibitor immunotherapy (IO) outcomes for patients with temporal bone-involving squamous cell carcinoma and guide neurotologic decision making.

Study Design: Retrospective cohort.

Setting: Multi-institutional tertiary-care referral centers.

Patients: Twenty-one patients (42 to 86 years) with biopsy-proven temporal bone squamous cell carcinoma (SCC) from 2018 - 2024.

Interventions: Neoadjuvant IO and imaging for response.

Main Outcome Measures: Response Evaluation Criteria in Solid Tumors (RECIST) 1.1 outcomes, surgery de-escalation, overall survival.

Results: Eighteen (85.7%) patients received cemiplimab, 2 (9.5%) patients received pembrolizumab, and 1 (4.8%) patient received atezolizumab. By RECIST 1.1 criteria for final tumor response, 6 (28.6%, 95% CI 11% to 52%) patients had a complete response (CR), 3 (14.3%, 95% CI 3% to 26%) patients had a partial response (PR), 3 (14.3%, 95% CI 3% to 36%) patients had stable disease (SD), and 9 (42.8%, 95% CI 22% to 66%) patients had progressive disease (PD). Two (9.5%) patients were de-escalated to non-surgical management, and 2 (9.5%) patients were de-escalated from lateral temporal bone resection (LTBR) to mastoidectomy. All three patients with CR who underwent resection had complete pathologic response at the primary site; 1 patient with SD had complete pathologic response. Three (14.3%) patients from the PD group had died at study end. Overall, 3-year survival for patients with CR, PR, or SD after ICI was 100% as opposed to 78% for patients with disease progression (p=0.034, HR 12.2, 95% CI 1.2 to 123).

Conclusions: Immunotherapy is an option for early-stage and advanced temporal bone SCC; 40 to 50% of patients exhibit some response. Ideally, imaging should be performed after 2 cycles to assess response and restage for surgical planning.

Professional Practice Gap & Educational Need: Outcomes of immunotherapy for temporal bone SCC to guide surgical decision making.

Learning Objective: Surgical management of temporal bone SCC for patients receiving or who have received immunotherapy for their lesion.

Desired Result: The desired result of this abstract is to improve clinical practice and surgical management of temporal bone SCC with the growing applicability of IO in this disease process.

Level of Evidence: Level IV

Indicate IRB or IACUC: MD Anderson Cancer Center IRB # PA19-0106, approved 3/6/2019; Baylor College of Medicine IRB# H-56798, approved 2/6/2025

Intratympanic Embolization for Management of Glomus Tumors: A Case Series

Benjamin T. Ostrander, MD, MSE; Catherine L. Kennedy, MD; Monika Manchanda, MD Ramachandra Tummala, MD; Tina Huang, MD

Objective: To evaluate the feasibility of a novel preoperative intratympanic embolization technique for management of tympanic and jugular paragangliomas

Study design: Retrospective case series

Setting: Tertiary referral center

Patients: Five patients with tympanic or jugular paragangliomas

Interventions: Intratympanic intratumoral direct embolization using Obsidio or n-butyl cyanoacrylate embolic agent followed by microscopic resection

Main Outcome Measures: Post-embolization cerebral angiogram, tumor resection status, mean estimated blood loss (EBL), adjuvant radiotherapy

Results: Five patients (mean age 69 years, 60% female) underwent preoperative intratympanic intratumoral direct embolization of glomus tumor. Preoperative audiogram revealed mean pure tone average of 58 dB and word discrimination score of 79%. Immediate post-embolization cerebral angiography confirmed reduction of the angiographic tumor blush. Microsurgical resection was then completed, with 3 total and 2 sub-total resections. Mean operative blood loss was 28 mL. Postoperatively, no patients had cranial neuropathies, hemorrhage, stroke, or sensorineural hearing loss. Of the 2 patients with glomus jugulare, 1 patient underwent adjuvant radiotherapy. The embolic agent was partly extratumoral and within the middle ear in two cases, with subsequent inflammatory reaction that gradually subsided over months. Postoperative otomicroscopic examination revealed pigmented tympanic membrane staining, an important and potentially permanent change after intratympanic Obsidio embolization. While this technique worked well for glomus tympanicum, injection of embolic agent into more inferior, larger glomus jugulare was challenging, resulting in more extra-tumoral embolic agent and subtotal resection requiring adjuvant radiotherapy.

Conclusions: Immediate preoperative intratympanic intratumoral direct embolization of glomus tumors is a novel and viable technique for management, with reduced bleeding during microscopic resection and potentially lower risk of complications compared to traditional intravascular embolization.

Learning Objective: To describe a novel intratympanic intratumoral direct embolization technique for the management of glomus tumors

Desired Result: To demonstrate the advantages and disadvantages of intratympanic embolization for glomus tumors such that surgeons may consider employing this management technique in their practice

Level of Evidence - Level V

Indicate IRB or IACUC: Exempt

Short- and Long-Term Outcomes of Sigmoid Sinus Wall Resurfacing versus Compression Surgery for Venous Pulsatile Tinnitus: A 313-Case Cohort

Yue-Lin Hsieh, MD, PhD; Wuqing Wang, MD, PhD, Jiake Zhong, MD

Objective: To characterize the variability in pulsatile tinnitus (PT) resolution following surgery for sigmoid sinus wall anomalies (SSWA) and to analyze the nuances of complications associated with sigmoid sinus wall resurfacing surgery before complete cessation of PT.

Study Design: Case series with retrospective data analysis.

Setting: Multi-institutional tertiary university medical centers.

Patients: A total of 313 surgical patients with venous pulsatile tinnitus attributable to SSWA.

Interventions: Sigmoid sinus wall reconstruction surgery and sigmoid sinus compression surgery.

Main Outcome Measures: Cross-sectional imaging (CT/MRI), Doppler ultrasound hemodynamics, and tinnitus handicap inventory (THI).

Results: PT resolved in 89.1% of patients. The mean follow-up duration was 48.4 ± 41.5 months. The incidence of postoperative complications was significantly higher in the compression surgery group compared to the resurfacing group ($p < 0.05$). No statistically significant difference was observed in effectiveness or THI score improvement between the two surgical approaches. The mean preoperative THI score was 57.5 ± 24.1, which decreased to 10.5 ± 5.4 postoperatively ($p < 0.05$). Short-term follow-up revealed immediate resolution of PT in 27% of patients, while 73% achieved complete silence of PT within an average of 1.3 weeks. Aural fullness was positively correlated with the duration required for PT to subside ($R = 0.71$, $p < 0.05$).

Conclusions: Both resurfacing and compression surgeries are effective long-term treatments; however, resurfacing surgery is associated with fewer complications. In the short term, PT typically resolves gradually within two weeks as middle ear fluid retention decreases.

Learning Objective: By the end of this session the participant will be able to: Compare the two surgical strategies for SSWA—sigmoid-sinus resurfacing versus sigmoid-sinus compression—with respect to operative risk, complication profile, and long-term PT resolution rates. Predict short-term PT behaviour after surgery, including the typical 1–2-week subsidence interval and the positive correlation between post-operative aural fullness and time-to-silence. Select the safer, equally effective resurfacing technique over compression when planning elective surgical correction of SSWA-related PT.

Desired Result: Participants will leave the module able to recognise sigmoid-sinus-wall anomalies as a curable cause of pulsatile tinnitus, choose the safer resurfacing approach, and counsel patients that their pulsatile tinnitus and handicap scores typically resolve within weeks, thereby embedding a standardised, low-risk, patient-centred care pathway that each centre will audit and continuously refine.

Level of Evidence - IV

Indicate IRB or IACUC: The present study was approved by the ethics committee of the Eye, Ear, Nose, and Throat Hospital of Fudan University (No. 2021102-1) on Feb 202, and all participants signed informed consent forms.

Thread-guided Eustachian Tube Obturation for Patulous Symptoms

Peter G. Volsky, MD; Benjamin VanTasel, DO; Aaron Snow, MD (presenter)

Objective: To describe a novel surgical technique of eustachian tube (ET) obturation with using readily available materials.

Study Design: Case series.

Setting: Tertiary academic otology/neurotology practice.

Patients: Three adult patients (4 ears) with patulous Eustachian tube (PET) were treated with the described technique after exhibiting autophony, aural fullness, tympanic membrane excursion on respiration, and failure of conservative management.

Interventions: Under sedation with local anesthesia, a suture thread was advanced through a myringotomy into the ET, to the nasopharynx, and out through the nose. On the opposite end, outside the ear, an obturator (an 18G angiocatheter) and a trailing suture (to facilitate reversal) were attached with a knot. Under traction from the nasal end, the obturator was guided through the myringotomy and positioned into the ET, secured by tactile feedback. Excess suture was trimmed and the myringotomy patched.

Main Outcome Measures: Technical feasibility, Symptom response (Patulous Handicap Index, PHI-10), and tympanic membrane integrity

Results: All 4 procedures resulted in successful obturation of the ET and a healed tympanic membrane. Patients reported improvement and PHI-10 scores were lower post-procedure. One ear developed seromucinous otitis media and was treated with tympanostomy. No other complications occurred.

Conclusions: Thread-guided ET obturation can be successfully performed with common supplies under local anesthesia. A small myringotomy permits passage of the obturator. No grafts, fillers, or tissue removal is necessary. Traction applied on either end should allow removal from the nose or ear, though the need has not yet arisen. Removability from the nose is a distinctive feature of this design, compared to other described techniques. This is a practical method of managing symptomatic, refractory PET dysfunction.

Learning Objective: At the conclusion of this presentation, learners will be familiar with the procedural steps, instrumentation, and anatomic considerations of a trans-tympanic ET obturation technique using nylon thread and an angiocatheter as an obturator. Still images and video demonstrate the operative technique, in which the obturator is positioned by passing a thread through the ET from the ear to the nose.

Desired Result: To familiarize otologists and neurotologists with a novel technique for ET obturation that can be readily performed using standard materials.

Level of Evidence: Level IV (case series).

IRB / IACUC: IRB # 25-09-NH-0219 “Not Research” designation; Macon & Joan Brock Virginia Health Sciences at Old Dominion University

Cochlear Implantation in Asymmetric Hearing Loss: A Scoping Review of Functional and Quality-of-Life Gains

Warren L. Luo, BS; Emily Clementi, BA; Ruth K. Mizu, MD; J. Dixon Johns, MD
Alexandra Arambula, MD; Sarah Mowry, MD; Michael Hoa, MD

Objective: Perform a scoping review on cochlear implantation (CI) in adults with asymmetric hearing loss (AHL), focusing on audiometric and quality-of-life (QoL) outcomes.

Data Sources: Five databases (Ovid MEDLINE, Embase, CENTRAL, CINAHL, Web of Science) from inception to November 13, 2023. English language publications only.

Study Selection: Peer-reviewed articles involving adults (>18 years) with AHL undergoing CI reporting pre- and post-operative audiometric or QoL data. Excluded: reviews, case reports, basic science studies, pediatric populations, non-English publications. Two independent reviewers screened per PRISMA-ScR guidelines with third-reviewer conflict resolution.

Data Extraction: Study characteristics, demographics, pre-operative pure-tone averages, and pre- and post-operative audiometric results (monosyllabic/disyllabic word recognition, sentences in quiet/noise) and validated QoL questionnaires. Sample sizes, means, and standard deviations extracted when available.

Data Synthesis: Given heterogeneity across 23 audiometric tests and 21 QoL instruments, narrative synthesis was performed without quantitative pooling. Results analyzed at 6- and 12-month timepoints.

Results: Twenty-five studies from 9 countries met criteria. CNC word recognition in the implanted ear improved from 3.6-18.3% preoperatively to 49.3-66.2% at 12 months. AzBio sentence recognition in quiet increased from 13-25% to 84% bimodally. In noise (+5 dB SNR), bimodal scores improved from 27-30% to 49-68% at 6 months. Speech, Spatial and Qualities of Hearing Scale showed significant improvements in 92% of studies (12/13); Nijmegen Cochlear Implant Questionnaire in 100% (6/6).

Conclusions: CI provides substantial auditory and QoL benefits for AHL adults comparable to traditional bilateral CI candidates, supporting reconsideration of FDA and Medicare candidacy criteria.

Learning Objective: Learners will be able to describe audiometric and QoL outcomes following CI in AHL patients and identify appropriate candidates who may benefit from expanded candidacy criteria.

Desired Result: Increased physician knowledge of CI benefits in AHL and improved identification of appropriate candidates for implantation beyond current restrictive criteria.

Level of Evidence: V

Indicate IRB or IACUC: Exempt

ANS TRAINEE AWARD

Beta-2 Transferrin May Not Be Specific for Presence of Cerebrospinal Fluid in Middle Ear Fluid

Anthony Thai, MD; Sasha Vasilijic, PhD; Lindsay S. Moore, MD; Peter J. Kullar, MD; Alan G. Cheng, MD
Iram N. Ahmad, MD; Douglas R. Sidell, MD; Karthik Balakrishnan, MD, MPH; Kay W. Chang, MD
Jennifer Y. Lee, MD; Konstantina M. Stankovic, MD, PhD; Jennifer C. Alyono, MD, MS

Objective: Quantify the rate of beta-2 transferrin (B2T)-positivity in middle ear fluid of patients undergoing pressure equalization tube (PET) placement for recurrent acute otitis media (RAOM) or chronic otitis media with effusion (COME)

Study Design: Prospective study

Setting: Tertiary referral center

Patients: 81 ears from 60 adult and pediatric patients undergoing PET placement. Mean age was 12.1 years. 60.6% of ears were male. 33.8% and 66.2% had RAOM and COME, respectively. The mean effusion duration was 6.2 months.

Interventions: PET placement. B2T levels were quantified in middle ear aspirates in duplicate using quantitative ELISA. 10 ears were excluded due to coefficients of variation >20% between duplicate wells, likely from sample viscosity.

Main Outcome Measures: B2T positivity

Results: Of 71 ears, 55 (77.5%) were B2T-positive. Compared to B2T-negative ears, B2T-positive ears were more likely to be younger (6.1 vs 32.9 years, p=0.004) and have mucoid effusion (70.9% vs 20.0%, p=0.001). 91.8% of ears aged 18 years or less were B2T-positive, compared to only 20% aged greater than 18 years. B2T-positivity was not associated with gender, effusion duration, or indication for PET placement. No patients had chronic otorrhea after PET placement.

Conclusions: Although B2T is considered the gold standard to detect cerebrospinal fluid (CSF), our study shows high B2T positivity rates in the middle ear fluid of patients undergoing PET placement for RAOM or COME, with no specific concern for CSF leak. B2T may not be specific for presence of CSF in the middle ear.

Learning Objective: B2T may not be specific for presence of CSF in middle ear fluid.

Desired Result: Clinicians should exercise caution when interpreting B2T in middle ear fluid, as B2T may not be specific for CSF.

Level of Evidence - III

Indicate IRB or IACUC: Stanford School of Medicine IRB, protocol #72440. Approved 11/10/2023

Assessment of MRI-Derived Synthetic CT for Otologic Surgical Planning

Sammy Y. Gao, BS; Yubo Fan, PhD; Kaiwen Chen, BS; Benoit M. Dawant, PhD
Robert F. Labadie, MD, PhD; Jack H. Noble, PhD

Objective: Synthetic CT (sCT) techniques aim to generate CT-equivalent images from MRI to support surgical planning while reducing radiation exposure. Prior studies have shown strong agreement between real CT (rCT) and sCT with DICE coefficients > 0.8. However, the clinical utility in otologic surgery has not yet been explored.

Study Design: Cross-sectional study

Setting: Academic tertiary medical center

Patients (Participants): Division of otology faculty

Interventions: Participants were blinded and randomly reviewed 60 scans (30 rCT, 30 sCT) and were asked to classify each as real or synthetic. Participants subsequently reviewed the 30 paired sets side-by-side and were asked to identify rCT versus sCT. Finally, once scans were revealed as sCT or rCT, they were asked to assess clinically-relevant anatomical visualization.

Main Outcome Measures: Accuracy distinguishing sCT from rCT; confidence in utilizing the sCT for anatomic evaluation and surgical planning

Results: Across participants (N=6), the ability to distinguish sCT from rCT did not exceed chance. Overall, mean ± SD accuracy was 57.2±7.1%. Sensitivity and specificity, representing correct identification of sCT and rCT, were 55.0±13.0% and 59.4±11.4%. Area under the receiver operating characteristic curve (AUC) was 0.597±0.11, indicating limited discriminability. Participants rated 95.0±4.3% of sCT acceptable for cochlear implantation planning and 86.7±9.4% acceptable for middle ear surgery planning. In paired and blinded sCT–rCT review, overall accuracy improved to 74.2±18.9%. In unblinded paired review, 18.9±12.9% of sCT were deemed unsuitable for surgical planning due to misrepresented ossicles, air cells, or soft tissue pathology.

Conclusions: Overall, experts had difficulty distinguishing rCT from sCT with image quality of sCT generally acceptable for surgical planning. Ongoing work aims to identify features from source MRI which predict distortion of sCT.

Learning Objective: To understand the current performance, limitations, and clinical applicability of synthetic CT generation algorithms for otologic surgical planning.

Desired Result: Increased awareness of the potential of synthetic CTs to reduce radiation exposure while recognizing the need for continued algorithm refinement to prevent anatomic misrepresentation and improve clinical reliability.

Level of Evidence - V

Indicate IRB or IACUC: Exempt

The Impact of Obstructive Sleep Apnea Diagnosis and Treatment on Spontaneous CSF Leaks: A Multi-Institutional Database Study

Adam S. Vesole, MD; Michael J. Ruckenstein, MD; Tiffany P. Hwa, MD

Objective: To evaluate the impact of obstructive sleep apnea (OSA) and its treatments on the incidence of spontaneous CSF (sCSF) leaks, encephaloceles and anterior or lateral skull base CSF leak repairs.

Study Design: Retrospective cohort database study with propensity score matching.

Setting: A multi-institutional collaborative database (TriNetX) extracting population level data from >160 healthcare organizations.

Patients: Adults (≥18 years old) diagnosed with OSA.

Interventions: Initiation of continuous positive airway pressure (CPAP), use of GLP-1 receptor agonists, or bariatric surgery.

Main Outcome Measures: Incidence of sCSF leak, encephalocele, and repair of anterior or lateral CSF leak. Secondary outcome measure: change in BMI following OSA treatment.

Results: Patients with OSA (n=2.6 million) were approximately 2 times more likely to develop sCSF leak/encephalocele and 1.6 times more likely to undergo a CSF leak repair than those without OSA (n=2.6 million) when controlling for BMI and idiopathic intracranial hypertension (IIH). Further, IIH patients with OSA were 1.2 times more likely to develop sCSF leak/encephalocele than IIH patients alone at a similar BMI.

Both CPAP initiation and GLP-1 receptor agonist use in OSA were independently associated with a significantly lower incidence of sCSF leak, encephalocele, and repair compared to those not on CPAP or a GLP-1, respectively (OR 0.6-0.7 with CPAP; OR 0.5-0.8 with GLP-1). The GLP-1 cohort reduced BMI by 5.6% versus 4.0% in the non-GLP-1 cohort over a maximum 3 year period. The impact of bariatric surgery was unable to be assessed due to limited sample size.

Conclusions: OSA is independently associated with the development of sCSF leak/encephalocele and subsequent skull base repair. Treatment of OSA with CPAP or weight loss via GLP-1 receptor agonists may significantly reduce CSF leak risk, especially in populations with concomitant IIH and obesity.

Learning Objective: 1) To assess the relationship between OSA and the incidence of sCSF leaks/encephaloceles and anterior or lateral skull base CSF leak repairs. 2) To evaluate if OSA treatment (CPAP, GLP-1 receptor agonists and bariatric surgery) reduces the risk of sCSF leak/encephalocele or CSF leak repair.

Desired Result: Attendees will appreciate the impact of OSA in the development of sCSF leaks and encephaloceles and how OSA treatments may significantly reduce their incidence.

Level of Evidence - IV

Indicate IRB or IACUC: Exempt.

Hearing Loss is Associated with Longitudinal Accumulation of Regional Brain Amyloid in the NOMEM Cohort

S. Dillon Powell, ME; Froogh Aziz, MS; Patrick J. Lao, PhD; Adam M. Brickman, PhD
Mark A. Eckert, PhD; José A. Luchsinger, MD, MPH; Justin S. Golub, MD, MS

Objective: Investigate the longitudinal association of hearing loss (HL), measured by pure tone average (PTA) and word recognition score (WRS), with a marker of Alzheimer's disease pathophysiology, measured using amyloid positron emission tomography (PET).

Study Design: Prospective cohort, longitudinal analysis

Setting: Northern Manhattan community

Participants: Healthy adult volunteers from NOMEM (Northern Manhattan Study of Metabolism and Mind)

Main Outcome Measures: Amyloid standardized uptake value ratio (SUVR) in cortical regions. Rate of amyloid accumulation is the difference in SUVR per 5.2 months (1 unit SD of time). Linear regression was performed, adjusted for age, sex, education level, and cardiovascular disease.

Results: 223 participants were included, 65.3% women, with a mean (SD) age at latest PET scan of 68.3 years (3.49), PTA of 21.9 dB (8.9), WRS of 97.7% (5.5), and time between scans of 22.8 months (5.2). Each SD increase in PTA was associated with greater whole brain SUVR at baseline (+0.03; p=0.026) and increased accumulation rate (+0.009; p=0.025). This relationship held in the left cingulate (baseline +0.030, p=0.029; rate +0.013, p=0.010), right cingulate (baseline +0.03, p=0.020; rate +0.018, p<0.001), left frontal (baseline +0.03, p=0.044; rate +0.009, p=0.031), and right frontal regions (baseline +0.02, p=0.060; rate +0.01, p=0.014). Baseline SUVR was greater in the left parietal (+0.03, p=0.037) and left temporal regions (+0.02, p=0.038); rate increase was non-significant in these regions. For each SD decrease in WRS, whole brain SUVR increased by 0.03 at baseline (p=0.002) and rate increased by 0.009 (p<0.001). This relationship held in all brain regions, though trended toward significance for left frontal region baseline (p=0.077) and left temporal region rate (p=0.055).

Conclusions: Worse hearing was associated with higher amyloid baseline and rate of accumulation in multiple brain regions. The reason for the association, including causality, requires further study.

Learning Objective: Participants will better understand the relationship between hearing loss and amyloid accumulation over time.

Desired Result: Increase physician knowledge of a hearing loss as a potential target for prevention of cognitive decline and dementia.

Level of Evidence - III

Indicate IRB or IACUC: Columbia IRB #AAAR5012.

Cardiovascular Effects of Transcutaneous Auricular Nerve Stimulation in Rats

Allison Oliva, MD; Bharadwaj Nandakumar, PhD; Lohane Moreira Da Costa
Patrick Ganzer, PhD; Vivek Kanumuri, MD

Hypothesis: We hypothesized that electrical stimulation of discrete auricular regions would elicit distinct hemodynamic responses reflecting differences in underlying neural innervation, and that these effects may persist independent of vagal efferent pathways.

Background: Transcutaneous auricular vagus nerve stimulation (taVNS) is a noninvasive method of modulating autonomic tone that works by stimulating the external ear and has demonstrated efficacy for inflammatory disorders, opioid disorders, and cardiovascular diseases. Auricular sensory innervation is complex with contributions from multiple cranial nerves, and the mechanisms by which taVNS alters cardiovascular parameters remain poorly understood. Improved understanding of mechanisms of cardiovascular responses mediated by aVNS would enhance translation of aVNS therapies for cardiovascular and autonomic disorders.

Methods: Adult rats underwent cutaneous electrical stimulation of three auricular or periauricular sites using a 30 Hz, 5mA, 10-second stimulation paradigm across five trials per location. Blood pressure and heart rate were continuously monitored via an implantable internal carotid artery catheter. Experiments were repeated following bilateral cervical vagotomy to assess the contribution of vagal pathways.

Results: Medial concha stimulation consistently produced transient decreases in mean arterial pressure (MAP) averaging 10 mm Hg ± 2 mm Hg, with earlier onset and higher response likelihood compared with other sites. These responses were augmented and became more consistent after bilateral vagotomy, whereas heart rate changes were inconsistent and not statistically significant.

Conclusions: Auricular stimulation evokes site-dependent hemodynamic responses that persist after vagal transection, suggesting that these responses are independent of vagal efferents. These findings highlight the importance of precise stimulation targeting and support further investigation into peripheral mechanisms underlying aVNS, with potential implications for optimizing noninvasive neuromodulation in clinical populations.

Learning Objective: To delineate differences in transcutaneous stimulation of distinct regions of the rat auricle with and without an intact vagal efferent pathway.

Desired Result: Identification of afferent-mediated pathway for transcutaneous auricular vagal nerve stimulation-elicited hypotension.

Level of Evidence – Not applicable

IACUC: IPROTO202100000175 to Patrick Ganzer and Vivek Kanumuri at University of Miami

SELECTED ABSTRACTS

POSTER PRESENTATIONS

IN ORDER OF PRESENTATION

61st Annual Spring Meeting
AMERICAN NEUROTOLOGY SOCIETY

April 24-26, 2026
Sheraton Phoenix Hotel
Phoenix Convention Center
Phoenix, AZ

ANS Posters will be displayed on Friday/Saturday
ANS Oral presentations are on Saturday/Sunday

Immune Landscape and PD-L1 Expression in Vestibular Schwannoma: A Transcriptomic Analysis

Jumah G. Ahmad, MD; David Z. Allen, MD; Vivian F. Kaul, MD

Hypothesis: PD-L1 expression reflects distinct patterns of immune infiltration in vestibular schwannoma (VS), which can be delineated using publicly available transcriptomic data.

Background: Although VS is a benign tumor, the tumor microenvironment may influence growth, immune modulation, and therapeutic susceptibility. Immune checkpoint pathways such as PD-L1 signaling have transformed cancer therapy, but their role in benign nerve sheath tumors remains unclear.

Methods: Gene expression profiles from 31 VS and 9 normal peripheral nerve samples from the Gene Expression Omnibus were analyzed. Single-sample gene set enrichment analysis (ssGSEA) using the GSVA package in R was performed quantifying immune signatures including T cells, cytotoxic activity, macrophages, IFNγ response, antigen presentation, NK cells, B cells, and regulatory T cells. PD-L1 expression was extracted from the same transcriptomic matrix. Differential enrichment between tumors and controls was tested using Limma, and correlations between PD-L1 and immune signatures were evaluated with Spearman's method. Tumors were stratified by PD-L1 expression (high vs. low, median split).

Results: Compared to controls, VS samples showed higher enrichment of macrophage (adjusted $p < 0.001$), IFNγ response ($p < 0.001$), and cytotoxic ($p = 1.3\times10^{-4}$) signatures. PD-L1 expression varied across tumors and correlated positively with antigen presentation ($\rho = 0.26$), IFNγ response ($\rho = 0.15$), and NK cell ($\rho = 0.17$) signatures, but weakly negatively with T-cell signatures ($\rho = -0.19$). High PD-L1 tumors trended toward greater cytotoxic and antigen presentation enrichment, though differences were not statistically significant. Clinical variables were unavailable.

Conclusions: Transcriptomic profiling reveals distinct immune landscapes in VS and links PD-L1 expression with cytotoxic and antigen presentation pathways. These findings highlight immune modulation in benign nerve sheath tumors and establish a framework for future integrated molecular–clinical studies.

Learning Objective: Understand the immune landscape of vestibular schwannoma and the role of PD-L1 in modulating immune signatures.

Desired Result: Increase physician knowledge of immune modulation in benign nerve sheath tumors and its potential implications for future therapies.

Level of Evidence - Level V.

Indicate IRB or IACUC: Exempt.

A Novel Technique for Superior Semicircular Canal Dehiscence Repair

Jumah G. Ahmad, MD; Mana Espahbodi, MD; Richard K. Gurgel, MD; Neil S. Patel, MD

Objective: To describe a novel minimally invasive technique for superior semicircular canal dehiscence (SSCD) repair using an endoscopic brow lift sheath.

Study Design: Retrospective case series.

Setting: Tertiary care referral center.

Patients: Adult patients with SSCD syndrome undergoing operative repair.

Intervention: Endoscopic-assisted mini–middle fossa approach using a sheathed endoscope and radiopaque glass ionomer for SSCD repair.

Main Outcome Measures: Improvement of autophony, pulsatile tinnitus, and sound- or pressure-induced vertigo; radiographic confirmation of repair.

Results: Three patients underwent SSCD repair using an endoscopic brow lift sheath introduced through a small craniotomy centered over the superior canal. The sheath's arched extension extends beyond the endoscope lens to retract soft tissue, providing a clear operative field for minimally invasive visualization and instrumentation. This approach minimizes temporal lobe retraction and facilitates faster neurologic recovery compared to the traditional middle-fossa craniotomy. It also enables superior visualization for resurfacing with rigid bone substitutes, a radiopaque glass ionomer, a technically challenging step with the transmastoid approach, which is more suited for plugging and subsequent associated transient postoperative vertigo. This technique is particularly advantageous for older or anticoagulated patients in whom minimizing retraction and bleeding risk is critical. All patients recovered uneventfully, were discharged on the same day or postoperative day one, and demonstrated radiographic evidence of appropriate repair. All reported improvement or resolution of autophony, pulsatile tinnitus, and sound/pressure-induced vertigo at last follow-up.

Conclusions: The sheathed endoscopic mini–middle fossa technique combines the visualization and access advantages of the traditional middle fossa approach in addition to the reduced morbidity of the transmastoid route for resurfacing, offering an effective, less invasive alternative for SSCD repair, particularly in higher-risk or elderly patients. Radiopaque glass ionomer allows for demonstration of appropriate repair on post-operative imaging.

Learning Objective: Understand the principles and advantages of the sheathed endoscopic mini–middle fossa technique for SSCD repair.

Desired Result: Introduce a novel minimally invasive alternative for SSCD repair that reduce morbidity while maintaining effective surgical access and visualization.

Level of Evidence - Level V.

Indicate IRB or IACUC: Exempt.

Long-Term Hearing Preservation in Pediatric Cochlear Implant Recipients with Electrode Contacts in the Functional Acoustic Hearing Region

Elena Quinonez Del Cid, BS; Margaret T. Dillon, AuD, PhD; Lisa R. Park, AuD
Kevin D. Brown, MD, PhD; Nicholas J. Thompson, MD

Objective: Review the influence of electrode contacts within the functional acoustic hearing region on long-term hearing preservation for pediatric cochlear implant (CI) recipients

Study Design: Retrospective review

Setting: Tertiary referral center

Patients: 69 pediatric CI recipients with functional low-frequency hearing preservation at device activation (≤80 dB HL at 250 Hz)

Interventions: Cochlear implantation with 24-, 26-, 28-, or 31.5-mm straight electrode array

Main Outcome Measures: Proximity of the electrode array to the functional acoustic hearing region was determined with intraoperative x-ray and unaided thresholds at initial activation. Low frequency pure tone average (LFPTA) was calculated using the unaided thresholds at 125, 250, and 500 Hz at the preoperative, activation, 6 month, and annual follow-up visits (out to 3 years post-activation).

Results: A linear mixed model analyzed the effects of angular insertion depth (AID) of the most apical electrode contact, proximity, age at implantation, biological sex, preoperative LFPTA, and interval on change in LFPTA. Long-term hearing preservation was significantly influenced by interval ($p<0.001$), indicating a decline in acoustic thresholds over time. There was also a significant effect of biological sex ($p=0.038$) with greater LFPTA shifts in males. There were no significant main effects of AID, proximity, or pre-operative LFPTA.

Conclusions: The majority of pediatric CI recipients with preserved low-frequency hearing after surgery maintained aidable acoustic thresholds long-term, but there were some who had delayed loss of residual hearing. Spatial overlap and deep insertions did not significantly influence long-term hearing preservation.

Learning Objective: Attendees should be able to explain the relationship between electrode placement relative to the functional acoustic hearing region and long-term hearing preservation.

Desired Result: Learners will acknowledge how electrode placement in relation to the functional acoustic hearing region influences hearing preservation outcomes and apply this information to surgical planning or mapping procedure.

Level of Evidence: III

Indicate IRB or IACUC: IRB #25-0570, University of North Carolina

Automated Facial and Vestibulocochlear Nerve Segmentation in the Cisternal and Intracanalicular Segments Using a Deep Learning U-Net Model

Michael Bartellas, MD, MSc; Yeshwant Chillakuru, MD, MSc; Matthew Su, BSc
Sofiya Yusina, BSc; Daniel Jethanamest, MD, MSc

Objective: To develop and evaluate a deep learning U-Net model capable of automatic segmentation of the facial (CN VII) and vestibulocochlear (CN VIII) nerves within the cisternal and intracanalicular segments on MRI.

Study Design: Retrospective imaging study.

Setting: Tertiary referral center.

Patients: Adult patients with normal anatomy on MRI internal auditory canal (IAC) studies and without skull base pathology.

Interventions: Manual segmentation of CN VII and VIII on MRI IAC CISS sequence was performed with 3D Slicer on 22 patients, split into training (70%), validation (15%), and test sets (15%). A U-Net convolutional neural network architecture was trained for automated segmentation using standard data augmentation techniques.

Main Outcome Measures: Segmentation performance was quantified using Dice score and manual review.

Results: The model was optimized on the validation set (Dice = 0.5350). On the test set, performance improved (Dice = 0.6108). Mean Dice scores were 0.4279 (R CN VII), 0.5475 (R CN VIII), 0.6541 (L CN VII), and 0.6511 (L CN VIII). Manual inspection confirmed anatomically accurate segmentations, with modest Dice values reflecting expected limitations when delineating small-caliber cranial nerves.

Conclusions: Our work represents one of the first applications of deep learning–based segmentation for CN VII and VIII. Future improvements in model performance and accuracy of automated delineation of these nerves may have clinical implications for the identification of tumor nerve of origin, enhancing preoperative planning for lateral skull base surgery, and to support research on cochlear nerve integrity in implant candidates with suspected nerve deficiency.

Learning Objective: To understand how convolutional neural network–based segmentation models can automate and standardize the delineation of cranial nerve anatomy on MRI.

Desired Result: Attendees will recognize how deep learning segmentation can improve reproducibility in cranial nerve identification and support the development of clinically translatable AI tools for skull base imaging and auditory implant research.

Level of Evidence – Level IV

IRB: NYU Grossman School of Medicine IRB #i25-00262; June 17, 2025

Hidden Growth: Characterizing Internal Expansion Within Central Necrotic Components of Vestibular Schwannomas

Ada Chung, BA; Beatrice Katsnelson, BA; Rithvik Ghankot, MS; Ariel Omiunu, MD
Frank Buono, MS, PhD; Amit Mahajan, MD; Nofrat Schwartz, MD

Objective: Vestibular schwannomas (VS) are routinely monitored for tumor growth post-GKS utilizing repeat MRI; this modality measures outward expansion of VS overlooking tumors that exhibit internal regrowth following central necrosis. We aim to determine prevalence of internal regrowth, preceding tumor outward expansion. Secondarily, we explore the application of an AI-based tool for identification of internal regrowth.

Study Design: Retrospective cross-sectional study of patients with unilateral VS who underwent GKS between 2001 and 2023. MRI volumetric analysis was performed at time of GKS and follow-up including and excluding central necrotic component.

Setting: Tertiary academic center.

Patients: 85 patients who underwent GKS of which four patients had internal regrowth. A total of 170 MRIs at baseline and follow-up were analyzed.

Interventions: The entire cohort was manually segmented, and clinically significant internal regrowth was determined by a ≥20% increase. These were then compared to AI-based segmentation

Main Outcome Measures: Rates of treatment failure and internal tumor regrowth, group differences assessed using Fisher's Exact and Mann-Whitney U Test, and human-to-AI comparisons.

Results: 4 of 85 patients (4.7%) demonstrated internal tumor growth. Three of four (75%) met criteria for treatment failure versus 11 of 81 external-growth cases (13.6%), a difference that was statistically significant ($p = 0.013$). No differences in radiation parameters and demographics were noted. Internal tumors were often medium-sized (67%), and external tumors were evenly distributed across all size categories. AI successfully identified internal growth and treatment failure categorization in 100% of cases.

Conclusions: Central tumor regrowth following GKS was observed in 5% and accounted for 27% of all treatment failures. This pattern warrants close surveillance to enable early detection of post-GKS progression. Notably, our AI model accurately identified these growth patterns, suggesting its potential in post-treatment monitoring.

Learning Objective: Understand the nuanced variability of volumetric assessment and growth classification, and its implications for clinical decision-making.

Desired Result: To increase clinician awareness of internal regrowth in vestibular schwannoma volumetry, and to encourage consideration of standardized measurement protocols or AI-assisted tools to improve consistency and optimize patient care.

Level of Evidence: Level IV

Indicate IRB or IACUC: Yale University's Institutional Review Board (HIC #0704002523)

Effect of Cochlear Implant on the Cognitive Function of Older Adults
A Systematic Review and Meta-Analysis

Christi A. Joyce; Kelly Zhang; Joost Stultien, MD; Alexandra E. Quimby, MD, MPH

Objective: To assess whether cochlear implantation (CI) affects cognitive function in older adults.

Data Sources: MEDLINE, Embase, Cochrane CENTRAL, Web of Science, PsycINFO, and CINAHL.

Study Selection: Two reviewers independently screened studies. Eligible studies were published in English language, included adults aged ≥60 years of age with post-lingual hearing loss who had undergone CI, and reported both pre- and post-CI objective cognitive assessment scores. Interventional studies, cohorts, case-controls, and case series with n>5 were included.

Data Extraction: Data from included studies were independently extracted by two reviewers. Study quality and risk of bias were evaluated.

Data Synthesis: Within subjects random effects meta-analysis was performed using the methodology of DerSimonian/ Laird. Separate meta-analyses were performed including studies reporting mean pre- and post-CI scores on the same cognitive test (for tests that were reported in ≥ 3 studies). Meta-analysis of standardized mean differences (SMD) was additionally performed considering the findings across all studies and reported tests.

Results: Twenty-five eligible studies were identified, including a total of 997 patients. Sixty-three separate cognitive tests were applied (including components of cognitive testing batteries) at a mean 14.55 months post-operatively. The most commonly applied was the Mini Mental Status Exam (MMSE) (9 studies). Meta-analysis of mean differences showed no significant effect of CI on MMSE score (mean difference= 0.64, 95% CI=-0.66, 1.95). Considering all studies, there was a small improvement in mean cognitive testing scores post-CI (pooled SMD=0.152, 95% CI= 0.033, 0.271).

Conclusions: CI may improve cognitive function in implanted older adults. Further research using uniform measurement tools is needed to better clarify this finding.

Learning Objective: Understand current evidence on the effect of cochlear implantation on cognitive function in older adults. Discuss implications of cochlear implantation for mitigating cognitive decline and promoting healthy aging.

Desired Result: This study aims to enhance physicians' understanding of the benefits associated with cochlear implantation in older adults. It is expected to increase competence in integrating cognitive outcomes into cochlear implant counseling, and ultimately support timely interventions that may contribute to improved patient outcomes through preservation of cognitive function and quality of life.

Level of Evidence - Level I

Indicate IRB or IACUC: Exempt.

Understanding Variability in Vestibular Migraine Outcomes: A Retrospective Review

Jack M. Dozier; Arvind Ganeshram; Batoul Berri, AuD
Devin L. McCaslin, PhD; Christopher M. Welch, MD, PhD

Objective: To identify clinical, demographic, and diagnostic predictors of treatment response among patients with vestibular migraine (VM) evaluated at a tertiary neurotology center, emphasizing dizziness characteristics and symptom burden.

Study Design: Retrospective chart review.

Setting: Tertiary referral center.

Patients: Adults (≥18 years) diagnosed with VM, without coexisting peripheral or central vestibular disorders, who completed neurotologic evaluation and at least one follow-up. Twenty-seven patients met inclusion criteria.

Interventions: Vestibular physical therapy (VPT) alone, VPT with lifestyle modification, or VPT with pharmacologic therapy.

Main Outcome Measures: Symptom burden and treatment response were assessed through subjective improvement and clinical follow-up. Predictors included demographics, migraine-associated features, dizziness characteristics, baseline Dizziness Handicap Inventory (DHI) scores, and comorbid mood or sleep disorders. Vestibular testing parameters included caloric responses and presence of spontaneous or positional nystagmus.

Results: Among 27 patients (mean age at diagnosis 49.4 ± 17.9 years, 74.1% female), mean dizziness duration before evaluation was 35.2 ± 65.2 months, with 77.8% reporting episodic vertigo. Common migraine-associated features included photophobia (59.3%), phonophobia (37.0%), and aura (48.1%). Vestibular-visual mismatch was present in 70% (14/20). Mean DHI was 45.1 ± 20.8. Mood disorders affected 81.5% and sleep disturbances 44.4%. 77.8% had spontaneous and/or positional nystagmus, and 51.2% had isolated caloric outliers. Among pharmacologic patients, 20% reported complete resolution, 60% partial improvement, and 20% persistent symptoms. In contrast, 83% of the VPT + lifestyle group and all VPT-only patients achieved complete resolution. However, those managed without medication generally had milder baseline symptoms, suggesting initial severity influenced treatment selection and outcome.

Conclusions: Patients with VM demonstrate heterogeneous clinical and psychological profiles. Symptom duration, dizziness pattern, migraine features, and baseline DHI may predict treatment response. Identifying these factors may enable more personalized therapy and inform future prospective studies.

Learning Objective: To determine clinical, demographic, and diagnostic predictors of treatment response in vestibular migraine.

Desired Result: Improved clinician understanding of prognostic indicators in vestibular migraine to guide individualized, evidence-based treatment strategies and optimize patient outcomes.

Level of Evidence: Level IV

Indicate IRB or IACUC: University of Michigan IRBMED, determined exempt 5/23/2025, IRB #HUM00273094

Incidence and Risk Factors of Postoperative Sensorineural Hearing Loss After Cholesteatoma Removal

Kim B. Le, BS; A. Race Schaeffer, BS; Rohan Vuppala, BS; Christian Jung, BA
Keshav V. Shah, BS; Michael J. Ruckenstein, MD; Tiffany P. Hwa, MD

Objective: This study aims to evaluate the incidence of sensorineural hearing loss (SNHL) following cholesteatoma surgery and identify potential risk factors contributing to its development.

Study Design: Retrospective case-control study

Setting: Single tertiary academic medical center

Patients: Patients who underwent cholesteatoma removal surgery between January 2021 and June 2024.

Interventions: Electronic medical records of qualifying patients were searched for relevant demographics, disease characteristics, extent of surgery, and audiometric data, defining SNHL as a 20dB drop from 250-4kHz. Analysis incorporated descriptive characteristics and general logistic regression.

Main Outcome Measures: Postoperative SNHL incidence and resolution rates, predictors of postoperative SNHL

Results: 283 patients met inclusion criteria (age 51.6±17.4 years; 155 [54.5%] males). 243 (85.9%) had preoperative mixed or conductive hearing loss, mean air-bone gap (ABG) 25.9±13.3 dB, and 145 (51.06%) demonstrated postoperative improvement in the ABG, with a mean improvement of 11.92±9.43 dB. 36 patients (12.7%) demonstrated new onset postoperative SNHL, with 31 patients (10.9%) diagnosed within the first 6 months postop and 5 patients (1.8%) after 12 months. Of 12 patients with postoperative SNHL and long term (>12 months) postoperative audiometric data, 3 (25%) had resolved or improved. Ear infection did not coincide with SNHL onset. A canal wall down approach (OR 0.282 [0.080, 0.871]; 0.035) was associated with decreased likelihood of SNHL in only the primary surgery cohort. Revision surgery, prosthesis placement, age, sex, primary language, and race did not reach significance.

Conclusions: SNHL is a non-negligible complication after cholesteatoma surgery. Future research with larger cohorts may optimize risk stratification to enhance patient counseling and surgical management. There is a possibility of resolution with long-term follow-up in a cohort of patients, but larger studies are needed to identify predictors of resolution.

Learning Objective: 1) Identify risk factors associated with SNHL development following cholesteatoma surgery and 2) understand the timeframe and pattern of postoperative SNHL resolution

Desired Result: Synthesize pre-existing knowledge about cholesteatoma removal with empiric data about risk factors and temporal patterns to better monitor patients for SNHL

Level of Evidence - IV – Retrospective case-control study

Indicate IRB or IACUC: University of Pennsylvania Institutional Review Board (#855138; Approved 01/11/2023)

Low Frequency Ship Motion and Acute Disorientation Predict Post Voyage Mal de Debarquement Symptoms: A Multi Voyage Study

Charlotte K. Hughes, MD, MPH; Jae Joon Kim, BS; Kiersten R. Russ, BS; Hudson Liu, BS
Jong Bin Lee, MD, PhD; Michael J. Eliason, MD; Akihiro J. Matsuoka, MD, DMSc, PhD

Objective: Mal de Débarquement Syndrome (MdDS) often follows prolonged passive motion, yet exposure profiles that confer risk remain unclear. Using a multi-leg voyage aboard a U.S. Navy hospital ship, we sought to link objective motion features with post-voyage symptoms.

Study Design: Prospective observational cohort

Setting: USNS Mercy (T-AH 19) during its Pacific Partnership 2024 deployment across the Indo-Pacific region

Patients: 38 Active-Duty U.S. Navy personnel

Interventions: MdDS Calculator, Simulator Sickness Questionnaire (SSQ), Stroop Test, and Symbol Digit Modalities Test (SDMT) after multiple sea transits. Voyage motion was recorded with a shipboard inertial measurement unit (IMU).

Main Outcome Measures: SSQ total and subscales; MdDS presence and duration of symptoms.

Results: Symptom burden varied by voyage, with rougher legs characterized by slow oscillatory motion showing the highest SSQ and MdDS rates. Low-frequency exposure (0.1-0.2 Hz) and root-mean-square (RMS) amplitude consistently predicted higher SSQ and MdDS. Migraine history was not an independent predictor after accounting for voyage conditions. Disorientation-related SSQ items (vertigo/dizziness) distinguished participants who later reported MdDS more strongly than nausea-related SSQ items. On the most provocative leg (CA-HI), cognitive performance showed modest slowing with longer Stroop interference times. In multivariable and machine-learning models, motion metrics and acute disorientation symptoms ranked as the most informative features for MdDS risk stratification.

Conclusions: Objective low-frequency ship motion and acute disorientation during transit – more than migraine history – signaled elevated risk for post-voyage MdDS symptoms. Integrating onboard motion monitoring with brief symptom screening may enable targeted counseling and prevention strategies for high-risk travelers.

Learning Objective: Educate readers about the relationship of ship motion exposures to post-voyage MdDS symptoms.

Desired Result: Motivate prospective validation studies and testing of mitigation approaches within Neurotology and vestibular care.

Level of Evidence - III

Indicate IRB or IACUC: UC San Diego IRB (#810413); Naval Medical Center San Diego IRB (#NMCSD.2023.0033)

Quality of Life with Vestibular Schwannoma Microsurgery Does Surgical Approach Matter

Alireza Zonnour, MD; Eric Cunningham, BA; Krish Suresh, MD
Marc Schwartz, MD; Rick Friedman, MD, PhD

Objective: To analyze change in quality-of-life (QOL) after vestibular schwannoma (VS) microsurgery and modifying factors including surgical approach.

Study Design: Retrospective cohort

Setting: Tertiary center

Patients: 74 patients with sporadic VS who completed both pre- and postoperative PANQOL questionnaire, mean age 49.6 years (SD 14.4).

Interventions: Microsurgery for tumor resection with single surgical team

Main Outcome Measures: Change in QOL from preoperative to one-year postoperative timepoint, measured by the Penn Acoustic Neuroma Quality-of-Life scale (ΔPANQOL).

Results: 53% underwent translabyrinthine (TL) approach; 47% underwent retrosigmoid (RS). Mean tumor size was 22.3 mm (SD 10.0) for TL, 19.0 mm (SD 4.3) for RS. Mean overall PANQOL score improved postoperatively by 4.88 (SD 12.8) points for TL, 0.51 (SD 10.8) for RS (p=0.119). Greatest improvement in PANQOL was found in the anxiety domain (mean=11.6, SD=20.4). On univariate analysis, TL had superior improvement in the hearing (β=8.14, p=0.019) and energy (β=8.90, p=0.033) domains. Mean change in the hearing domain was 5.00 for TL (SD 13.62), and -3.14 for RS (SD 15.58). On multivariate analysis controlling for tumor size and change in hearing with surgery, TL trended toward greater improvement in the hearing domain (β=7.19, p=0.054), while RS had greater improvement in the face domain (β=-7.22, p=0.049). On univariate analysis, larger tumor size was associated with greater improvement in the energy (β=0.60, p=0.018) and pain (β=0.09, p=0.044) domains. Both remained significant on multivariate analysis.

Conclusions: VS microsurgery improves QOL, most significantly with respect to anxiety. Interestingly, translabyrinthine surgery demonstrated greater improvement in hearing-related QOL, suggesting positive adaptation to single-sided deafness when accepted upfront as a consequence of surgery. Also of note, patients with larger tumors may experience greater improvement in energy and pain-related QOL with microsurgery.

Learning Objective: To understand long-term postoperative quality of life with VS microsurgery and associated factors

Desired Result: Attendees will better understand the effects of VS microsurgery on postoperative long-term quality of life and possible effects of surgical approach selection.

Level of Evidence - III

Indicate IRB or IACUC: University of California San Diego IRB #180978

Hearing Loss Etiology as a Determinant of Cochlear Implant Rehabilitation Velocity and Trajectory Patterns

Stephanie M. Younan, MPH, BS; Lourdes Kaufman, BA; Connie Chang-Chien, BS
Pearl Doan, BS; Nicole T. Jiam, MD

Objective: While deprivation duration has traditionally been found to predict outcomes, emerging evidence suggests etiology may shape rehabilitation trajectories. We investigated whether hearing loss etiology predicts cochlear implant (CI) rehabilitation velocity, plateau timing, and trajectory patterns, independent of deprivation duration.

Study Design: Retrospective cohort study with longitudinal trajectory analysis.

Setting: Tertiary academic center.

Patients and Intervention: 37 adult CI recipients with defined hearing loss etiology had serial outcomes data (≥2 timepoints at 1, 3, 6, 12 months post-activation): Genetic/Hereditary (n=11), Age-related (Presbycusis) (n=10), Infectious (Post-Meningitis) (n=6), Otologic/Iatrogenic (n=6), and Noise-induced (n=5).

Main Outcome Measures: Twelve-month CNC word recognition scores, rehabilitation velocity (CNC percentage point change per month), and trajectory patterns (characterized by improvement, plateau, or decline across four timepoints).

Results: Etiology groups showed significantly divergent 12-month outcomes (Kruskal-Wallis H=9.525, p=0.049), with Genetic/Hereditary achieving superior performance (67.2±17.1%, median 71.0%) and Infectious showing poorest outcomes (32.8±22.8%, median 36.0%). Intermediate performance was observed in Otologic/Iatrogenic (57.5±23.4%, median 54.0%), Noise-Induced (56.8±9.9%, median 52.0%), and Age-Related groups (46.6±17.1%, median 42.0%). Rehabilitation velocities varied substantially: Noise-Induced and Genetic/Hereditary demonstrated the fastest improvement (median 1.86 and 1.84 points/month), Age-Related showed high variability (2.85±6.00 points/month, median 1.58), Otologic/Iatrogenic showed moderate velocity (median 1.48 points/month), while Infectious showed near-plateau trajectories (-1.03±1.81 points/month, median -0.40). Trajectory patterns further distinguished groups: Genetic/Hereditary maintained consistently high performance from early activation (50.0% at 1-month to 75.6% at 12-months), Age-Related demonstrated gradual linear improvement (28.9% to 51.7%), Infectious showed minimal improvement (27.5% to 36.0%), and Noise-Induced exhibited variable trajectories with a 6-month performance peak.

Conclusions: Etiology of hearing loss represents a potentially important determinant of CI rehabilitation trajectories. Distinct patterns suggest that the underlying pathology constrains the rehabilitative potential and limits the functional outcome ceiling, indicating utility for etiology-stratified counseling protocols.

Learning Objective: To understand how hearing loss etiology independently influences cochlear implant rehabilitation trajectories and outcomes.

Desired Result: Implementation of etiology-stratified patient counseling and outcome prediction protocols in cochlear implant programs.

Level of Evidence - Level III

Indicate IRB or IACUC: UCSF IRB # 25-43648; Approval Date: 07/30/25

Linking Vestibular Schwannoma and Normal Pressure Hydrocephalus: Insights from a Multi-Institutional Cohort Study

Marianne Rara, BS; Khushi Bhatt, BS; Hera Kim, BS; Katelyn Tran, BS
Mehdi Abouzari, MD, PhD; Hamid R. Djalilian, MD

Objective: To investigate the association between vestibular schwannoma (VS) and normal pressure hydrocephalus (NPH).

Methods: A retrospective cohort study was conducted using the multi-center TriNetX Research Network. Adults with VS were compared to matched patients without VS. Secondary analyses evaluated the impact of comorbidities, and tertiary analyses assessed prior surgery and radiation. Propensity score matching was limited by platform constraints. Outcomes included NPH prevalence and time to diagnosis, analyzed used TriNetX measures of association and Kaplan-Meier functions.

Results: Patients with VS had a significantly higher risk of developing NPH than those without VS (RR: 7.68, 95% CI: 5.84-10.09). VS was also associated with earlier NPH diagnosis ($p<0.001$; HR: 7.20, 95% CI: 5.47-9.46), though the proportional hazards assumption was violated ($p=0.012$). Within the VS cohort, comorbid hypertension, cerebral infarction, transient ischemic attacks, and ischemic heart disease were linked to higher NPH rates (RR: 2.78, 95% CI: 2.12-3.64; RR: 2.63, 95% CI: 1.73-4.00; RR: 1.99, 95% CI: 1.15-3.44; RR: 1.90, 95% CI: 1.41-2.57, respectively). All but transient ischemic attacks were associated with earlier diagnosis ($p<0.001$, $p<0.001$, $p=0.007$, respectively). No significant differences were observed by sex, neurofibromatosis type 2, schwannomatosis, diabetes, peripheral vascular disease, atherosclerosis, or weight. Prior radiation was associated with increased NPH risk (RR: 2.42, 95% CI: 1.54-3.82) and earlier diagnosis ($p<0.001$) compared to VS patients without radiation. Patients with prior surgery and those with radiation had comparable NPH risk (RR: 0.78, 95% CI: 0.39-1.56) and time to diagnosis ($p=0.593$).

Conclusions: Vestibular schwannoma is associated with elevated NPH risk. Among affected patients, vascular comorbidities—particularly hypertension, cerebral infarction, transient ischemic attacks, and ischemic heart disease—are linked to greater risk and faster progression. Prior radiation further increases both risk and diagnostic acceleration.

REQUIRED:
Learning Objective: To define the association between vestibular schwannoma and normal pressure hydrocephalus, with attention to how comorbidities modify risk. Provide neurotologists with insight into earlier identification and monitoring strategies for high-risk patients, facilitating evidence-based clinical decision-making.

Desired Result: Enhance physician knowledge and competence by enabling neurotologists to identify high-risk patients and consider earlier monitoring or evaluation to improve patient outcomes.

Level of Evidence: III

Indicate IRB or IACUC: Exempt.

Pre-Existing Psychiatric Comorbidity: Does it Impact Cochlear Implant Outcomes in Veterans?

Laasya P. Achanta, BSA; Kaitlyn A. Brooks, MD
W. Craig Kemper, MD; Nathan R. Lindquist, MD

Objective: To assess psychiatric comorbidities and outcomes for veterans with cochlear implantation (CI).

Study Design: Retrospective cohort.

Setting: Single institution tertiary-care veterans affairs medical center (VAMC).

Patients: Ninety-two adult patients (age range 35-92 years, 99% male) with post-lingual deafness from 1998 - 2024.

Interventions: Cochlear implantation.

Main Outcome Measures: Represented psychiatric diagnoses, number of psychiatric diagnoses, CI-aided speech recognition scores, CI-aided high-performance (>70% monaurally aided).

Results: Twenty-three (25%) patients undergoing CI had comorbid psychiatric diagnoses. For these patients, the most common diagnoses were Post-Traumatic Stress Disorder (25%), Major Depressive Disorder (22%), Alcohol Use Disorder (13%), and Generalized Anxiety Disorder (13%). Most (52%) patients had only one psychiatric diagnosis, while 11 (48%) had multiple. Sixty-nine patients did not have psychiatric comorbidities and formed the control group. Pre-CI WRS were similar between patients with and without psychiatric diagnoses (median pre-CI AzBio 15.5% versus 14%), but patients with psychiatric co-morbidity achieved a lower median CI-aided AzBio score than patients without psychiatric co-morbidity (CI-aided WRS 65.5% versus 80%, p=0.15). This finding was not statistically significant. A lower rate of patients with psychiatric disorders became high-performing users when compared to patients without psychiatric disorders in regards to CNC (12% vs 27%, p=0.17) and AzBio (39% vs 63%, p=0.07), though these did not reach statistical significance.

Conclusions: Patients with preexisting psychiatric diagnoses experience comparable improvements in speech perception outcomes after CI, but may have a lower likelihood of reaching high-performance status. Further, higher powered studies are necessary to determine if psychiatric co-morbidity impacts CI outcomes and, conversely, whether CI improves severity of pre-existing mental health diagnoses.

Learning Objective: To determine how psychiatric comorbidity affects speech outcomes following cochlear implantation in the veteran population.

Desired Result: To evaluate institutional CI outcomes in patients with and without psychiatric comorbidities to inform clinical practice and identify areas for future research.

Level of Evidence - Level III

Indicate IRB or IACUC: Michael E. DeBakey Veterans Affairs Medical Center IRB #1773722-5, Approved 3/21/2025; BCM IRB H-54164, Approved 2/22/2024.

The Predictive Power of Computerized Posturography with and without Clinical Features for Accurate Vestibular Migraine Diagnosis

Anita Singh, BS; Peter James, MD; Matthew Crowson, MD
Biratal Wagle, MS; Michaela Geffert, MS; James Saunders, MD

Hypothesis: Computerized dynamic posturography (CDP) metrics improve predictive accuracy for vestibular migraine (VM) diagnosis in adults when combined with clinical features.

Background: VM affects at least 1–3% of the population but remains underdiagnosed due to the lack of objective biomarkers. CDP objectively quantifies vestibular, visual, and somatosensory integration, potentially revealing balance deficits not apparent clinically. CDP may harbor a diagnostic signal for VM, given the demonstrable impact of VM on vestibular, visual, and somatosensory integration and associated symptoms.

Methods: Data from 334 patients (46 VM, 288 non-VM; 13.8% prevalence) and 6,121 CDP trials were analyzed. 15 CDP features (center of pressure, sway, force, moment, and motion metrics) and 9 clinical variables (episode characteristics, migraine history, symptoms, audiometry) were modeled using XGBoost and Random Forest algorithms with 5-fold stratified cross-validation. Three configurations were compared: CDP-only, clinical-only, and combined. Decision thresholds were optimized for ≥80% sensitivity, and SHAP analysis for feature importance.

Results: CDP features alone were non-discriminative for the diagnosis of VM (AUC 0.53; sensitivity <10%), whereas clinical features alone achieved moderate accuracy (AUC 0.80; sensitivity 50%). The combined model improved diagnostic accuracy (AUC 0.861, sensitivity 82.8%, specificity 75.2%). Negative predictive value was high (96.4%), though positive predictive value remained limited (36.2%) given low disease prevalence. SHAP analysis showed photophobia (2.29) and phonophobia (1.45) as top predictors, with the strongest CDP feature, vertical force (1.79), ranking second overall.

Conclusions: CDP alone is not discriminative for VM, but in combination with clinical features, it provides incremental predictive value for diagnosis of VM. While a gold-standard biomarker for VM remains elusive, these findings support CDP-enhanced, machine learning–based approaches for objective VM diagnosis prediction.

Professional Practice Gap & Educational Need: VM remains one of the most frequently overlooked causes of episodic vertigo due to the absence of objective diagnostic markers and the overlap of symptoms with other vestibular and migraine-related disorders. Current diagnostic approaches rely primarily on subjective symptom reporting and clinical pattern recognition, which are limited by inter-clinician variability and patient recall bias. There is a growing need for educational frameworks and clinical tools that bridge traditional neuro-otologic assessment with data-driven analytics which will enable more accurate, objective, and reproducible diagnosis of complex vestibular syndromes such as VM.

Learning Objective: Application of machine learning techniques to the development of clinical tools

Desired Result: Understanding of the use of machine learning and CDP in streamlining vestibular diagnostics

Level of Evidence - III

Indicate IRB or IACUC: IRB Study 02000534

Comparison of Transcranial Facial Motor Evoked Potentials and Prass Probe–Evoked EMG As Predictors of Postoperative Facial Nerve Dysfunction after Acoustic Neuroma Surgery

Shahid Iqbal, MBBS; Jonathan Dilgen, PhD; Krish Suresh, MD
Marc Schwartz, MD; Rick Friedman, MD, PhD

Objective: To characterize patterns of transcranial facial motor evoked potential (TcFMEP) changes compared with direct facial nerve stimulation (Prass probe–evoked CMAPs) during acoustic neuroma resection in patients who developed poor postoperative facial nerve function.

Study Design: Retrospective case review

Setting: Tertiary referral center for acoustic neuroma

Patients: Six patients who underwent acoustic neuroma surgery with poor postoperative facial function as defined by House-Brackmann scale of 4 to 6 at post-operative clinic follow up.

Main Outcome Measures:
(1) Percentage of post-resection TcFMEP amplitude relative to pre-resection baseline.
(2) Whether a favorable Prass probe stimulation threshold was achieved on direct facial nerve stimulation.
(3) Early postoperative House–Brackmann grade.

Results:
Tumor size ranged from 10–45 mm (mean 27.3 ± 12.6 mm). Surgical approaches included translabyrinthine (n=4), retrosigmoid (n=1), and middle fossa (n=1). TcFMEP amplitudes decreased markedly following resection (range 0–100% of baseline). Only 1 of 6 patients (17%) demonstrated a preserved TcFMEP signal post-resection. In contrast, 4 of 6 patients (67%) demonstrated a favorable Prass probe stimulation threshold despite subsequently developing poor postoperative facial nerve function. All six patients ultimately exhibited poor early facial outcomes (HB IV–VI).

Conclusions:
TcFMEP changes showed consistent concordance with poor postoperative facial nerve function, whereas Prass probe stimulation produced a high false-negative rate, falsely suggesting intact nerve function in 67% of patients who ultimately had HB IV–VI outcomes. These findings highlight that direct stimulation alone may provide misleading intraoperative reassurance, and TcFMEP may more accurately reflect evolving facial nerve injury during acoustic neuroma resection.

Learning Objective: To compare TcFMEP and Prass probe–evoked signals before and after tumor resection and assess their reliability in predicting postoperative facial nerve outcomes.

Desired Result: Results which are reflective of the poor facial nerve outcome

Level of Evidence - Level V

Indicate IRB or IACUC: Exempt (Not applicable)

Neurotologic Manifestations as Pre-Diagnostic Markers of Lyme Disease
A Retrospective Cohort Study

Amrita Bonthu, MS; Todd Otteson, MD, MPH

Objective: To characterize the temporal relationship of neurotologic conditions to a Lyme disease diagnosis

Study Design: Retrospective cohort study

Setting: TriNetX Research Network (111 HCOs)

Patients: Confirmed Lyme disease (ICD-10A69.2 and LOINC-11006-4). Inclusion required an index diagnosis between 1 and 20 years prior (for adequate follow-up) and ongoing healthcare utilization; exclusions comprised congenital, noise-induced, or ototoxic hearing loss.

Interventions: Advanced explore cohort of age, joint pain, and neurotologic symptoms

Main Outcome Measures: Frequency of neurotologic symptoms (based on Lyme case reports) and joint pain (for reference) was assessed at pre- and post-diagnostic intervals.

Results: The cohort (N=20,843) had a mean age at index of 50.6 ± 22.4 years and was predominantly male (51.5%) and white (93.9%). Pre-diagnosis, facial nerve disorders (3.7%, n=762 vs. 0.3%, n=66), joint pain (35.8%, n=7,466 vs. 20.8%, n=4,327), and dizziness/giddiness (8.0%, n=1,658 vs. 5.2%, n=1,078) all surged in the year prior compared to a 3-5 year baseline. In contrast, sensorineural and unspecified hearing loss (5.0%, n=1,023), tinnitus (1.2%, n=250), and vestibular dysfunction (1.1%, n=199) had a sustained prevalence already present 3-5 years prior. Post-diagnosis, most symptoms fell sharply from their peaks. In the 0-1 month period, this included joint pain (16.1%, n=3,361), dizziness (2.7%, n=571), hearing loss (1.0%, n=204), tinnitus (0.3%, n=54), and vestibular dysfunction (0.3%, n=68). Facial nerve disorders showed continuous resolution (3.1%, n=654 at 0-1 month, falling to 0.4%, n=82 by 3-6 months).

Conclusions: The pre-diagnostic peak in neurotologic symptoms may represent a key, often-missed, detection opportunity. The rapid post-diagnosis decline of these acute symptoms, which likely reflects a response to treatment, suggests the potential importance of this early recognition.

Learning Objective: To understand the timing and clinical significance of neurotologic symptoms in Lyme disease.

Desired Result: Attendees will appreciate the importance of recognizing neurotologic symptoms for the early diagnosis of Lyme disease, highlighting the otolaryngologist's crucial role in both this early detection and in managing the long-term auditory and balance problems that may persist.

Level of Evidence: Level III

Indicate IRB or IACUC: Exempt.

Durability of Hydroxyapatite Bone Cement in Lateral Skull Base Repair

Douglas J. Totten, MD, MBA; Hunter L. Elms, MD; Amanda Wissmann Klage, BS
Evan C. Cumpston, MD; Charles W. Yates, MD; Rick F. Nelson, MD, PhD

Objective: To assess long-term durability of hydroxyapatite bone cement after lateral skull base (LSB) repair

Study Design: Retrospective cohort study

Setting: Tertiary referral center

Patients: Patients who underwent LSB repair with the use of hydroxyapatite bone cement who subsequently underwent computed tomography (CT) imaging of the skull base one or more years after repair

Interventions: Middle fossa craniotomy and repair of the lateral skull base using hydroxyapatite bone cement

Main Outcome Measures: Thickness of repaired skull base on initial and subsequent CT imaging was measured with calipers at identical sites over previously dehiscent tegmen; change in body-mass index (BMI), diagnosis of obstructive sleep apnea (OSA).

Results: 108 lateral skull base repairs with bone cement were performed from 2018-2024 with 2 (1.9%) recurrent leaks. 20 patients had follow-up CT imaging of 23 skull base repairs (3 bilateral) at an average of 38.7 (standard deviation 16.7) months postoperatively. Repair thickness on follow-up imaging ranged from 90.2%-101.4% of initial repair thickness (median: 97.4%, interquartile range: 95.0%-99.5%). Average repair height was 4.4 (0.8) mm postoperatively and,4.2 (0.8) mm at last follow-up (97%, p=0.48). Mean BMI at time of initial CT was 36.9 (7.6) kg/m^2 compared to 35.7 (7.6) kg/m^2 at last follow-up. OSA was diagnosed in 11 (47.8%) cases.

Conclusions: Hydroxyapatite bone cement repair of sCSF leaks shows no significant deterioration at an average of more than 3 years despite persistence of established risk factors for sCSF leaks.

Learning Objective: Hydroxyapatite bone cement provides long-lasting durable repair of the lateral skull base.

Desired Result: Hydroxyapatite bone cement is a durable material that may be used in lateral skull base repair.

Level of Evidence - IV

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

Prevalence of Intraoperative Superior Semicircular Canal Dehiscence in Spontaneous Cerebrospinal Fluid Leak Patients

Mikayla G. Hubbard, BS; Hunter L. Elms, MD; Douglas J. Totten, MD
Evan C. Cumpston, MD; Charles W. Yates, MD; Rick F. Nelson, MD, PhD

Objective: Determine superior semicircular canal dehiscence (SSCD) prevalence in lateral spontaneous cerebrospinal fluid leak (sCSFL) patients and assess the predictive value of CT in identifying SSCD.

Study Design: Retrospective cohort study.

Setting: Tertiary referral center.

Patients: sCSFL patients surgically treated between January 2015 and July 2025.

Interventions: Preoperative high-resolution CT and middle fossa craniotomy (MCF) skull base repair.

Main Outcome Measures: Preoperative CT prevalence of near-dehiscence (1 cut) or definite SSCD (≥2-continuous cuts) and intraoperative near dehiscence ("blue-lined") or definitive SSCD.

Results: One hundred eighty-two MCF repairs were performed on 161 patients (66.0% female). Intraoperative SSCD (7.1%) and "blue-lined" near-dehiscence (9.9%) were both present at lower rates than expected based on CT findings (13.1% SSCD, 12.6% near-dehiscence). Compared to patients with an intact intraoperative superior canal, patients with SSCD or near-dehiscence did not have statistically significant differences in mean ± standard deviation age (58.7±11.8 vs. 55.0±10.0 years), BMI (39.2±9.4 vs. 38.9±9.7 kg/m^2), AHI (32.4±32.1 vs. 28.7±33.7 events/hr), or opening pressure on lumbar puncture (23.6±8.0 vs. 24.0±10.4 cm H_2O). Patients with intraoperative SSCD or near-dehiscence were more likely to report dizziness (p=0.001, OR 4.97, 95%CI 1.71-13.05). CT demonstrated 80.6% sensitivity, 85.4% specificity, 53.1% PPV, and 95.6% NPV in detecting SSCD or near-dehiscent findings.

Conclusions: The prevalence of intraoperative SSCD or "blue-lined" near-dehiscence is 17.0% in sCSFL patients, which is 33% lower than predicted by CT. Risk factors known to increase intracranial pressure are not continued risk factors for predicting intraoperative SSCD. CT is optimal at ruling out SSCD in those with sCSFLs but shows lower accuracy in positive identification.

Learning Objective: Evaluate SSCD prevalence in those primarily presenting with sCSFL.

Desired Result: Elucidate risk factors associated with SSCD in sCSFL patients.

Level of Evidence: IV

Indicate IRB or IACUC: Indiana University IRB #13133

Effect of Cochlear Implant Electrode Array to Scala Tympani Volume Ratio on Early Hearing Preservation

Saangyoung E. Lee, MD; Luke Helpard, PhD; Margaret T. Dillon, AuD, PhD; A. Morgan Selleck, MD
Nicholas J. Thompson, MD; Matthew M. Dedmon, MD, PhD; Kevin D. Brown, MD, PhD

Objective: Analyze the influence of patient and device variables on the low frequency hearing preservation for cochlear implant (CI) recipients of straight electrode arrays.

Study Design: Retrospective Review

Setting: Tertiary Care Center

Patients: 42 adults with pre-operative unaided hearing thresholds ≤45 decibel hearing level at 250 Hz.

Interventions: Patients underwent cochlear implantation with a 24-, 28-, or 31.5 mm straight electrode array.

Main Outcome Measures: A linear mixed effects model analyzed the effects of scala tympani (ST) volume, electrode array volume to ST volume ratio, angular insertion depth (AID), age at surgery, and biologic sex on low frequency pure tone average (LFPTA; 125, 250, & 500 Hz) shifts at CI activation and 6 months post-activation.

Results: LFPTA shifts were significantly influenced by ST volume (p=0.004), array volume to ST volume ratio (p=0.04), and sex (p=0.02), with better hearing preservation observed for cases with larger ST volume, smaller array volume to ST volume ratio, and female biological sex. There were no significant main effects of interval (p=0.08), age (p=0.07), or AID (p=0.13).

Conclusions: Patient and device variables such as larger ST volume, less array volume to ST volume ratio, female biologic sex are fixed variables that should be considered for hearing preservation in cochlear implantation.

Learning Objective: Individual variables, such as scala tympani volume and the ratio of the electrode array volume to scala tympani volume, influence hearing preservation for cochlear implant recipients.

Desired Result: The learner will describe how to calculate scala tympani volume and the electrode array volume to scala tympani volume ratio and assess the role of these variables on hearing preservation for cochlear implant candidates with functional low-frequency hearing.

Level of Evidence: 3

Indicate IRB or IACUC: UNC IRB 09-2328

Single-Cell RNA Sequencing Analysis of Vestibular Schwannoma Reveals Functionally Distinct Fibroblast Subsets

Derrick C. Wan, MD; Camille Brenac, MD; Maxime Fieux, MD, PhD; Michael T. Longaker, MD, MBA
Michael Januszyk, MD, PhD; Konstantina M. Stankovic, MD, PhD; Jennifer C. Alyono, MD

Objective: This meta-analysis aims to define the role of heterogeneous, functionally distinct stromal fibroblast subtypes and their interactions with Schwann cells and immune/inflammatory cell components to better understand how these cells impact VS behavior.

Background: While hearing loss is the most common presenting symptom in patients with vestibular schwannoma (VS), tumor size and growth have poorly correlated with degree of severity. Thus, nerve compression alone does not fully explain the hearing loss associated with VS. Tumor development, aggressiveness, and progression are well-recognized as being closely linked to the stromal microenvironment, with complex interactions described between these components.

Study Design: We conducted a meta-analysis of four publicly available scRNA-seq datasets representing 28 VS human samples and two nerve controls. Data integration was performed using Harmony, followed by dimensionality reduction for visualization. Differential expression and gene set enrichment analysis were conducted to identify inflammatory markers and pathways involved. Cell-cell interactions were further investigated using CellChat, highlighting key signaling interactions.

Results: Five distinct subclusters of tumor-associated fibroblasts were identified with enrichment of inflammatory fibroblasts in tumor samples compared to controls. This group was increased in tumors with greater hearing loss and exhibited elevated NLRP3 inflammasome activity, suggesting these fibroblasts may play a role in tumor-promoting inflammation and tissue damage. Furthermore, this subcluster demonstrated increased intercellular communication with Schwann cells via midkine, a mediator with known role in tumor proliferation, and with immune/inflammatory cells.

Conclusions: These findings suggest a potential role for inflammatory fibroblasts in promoting VS tumor behavior leading to hearing loss and identify a previously under recognized cellular subcluster that could serve as a therapeutic target.

Learning Objective: To understand fibroblast subgroup functional heterogeneity in vestibular schwannoma and how they may interact with other cellular components in driving tumor behavior.

Desired Result: Appreciate fibroblast heterogeneity in tumors and comprehend how specific subsets may impact clinical presentation and be targeted with future therapeutics.

Level of Evidence – Does not Apply

Indicate IRB or IACUC: Not applicable

Audiometric Outcomes of the Middle Cranial Fossa Approach for Tegmen Repair

Katelyn Robillard, MD, PhD; Cameron Lindemann, DO; Ethan Hoasjoe, BS
Lauren Hill, BS; Moises Arriaga, MD

Objective: The primary objective of this study was to determine audiometric outcomes following middle cranial fossa approach for tegmen repair.

Study Design: Single-center, retrospective cohort study.

Setting: Tertiary referral center.

Patients: In a convenience sample of 94 patients (100 cases), 60% were female, and average age at time of surgery was 58 years (range 16 to 79).

Interventions: Preauricular infratemporal fossa approach with extradural repair of tegmen defect.

Main Outcome Measures: Changes in air conduction pure tone threshold (PTT) and speech reception threshold (SRT).

Results: Pure tone and speech audiometry were performed before and after surgery. Average changes in PTTs and SRTs were analyzed using a two-tailed paired t-test. Overall, there was a decrease in PTT from 40.3 to 37.3 dB at 250 Hz ($p=0.03$). In those without encephalocele, there was a decrease in PTT from 38.5 to 30.8 dB at 250 Hz ($p=0.03$). In cases without CSF leak, there was a decrease in PTT from 40.1 to 37.0 dB at 250 Hz ($p=0.047$). In cases without cholesteatoma, there was a decrease in PTT from 38.8 to 35.3 dB at 250 Hz ($p=0.02$). Interestingly, in cases with evidence of cholesteatoma, there was an increase in PTT from 44.6 to 48.8 dB at 2000 Hz ($p=0.03$).

Conclusions: These results support our hypothesis that the middle cranial fossa approach leads to stable or improved hearing. Low-frequency improvements were observed in patients without adverse features (e.g., encephalocele, CSF leak, cholesteatoma). While we also expect improvements in those with middle ear effusion due to CSF leak, this was not demonstrated in the current study, likely due to low power ($n=14$). The increased air conduction threshold in patients with cholesteatoma may represent a conductive hearing loss due to progression of disease in the months following surgery or compression of middle ear structures in a newly closed cavity.

Learning Objective: Readers should be able to identify changes in pure tone audiometry that demonstrate stable hearing outcomes following surgery to repair tegmen defects.

Desired Result: Increase patient and provider awareness of the safety of middle cranial fossa approach for tegmen repair**.**

Level of Evidence: Level III

Indicate IRB or IACUC: IRB #581, LSU Health Sciences Center – New Orleans

Procedural Technique and Position Confirmation Tests for Apical Electrode Placement

Justin Cottrell, MD; David Landsberger PhD; Arianna Winchester, MD
William Shapiro, Au; Sean McMenomey, MD; J. Thomas Roland Jr., MD

Objective: The placement of a standard electrode array with an additional electrode placed into the cochlear apex has demonstrated lower pitch perception in patients. We sought to describe a reproducible surgical technique for accurate apical cochleostomy and ground-electrode placement during cochlear implantation in patients with normal anatomy, and to review how placement quality can be assessed using intraoperative methods.

Study Design: Cadaveric dissection study with integration of translational procedural and post-operative performance validation.

Setting: Tertiary academic center.

Patients: Human cadaveric temporal bone specimens and representative surgical cases from cochlear implant recipients that underwent apical electrode placement.

Interventions: Stepwise apical cochleostomy technique based on radiologic measurements are employed and documented to insert a ground electrode (ECE1) into the helicotrema. Placement quality is assessed with further cadaveric analysis, intra-operative x-ray, and current spread measurements. Pitch perception utilizing the apical ground was correlated with intra-operative measures.

Main Outcome Measures: Accuracy of cochleostomy placement, absence of injury to the facial nerve or carotid canal, and electrophysiologic evidence of apical current modulation.

Results: Cadaveric analysis demonstrated 100% accuracy in achieving precise apical cochleostomy placement, without injury to surrounding structures. Translating these improved procedural steps to cochlear implant recipients demonstrated improved performance and current modulation ability utilizing intra-operative and post-operative assessments. Current spread measures appear superior to x-ray for confirming adequate apical electrode placement.

Conclusions: A defined procedural framework coupled with real-time confirmation tools at the time of surgery can improve apical electrode placement accuracy. Improved placement consistency will assist in future study of the benefit apical electrode placement may provide cochlear implant patients.

Professional Practice Gap & Educational Need: Research is currently underway to study how standard electrode insertion, and placement of an apical electrode, can help shift current towards the apex and improve low frequency pitch perception. Limited literature exists to facilitate a safe and accurate apical electrode placement, in addition to intraoperative placement confirmation. This information is important for improving placement safety, and consistency to facilitate interpretation of surgical outcomes.

Learning Objective: To understand how an accurate apical cochleostomy can be made, and how to confirm adequate apical electrode placement at the time of surgery.

Desired Result: Improve the surgical consistency and safety of apical electrode placement, and allow for intra-operative confirmation that improves the quality of study in this area of research

Level of Evidence - Level IV

Indicate IRB or IACUC: IRB# i25-00378

Sex-Based Differences in Quality of Life for Vestibular Schwannoma Patients Among Observation, Microsurgery, and Radiation

Nader G. Zalaquett, MD; Christine M. Lohse, MS; Michael J. Link, MD
Matthew L. Carlson, MD, MBA

Objective: Quality of life (QOL) is an important consideration in vestibular schwannoma (VS) patients when assessing management options. Understanding sex-based differences in QOL may facilitate patient counseling.

Study Design: Prospective cohort

Setting: Mayo Clinic and Acoustic Neuroma Association

Patients: Vestibular Schwannoma patients

Interventions: Observation, radiation, or microsurgery

Main Outcome Measures: Penn Acoustic Neuroma Quality of Life (PANQOL) scores

Results: A total of 481 patients were analyzed. In the observation group, women reported worse anxiety (66 vs. 81, p=0.001), facial function (81 vs. 90, p=0.02), and total (66 vs. 73, p=0.03) PANQOL scores at baseline. At follow-up, men declined more in facial function (−5 vs. +3, p=0.01). For microsurgery, women reported worse facial function and balance at baseline. At follow-up, men declined more in facial function (−16 vs. −3, p<0.001), balance (−7 vs. +2, p=0.04), energy (−4 vs. +5, p=0.03), and total (−5 vs. +2, p=0.02) PANQOL scores. For radiation, women reported worse anxiety, balance, pain, and total scores at baseline. At follow-up, anxiety improved in women (+5) but worsened in men (−6, p=0.008). Three sex-based differences exceeded minimally important difference thresholds established for the PANQOL: anxiety at baseline in radiation, balance at baseline in radiation, and balance at follow-up in radiation.

Conclusions: Women at baseline had worse anxiety, balance, pain, and overall QOL assessed using the PANQOL, whereas men declined more with treatment and observation. The largest difference in PANQOL change between sexes occurred after microsurgery, with men experiencing greater losses in facial function, balance, energy, and total scores.

Learning Objective: Among patients with vestibular schwannoma, women reported worse baseline PANQOL scores, while men experienced greater declines in PANQOL scores after treatment and observation, especially after microsurgery.

Desired Result: NA

Level of Evidence – Level III

Indicate IRB or IACUC: IRB protocol 14-009331

Virtual and Augmented Reality Applications in Cochlear Implant Workup and Aural Rehabilitation: A Scoping Review

Andrew L. S. Thornton, BA; Jack Lin, BS; Aaron C. Moberly, MD

Objective: To describe current use of virtual reality and augmented reality (VR/AR) technologies in the preoperative workup, postoperative assessment, and aural rehabilitation of cochlear implant (CI) patients.

Data Sources: Searches were performed in PubMed and Embase for English-language, human studies (2000–present) using keywords related to hearing loss, cochlear implantation, and immersive or extended reality.

Study Selection: Eligible studies used VR, AR, mixed, or extended reality technologies in CI care, specifically for preoperative counseling, postoperative assessment, or postoperative aural rehabilitation. Two reviewers independently screened titles and abstracts for inclusion.

Data Extraction: Thirty-three studies met inclusion criteria (PubMed = 10, Embase = 18, hand-searched = 5). Seven studies overlapped across databases, yielding 26 unique studies. Data were extracted on study design, population, technology platform, and intervention domain. Each study was categorized as focusing on preoperative workup, postoperative rehabilitation, or general hearing applications related to cochlear implantation.

Results: Approximately three-quarters of studies focused on postoperative assessment and/or aural rehabilitation, and one-quarter addressed preoperative education or counseling. Most studies (69%, n=18) were pilot or proof-of-concept investigations involving adults or older children, with a smaller proportion designed as randomized controlled trials (15%, n=4).
Preoperative simulations supported counseling and decision-making. VR-based auditory and spatial-hearing training programs (e.g., *BEARS*, *HELIX*, *EarVR*) improved localization accuracy and reduced listening effort. AR wearables enhanced real-world communication and environmental awareness. Across studies, heterogeneity in design, outcome measures, and technology limited direct comparison and evidence synthesis.

Conclusions: VR and AR tools show promise for improving CI patient education and aural-rehabilitation outcomes through immersive, interactive experiences. Standardized protocols and validated outcome measures are needed to evaluate real-world efficacy and support clinical integration.

Learning Objective: Summarize and evaluate existing uses of VR/AR in CI workup and rehabilitation.

Desired Result: Promote evidence-based adoption of immersive technologies to enhance patient engagement and hearing outcomes.

Level of Evidence: V

IRB: Exempt

Growth Trends in Neurotology Fellowship Training

Andrew L.S. Thornton, BA; Alexander Chern, MD
Jenny X. Chen, MD, EdM; Margaret B. Mitchell, MD, MS-HPEd

Objective: To evaluate trends in the growth of neurotology fellowships compared to otolaryngology residency programs

Study Design: Retrospective longitudinal analysis of national training program data

Setting: Accreditation Council for Graduate Medical Education (ACGME)-accredited otolaryngology and neurotology fellowship programs in the United States

Patients/participants: All neurotology fellows and otolaryngology residents from 2017-2024

Interventions: Not applicable

Main Outcome Measures: Program, fellow, faculty counts, and trainee demographics were collected. Percent change and compound annual growth rate (CAGR) were analyzed in parallel with otolaryngology residency.

Results: From 2017-2024, the total number of ACGME-accredited neurotology fellowship programs steadily increased from 23 to 29 (+26%, CAGR 3.4%/yr) and fellows from 29 to 39 (+35%, 4.3%/yr). This significantly outpaced otolaryngology residency growth, with which increased from 1,592 to 1,846 total residents (+16%, 2.1%/yr, $p<0.001$). Over the last 5 years, an increasing amount of otolaryngology residents have subspecialized (13.8% to 17.9%).

Since 2017, total neurotology faculty expanded from 126 to 146 (+16%, 2.1%/yr), on pace with overall otolaryngology faculty expansion (2,518 to 2,917, +16%, 2.1%/yr). Mean neurotology faculty per program decreased slightly (5.5→5.0).

Female representation in neurotology fellowships rose from 27.6% to 41.0% (5.8%/yr), approaching that of otolaryngology residency programs. With regard to racial and ethnic diversity, while most fellows identify as White (>50%), Asian and Hispanic representation increased over this time (from 13.8% to 25.6%and 3.5% to 10.3%), respectively).

Conclusions: Neurotology fellowship capacity and faculty have seen modest expansion since 2017, with notable improvements in female representation. The growth of neurotology fellows has outpaced the growth in otolaryngology residents. Future studies should examine post-training workforce trends and assess the otologic and neurotologic needs of the aging U.S. population.

Learning Objective: To describe national growth and demographic trends in neurotology fellowships and contextualize them within otolaryngology training.

Desired Result: Recognize workforce trends and identify opportunities to better address evolving population needs.

Level of Evidence: III

IRB or IACUC: Exempt

Audiometric Outcomes following Surgical Repair of Cerebrospinal Fluid Leaks

Vivienne E. Pham, BS; Zheng Hong Tan, PhD; Ada Sher, MD; Oliver F. Adunka, MD MBA
Desi P. Schoo, MD; Yin Ren, MD PhD; Robert J. Macielak, MD

Objective: To compare audiologic outcomes following surgical repair of temporal bone cerebrospinal fluid (CSF) leaks via either a transmastoid or middle cranial fossa (MCF) approach

Study Design: Retrospective case series

Setting: Tertiary referral center

Patients: Patients presenting with primary CSF leaks involving the temporal bone undergoing surgical repair between January 2017 and August 2024

Interventions: CSF leak repair via a transmastoid or MCF approach

Main Outcome Measures: Pre- and postoperative four-frequency air-conduction (AC) pure-tone average (PTA), bone-conduction (BC) PTA, and PTA air-bone gap (ABG) in the operative ear

Results: Forty-one patients were identified, with 16 patients (39.0%) undergoing a transmastoid approach and 25 patients (61.0%) undergoing a MCF approach for CSF leak repair. Before transmastoid repair, the average AC-PTA, BC-PTA, and PTA ABG were 40.4 dB HL (standard deviation [SD]=13.7), 21.2 dB HL (SD=11.0), and 19.1 dB HL (SD=9.33), respectively, and after surgery, the average AC-PTA, BC-PTA, and PTA ABG were 35.9 dB HL (SD=19.2), 21.9 dB HL (SD=16.4), and 14.1 dB HL (SD=8.51), respectively. Considering these values, there was a significant decrease in PTA ABG after surgery in the transmastoid cohort (p=0.0419). Before MCF repair, the average AC-PTA, BC-PTA, and PTA ABG were 33.9 dB HL (SD=15.3), 21.8 dB HL (SD=12.5), and 12.1 dB HL (SD=11.3), respectively, and after surgery, the AC-PTA, BC-PTA, and PTA ABG were 34.0 dB HL (SD=20.8), 22.2 dB HL (SD=11.8), and 11.9 dB HL (SD=14.8), respectively. Considering these values, there was no significant change in the PTA ABG in the MCF cohort (p=0.932). When comparing pre- and post-operative PTA ABG change between these cohorts, there was no significant difference (p = 0.189) between the transmastoid approach (-5.07 dB HL [SD=9.11]) and the MCF approach (-0.242 dB HL [SD=14.0]).

Conclusions: While there was noted to be a significant decrease in PTA ABG in the transmastoid cohort, the clinical significance is likely limited given test-retest variability in pure-tone audiometry. Acknowledging this, neither approach to CSF leak repair provides substantial audiometric improvement despite initial documented hearing loss.

Professional Practice Gap & Educational Need: The audiometric outcomes after temporal bone cerebrospinal fluid leak repair remain poorly studied.

Learning Objective: To identify if there is any audiometric benefit to cerebrospinal fluid leak repair via either a transmastoid or middle cranial fossa approach.

Desired Result: That providers will understand the limited audiometric benefit of cerebrospinal fluid leak repair, which will help in clinical decision making and patient counseling.

Level of Evidence - Level IV

Indicate IRB or IACUC: The Ohio State University IRB Protocol # 2024H0277

Exploration of Comorbidities and Vestibular Testing in a Criteria Confirmed Vestibular Migraine Cohort

Bryce Kassalow, BA; Michell, Lee Parlett, BS, MS; Catalina Argandona Lopez, BS
Charles Keilin, MD; Christopher Welch, MD, PhD

Objective: To determine common comorbidities in a cohort of patients with International Classification of Headache Disorders (ICHD-3) criteria-confirmed Vestibular Migraine (VM), with assessment of the diagnostic utility of formal vestibular testing in this population.

Study Design: Cross-sectional case-control study

Patients: Comorbidity analysis included all Michigan Medicine patients between 2010 and 2020 whose charts contained ICD-10 codes R42 and G43.909 for "dizziness and giddiness" and "migraine, unspecified, not intractable, without status migrainosus" (n=6440). Vestibular testing analyses included the subset of this cohort that underwent vestibular testing at the University of Michigan (n=263) and compared those who met ICHD-3 criteria (N=120) with those that did not (n=142). Our cohort was predominantly female (79%) and Caucasian (83%).

Setting: Tertiary referral center

Interventions: Diagnostic

Main Outcome Measures: Vestibular testing results in multiple domains, quantitative continuous variables, and demographic data

Results: Compared to a large control (n=4,006,687)**,** our broad VM cohort had significantly higher prevalence of multiple comorbidities, including but not limited to Celiac disease (OR=7.14, 95% CI [5.68,9.09]) and POTS (OR=30.3, 95% CI [24.04,38.25]). There were no statistically significant differences in frequencies of vestibular testing abnormalities between criteria-confirmed VM patients and controls utilizing chi-squared tests with Bonferroni correction (positional nystagmus, spontaneous nystagmus, caloric testing, rotational chair abnormalities, and Dix-Hallpike testing all yielded $p > .05$). There was also no intergroup difference in distribution of caloric asymmetry (*K-S Statistic: 0.07, p=.87*) or preponderance (*K-S Statistic: 0.15, p=.22*).

Conclusions: We found no significant difference in vestibular testing results between patients with ICHD-3 criteria-confirmed VM and controls who did not meet criteria, whereas typical diagnostic criteria and comorbid conditions may be more highly predictive of the condition.

Learning Objective: To determine the utility of assessment of comorbid conditions and vestibular testing in diagnosing vestibular migraine

Desired Result: By informing clinicians of the diagnostic value, or lack thereof, of formal vestibular testing in patients with criteria-confirmed vestibular migraine, we hope to help this patient population avoid unnecessary testing and allow clinicians to provide more cost-effective care.

Level of Evidence – Level IV

Indicate IRB or IACUC: HUM00257250, University of Michigan

A Longitudinal Volumetric Analysis of Near-Total Resection of Vestibular Schwannoma

Krish Suresh, MD; Michael Brandel, MD; Alireza Zonnour, MD; Eric Cunningham, MD
Abhishek Bhatt, MD; Rick Friedman, MD, PhD; Marc Schwartz, MD

Objective: 1) Establish a volumetric basis for near-total resection (NTR), 2) analyze volumetric growth after NTR and associated risk factors.

Study Design: Retrospective study

Setting: Tertiary referral center

Patients: 88 patients with sporadic vestibular schwannoma, mean age 50 years.

Interventions: Microsurgery with a single surgical team resulting in NTR, determined intraoperatively as a thin layer of tumor left along an adherent interface.

Main Outcome Measures: 1) Volumetric growth defined as 10% increase on surveillance magnetic resonance imaging (MRI) compared to baseline postoperative MRI. 2) Need for salvage radiation. 3) Long-term facial nerve function.

Results: 88% underwent translabyrinthine surgery; 12% retrosigmoid. Mean preoperative tumor volume was 11.1 cm^3 (SD 10.4). Mean baseline postoperative tumor volume was .183 cm^3 (SD .223); mean percentage of residual tumor was 2.1%. 24 patients (27%) had no appreciable tumor on baseline postoperative MRI. Survival analysis with event defined as 10% volumetric growth resulted in 8 patients experiencing growth at mean 2.5 years; 2-year progression free survival (PFS) was 92%, 5-year PFS 73%. On univariate Cox proportional hazards analysis, retrosigmoid approach was associated with tumor growth (hazard ratio 6.86, p=0.04); 2/8 events were retrosigmoid and notable for preserved cochlear nerve. Survival analysis with event defined as salvage radiation found 5 patients undergoing radiation at mean 4 years; 2-year PFS was 98%, 5-year PFS 85%. Cox analysis found no significant associations. On long-term facial nerve follow-up (mean 2 years), 73% had House-Brackmann (HB) I-II function, 17% HB III, 10% HB IV-VI.

Conclusions: NTR has been defined as >95% tumor removal by volume, and this is consistent with our volumetric analysis finding mean 2.1% residual tumor. Retrosigmoid approach with preservation of eighth cranial nerve for hearing preservation may increase risk of tumor growth after NTR.

Learning Objective: To understand a volumetric basis for NTR and volumetric progression after NTR with associated risk factors.

Desired Result: Attendees will appreciate a more rigorous definition of NTR and risks of regrowth associated with NTR.

Level of Evidence - III

Indicate IRB or IACUC: University of California San Diego IRB #180978

Longitudinal Correlation of Hearing Loss and Cochlear Protein Precipitates in *NF2*-SWN Mouse Models

Isam A. Naber, MD; Marco Giovannini, MD, PhD
Jeremie Vitte, PhD; Christian M. Kabongo, BS

Hypothesis: Our hypothesis is that accumulation of proteins in the inner ear fluid contributes to hearing loss (HL) in *NF2*-related schwannomatosis (*NF2*-SWN) mouse models and mirrors the pathophysiology of patients with vestibular schwannoma (VS).

Background: HL in patients with VS does not consistently correlate with tumor size, suggesting mechanisms beyond nerve compression. High-resolution FLAIR MRI showed elevated cochlear signal and intralabyrinthine protein in 94% of ears with VS and HL. Histological studies confirm proteinaceous precipitates within the cochlear spaces, supporting a possible contribution to HL pathogenesis.

Methods: Hearing levels of two *NF2*-SWN mouse models (*P0-NF2*$^{\Delta 2\text{-}3}$ and *Postn-Cre;Nf2*$^{flox/flox}$) and their control littermates were determined using tone-burst ABR at 3, 6, 9, and 12 months of age. Protein precipitates extent was evaluated on H&E-stained sections from one temporal bone. Contralateral cleared cochleae were immunolabelled to assess hair cell, SGNs and Schwann cell changes. Perilymph was collected for proteomic profiling by mass spectrometry.

Results: At 6 months, *Postn-Cre;Nf2*$^{flox/flox}$ mice exhibited significant threshold elevations compared to *Nf2*$^{flox/flox}$ littermates, and progressed to a wider spectrum of frequencies at 9 months.

Conclusions: *Postn-Cre;Nf2*$^{flox/flox}$ mice demonstrated a progressive HL compared to controls. Further histological analyses will identify the association of this phenotype with cellular damages caused by an imbalance in protein homeostasis.

Learning Objective: To understand if the protein precipitation in inner ear fluids in *NF2*-SWN mouse models contributes to progressive cochlear injury and HL.

Desired Result: The progression of HL correlates with the natural history of protein precipitation in cochlear spaces in *NF2*-SWN mouse models.

Level of Evidence: Level III

Indicate IRB or IACUC: UCLA IACUC #ARC-2019-018.

Reconsidering the Management of Middle Ear Myoclonus: A Case Series Presentation and Systematic Review of Surgical Outcomes following Lysis of the Tensor Tympani and Stapedial Tendons

Daniel Swanson, MD; Christina L. Zhu, BS; Mona Dabbas, BS; Richa Nathan, BS
Selena E. Briggs, MD, PhD, MBA; Michael Hoa, MD; H. Jeffrey Kim, MD

Objective: To present a case series of two patients and three ears undergoing surgical intervention for middle ear myoclonus (MEM) and to emphasize that lysis of the tensor tympani (TT) and/or stapedial tendons (ST) should be considered among first-line treatment options

Data Sources: A systematic search of MEDLINE, Embase, CENTRAL, and Web of Science was performed for English-language studies published prior to August 2025 using the keywords "myoclonus," "tinnitus," "middle ear," "tensor tympani," "stapedius," "surgical management," and related terms.

Study Selection: A total of 756 articles were screened based on title and abstract with 17 articles describing medical and/or surgical management of MEM selected for full-text review.

Data Extraction: Two independent reviewers (CZ, DS) extracted data on patient demographics, symptom duration, prior medical therapy, therapeutic response, surgical procedure (lysis of ST, TT, or both), surgical technique (cold steel vs. laser), laterality, and postoperative outcomes.

Data Synthesis: Descriptive statistical analysis was performed to summarize management strategies and clinical outcomes

Conclusions: All three of our surgical ears treated with lysis of both TT and ST experienced complete resolution in their middle ear myoclonus in the respective ear. Among the 72 total patients in our review with MEM who received surgical intervention, 60 patients (83.3%) previously tried anticonvulsants and/or muscle relaxants prior to surgical intervention, while 12 patients (16.7%) proceeded with surgery as an initial treatment. Complete symptom resolution occurred in 67 patients (93.1%), partial improvement in four patients (5.5%), and recurrence of symptoms in one patient (1.4%). No surgical complications were reported. Lysis of the ST and/or TT is a safe and effective intervention associated with high rates of symptom resolution. Patients should be informed of the high likelihood of complete symptom resolution with surgical intervention in this condition.

Learning Objective: To recognize lysis of the TT and/or ST as effective surgical options for middle ear myoclonus.

Desired Result: To increase knowledge of the high likelihood of complete symptom resolution of middle ear myoclonus when treated surgically with lysis of the tensor tympani and/or stapedial tendons.

Level of Evidence - V

Indicate IRB or IACUC: IRB STUDY00009516, Medstar Georgetown University Hospital IRB, approved 7/14/2025

Obstructive Sleep Apnea in Patients Undergoing Lateral Skull Base Cerebrospinal Fluid Leak Repair: Prevalence and Postoperative Outcomes

Ritu R. Trivedi, BA; Dhillon R. Advano, BS; Antara Gupta, BS
J. Walter Kutz Jr, MD; Rance J.T. Fujiwara, MD, MBA

Objective: To evaluate the prevalence of obstructive sleep apnea (OSA) in patients undergoing lateral skull base cerebrospinal fluid (CSF) leak repairs and assess its impact on postoperative outcomes

Study Design: Retrospective review

Setting: Single-institution tertiary care center

Patients: 178 adult patients who underwent lateral skull base repair for CSF leaks between May 2013 and June 2024 were included. 64 (36%) patients were male with a median age of 59 years [IQR: 50-68].

Interventions: CSF leak repairs via transmastoid and/or middle fossa craniotomy

Main Outcome Measures: The diagnosis of OSA was determined based on reported history and available sleep study data. Postoperative outcomes included occurrence of revision surgery, symptom resolution, and postoperative migraine.

Results: 83 patients (47%) had a diagnosis of OSA, and 54 patients (30%) reported using continuous positive airway pressure (CPAP) therapy. Among the 36 patients with available sleep study data, the median apnea-hypopnea index (AHI) was 17 [IQR: 6-25] while patients with confirmed OSA had a median AHI of 19 [IQR: 7-27, n=31]. The majority of OSA patients (92%) had idiopathic CSF leaks, with smaller proportions attributed to iatrogenic (6%) and traumatic (1%) causes. There were no significant differences in leak etiology or leak location between patients with and without OSA. In terms of outcomes, OSA status did not significantly affect symptom resolution or the incidence of postoperative headaches. Similarly, CPAP use was not associated with differences in revision surgery rates, symptom resolution, leak etiology, or leak location.

Conclusions: While OSA is highly prevalent in patients with lateral skull base CSF leaks, it does not appear to significantly influence surgical outcomes or leak characteristics.

Learning Objective: To learn about the prevalence and effect of OSA on postoperative outcomes after a lateral skull base CSF leak repair

Desired Result: To guide counseling for patients with OSA who are undergoing lateral skull base CSF leak repair

Level of Evidence - Level IV

Indicate IRB or IACUC: University of Texas Southwestern Institutional Review Board; STU-2024-0631

Declining Reimbursements and Rising Volumes: Trends in Medicare-Funded Cochlear Implantation in the United States

Ashwin Jhawer, BS; Andrew Liu, BA; Divya A. Chari, MD

Objective: To assess whether regional variations in Medicare reimbursement are associated with differences in the number of cochlear implant (CI) surgeries performed.

Study Design: Cross-sectional analysis

Setting: Medicare B National Summary Files

Patients: Medicare B fee-for-service (FFS) beneficiaries who underwent CI surgery from 2017 to 2023.

Intervention: Cochlear implantations (current procedural terminology code 69930).

Main Outcome Measures: Descriptive statistics of national, state, and regional (Northeast, Midwest, West, South) reimbursement trends were performed. Mixed-effects linear regression models of reimbursement rate with primary outcome CI rate per million FFS beneficiaries per surgeon were performed.

Results: 15,548 CI surgeries were included for analysis. From 2017 to 2023, the number of CI surgeries performed nationally increased from 2,074 to 2,895, while the average inflation-adjusted provider reimbursement per CI declined from $1,168.76 to $960.08. The Northeast demonstrated the greatest average reimbursement per surgeon, while the West had the highest CI rate. Mixed-effects regression models demonstrated a positive trend between reimbursement and CI rates across regions, although this result was not statistically significant (β=0.02; p=0.27; 95% CI [–0.02, 0.07]). Being in the top quartile of CI reimbursements was associated with higher CI rates across regions and states, although this result was also not statistically significant (region: β=5.23; p=0.49; 95% CI [–9.57, 20.03], state-level: β=1.58; p=0.604; 95% CI [–4.42, 7.59]).

Conclusions: Despite declining Medicare reimbursements for cochlear implantation, national CI volumes continued to rise. While higher reimbursement levels trended towards greater utilization, this relationship was not statistically significant, suggesting that factors beyond payment, such as referral patterns, surgeon availability, and patient demand, may play a role in driving access to CI.

Learning Objective: To examine how declining Medicare reimbursements and regional payment variation influence trends in cochlear implantation.

Desired Result: Identification of whether financial incentives or other non-reimbursement factors drive regional differences in cochlear implant use.

Level of Evidence – Level IV

Indicate IRB or IACUC: Exempt.

Long-Term Cochlear Implant Outcomes and Management in Patients Treated with Radiation and Chemotherapy for Childhood Medulloblastoma

Wonhee Lee, MS; Matthew Kircher, MD; John Leonetti, MD
Matthew Carlson, MD, MBA; Karl Khandalavala, MD

Objective: To evaluate long-term cochlear implant (CI) outcomes and postoperative complications in patients who underwent radiation therapy and chemotherapy for medulloblastoma during childhood.

Study Design: Retrospective multi-institutional chart review.

Setting: Tertiary referral centers.
Patients: Patients with a history of childhood medulloblastoma treated with cranial radiation and chemotherapy who subsequently underwent cochlear implantation between 1989 and 2025.
Interventions: Cochlear implantation and postoperative management in patients with prior cranial chemoradiation exposure.

Main Outcome Measures: Speech-perception outcomes, wound-related complications, device longevity, and reconstructive strategies following CI in irradiated patients.

Results: Preliminary review identified approximately ten patients meeting inclusion criteria. The analysis focuses on long-term CI performance and the incidence, timing, and management of wound complications such as flap breakdown, infection, and device exposure. Previous literature on irradiated CI recipients has been limited by short follow-up and smaller sample sizes, often reporting higher complication rates in central nervous system pathology cohorts compared with head and neck malignancies. This study extends current evidence by characterizing outcomes after more than a decade of follow-up, the longest evaluation to date in literature, assessing device durability, delayed wound events, and reconstructive management strategies in post-radiation medulloblastoma survivors.

Conclusions: Cochlear implantation following childhood cranial irradiation for medulloblastoma is feasible and provides meaningful hearing restoration, but wound complications are more frequent and may occur years after implantation. Long-term follow-up is critical to identify delayed failures and to optimize reconstructive strategies that preserve device function and improve patient quality of life.

Learning Objective: To understand long-term cochlear implant outcomes and management of wound-related complications in patients who received childhood cranial radiation for medulloblastoma.

Desired Result: Attendees will recognize risk factors for postoperative complications in irradiated patients and apply multidisciplinary, long-term management strategies to optimize CI success and wound-healing outcomes.

Level of Evidence - Level IV – Case series (retrospective chart review)

Indicate IRB or IACUC: SUBMITTED **-** Loyola University Chicago Health Sciences Division IRB #LU 220072

Adjuvant Radiotherapy Following Lateral Temporal Bone Resection
A Multi-National Database Study

Matthew D. Adams, MD; Andrés Gorbea Dolagaray, MD; LeeAnn T. Marcello, BS

Objective: To elucidate the impact of adjuvant radiotherapy (RT) on overall survival within 12 weeks of lateral temporal bone resection (LTBR), and investigate the rates of complications.

Study Design: Retrospective cohort study of the TriNetX database.

Setting: TriNetX is a live HIPAA-compliant federated cloud electronic health record research network representing pooled data from 125-million patients from 69 healthcare organizations in the United States.

Patients: Subjects with temporal bone neoplasms who underwent LTBR. Cohorts were generated by those who did or did not receive adjuvant RT. Patients were matched 1:1 using propensity score matching for demographics, medical comorbidities, Eastern Cooperative Oncology Group (ECOG) score, and TNM staging.

Main Outcome Measures: Five-year overall survival; hazard ratio (HR) and risk ratio (RR) with 95% confidence intervals; rates of complications.

Results: 651 patients were identified, 547 patients treated with LTBR alone and 104 treated with LTBR and RT. In the LTBR group, 12 patients developed post-operative meningitis and 27 patients had bone-anchored hearing aid placement. After propensity score matching, 93 patients were identified in each cohort. There was no difference in age or sex between groups. Five-year overall survival was similar between cohorts (65.5% in LTBR alone vs 64.3% in LTBR and RT, HR 0.937, 95% CI 0.527 - 1.668, p = 0.751). There was no increased risk for facial nerve palsy between groups (RR 1.016, 95% CI 0.490 - 2.110). The rates of meningitis, CSF leak, and bone-anchored hearing aid placement were not detectable after propensity-score matching.

Conclusions: This study supports that RT imparts no added overall survival benefit in patients with temporal bone neoplasia undergoing LTBR, and does not increase the risk of facial nerve palsy.

Learning Objectives: 1. Understand the impact of adjuvant RT following LTBR in a patient-matched, multi-national database study, 2. Learn the rates of associated complications and trends in hearing rehabilitation.

Desired Result: Clarification of treatment paradigms of temporal bone neoplasia following LTBR and their consequences may improve neurotologic and multidisciplinary care. We hope to motivate future studies on the role of adjuvant therapies in lateral temporal bone neoplasia following LTBR.

Level of Evidence – Level III.

Indicate IRB or IACUC: Exempt.

Magnetic Resonance Imaging Artifact Associated with the Oticon Sentio Transcutaneous Bone Conduction Hearing Implant

Theresa B. Hennesy, MD; David A. Zander, MD; Theodore J. Kryzer, BS; Justin M. Honce, MD
Matthew L. Carlson, MD, MBA; Ashley M. Nassiri, MD, MBA

Hypothesis: Magnetic Resonance (MR) imaging of the temporal bone will be hindered after implantation with an Oticon Sentio Ti bone conduction implant (BCI), which may be partially addressed with metal mitigation techniques.

Background: Prior studies have demonstrated that transcutaneous BCIs create significant artifact and distortion on MR imaging. This artifact limits the ability to use MR for surveillance of cholesteatoma or vestibular schwannoma. Since its FDA clearance in July 2024, no published studies have evaluated the MR artifact of the Oticon Sentio device.

Methods: One cadaveric head specimen was unilaterally implanted with a Sentio bone conduction device according to manufacturer instructions. MR imaging was performed with a Siemens 1.5 Tesla MRI on XA60 software before and after implantation. Imaging was performed with both standard and metal mitigation techniques. Image scoring (diagnostic vs. non-diagnostic image) and qualitative assessment were performed by two experienced neuroradiologists according to anatomical subsites.

Results: Image distortion and artifact were noted in all post-implant imaging sequences. For all sequences, imaging of the ipsilateral middle ear, mastoid, and internal auditory canal (IAC) was nondiagnostic. The Axial T1 Turbo Spin Echo (TSE) high bandwidth sequence had the best artifact reduction; however, the ipsilateral temporal bone remained non-diagnostic. Non-echo planar diffusion-weighted imaging (non-EPI DWI) is nondiagnostic for the ipsilateral temporal bone and the contralateral IAC and middle ear.

Conclusions: After implantation of the Oticon Sentio device, the ipsilateral temporal bone is rendered non-diagnostic on all MR sequences due to artifact. The non-EPI DWI HASTE sequence, used for cholesteatoma identification, is nondiagnostic for all ipsilateral and most contralateral temporal bone subsites, which is noteworthy as this implant is commonly used for hearing loss following cholesteatoma treatment.

Learning Objectives: Name the anatomical subsites of the temporal bone that are not reliably imaged with MR after implantation with Oticon Sentio. Understand that artifact is maximally reduced with the Axial T1 TSE high bandwidth sequence.

Desired Result: Physicians and audiologists would understand the expected extent of MR artifact created by the Oticon Sentio device and consider this in patient selection for transcutaneous bone conduction hearing devices and preoperative counseling.

Level of Evidence: V

Indicate IRB or IACUC: Exempt

Tegmen Dehiscence – Predictors of Otic Meningitis and Operative Intervention

Zachary A. Kons, MD; Carleton E. Corrales, MD

Objective: To identify risk factors for otic meningitis and determinants of surgical management in tegmen tympani and/or tegmen mastoideum dehiscence.

Study Design: Retrospective chart review.

Setting: Single surgeon practice, single institution.

Patients: 63 adults (35F/28M; mean age 53.6±13.3 years; BMI 31.2±6.4 kg/m^2) evaluated for tegmen dehiscence.

Interventions: Retrospective chart review of existing medical records. No study-directed interventions.

Main Outcome Measures: Development of otic meningitis and receipt of operative repair. Covariates included demographics, comorbidities (HTN, diabetes, lIH, OSA with CPAP, ETD, CSOM), presenting signs/symptoms, and CT findings. Univariable logistic regression reported odds ratios with 95% Cis and two-sided p values.

Results: Otic meningitis occurred in 13/63 (21%); 48/63 (76%) underwent repair. Headache and vision changes at presentation were associated with higher odds of meningitis (p=0.005 and 0.036), whereas hearing loss was associated with lower odds (p=0.023). No presenting sign/symptom significantly predicted undergoing repair. No comorbidity significantly predicted meningitis or operative management, though OSA trended toward greater odds of surgery (p=0.071). Encephalocele trended toward lower meningitis odds (p=0.064); no CT variable reached significance for meningitis. Concurrent tympani+mastoideum dehiscence predicted repair (p=0.040), mastoideum-only predicted nonoperative management (p=0.020).

Conclusions: In this single-institution cohort, headaches and vision changes identified patients at higher meningitis risk, while hearing loss suggested lower risk. Patterns of CT dehiscence, but not comorbidities, were associated with surgical management. Larger multi-institutional studies are needed to refine predictors and guide standardized indications for repair.

Learning Objective: Identify clinical and imaging predictors of otic meningitis and of operative repair in patients with tegmen dehiscence for risk stratification.

Desired Result: Determine presenting features, comorbidities, and radiographic findings that affect meningitis risk and correlate with operative management, enabling more effective counseling and management of these patients.

Level of Evidence – Level III

Indicate IRB or IACUC: IRB Approval 2025P002055

Assessing Chronic Post-Treatment Dizziness in the Vestibular Schwannoma Population: A Survey Hosted by the Acoustic Neuroma Association

Robert J. Macielak, MD; William Liu, BS; Nicholas S. Andresen, MD; Yin Ren, MD PhD
Edward E. Dodson, MD; Oliver F. Adunka, MD MBA; Desi P. Schoo, MD

Objective: To analyze the burden of post-treatment chronic dizziness in the vestibular schwannoma (VS) population.

Study Design: Cross-sectional survey.

Setting: Online survey.

Patients: Patients who have undergone radiation or microsurgery for treatment of VS.

Interventions: Microsurgery or radiation.

Main Outcome Measures: Self-reported symptoms of chronic dizziness after radiation or microsurgery for VS.

Results: Thirty-eight surgical patients and 21 radiation patients completed the post-treatment surveys. Among the post-surgical patients, 35 (92%) were female, 16 (42%) were > 50-years-old, and 19 (50%) underwent surgery within the last two years. Preoperatively, dizziness, vertigo, and imbalance were reported by 29 (76%), 24 (63%), and 28 (74%) patients, and by 28 (74%), 16 (42%), and 33 (87%) patients postoperatively at the time of the survey, respectively. Many surgical patients reported symptoms suggestive of central dizziness, including dizziness in moving cars (16, 42%), with looking at complex patterns (18, 47%), or while in busy environments (22, 58%), and 16 patients (42%) reported dizziness with headaches. Among the post-radiation patients, 17 (81%) were female, 19 (90%) were > 50 years old, and 9 (43%) underwent radiation within the past two years. Pre-radiation, dizziness, vertigo, and imbalance were reported by 12 (57%), 9 (43%), and 12 (57%) patients, and by 14 (67%), 9 (43%), and 17 (81%) patients after radiation at the time of the survey, respectively. Post-radiation patients reported symptoms suggestive of central dizziness, including dizziness in moving cars (9, 43%), with looking at complex patterns (9, 43%), or while in busy environments (11, 52%), and 9 patients (43%) reported dizziness with headaches. At the time of survey completion, there was no significant difference in the Dizziness Handicap Inventory between the surgery (n=22, mean 35.7, SD 23.0) and radiation (n=8, mean 45.0, SD 11.3) cohorts (p=0.17). Considering all patients who have completed the survey (n=59), 43 patients (81%) report experiencing symptoms suggestive of central dizziness after treatment, regardless of the treatment.

Conclusions: Chronic dizziness is common after both radiation and microsurgery for VS. Given the prevalence identified herein, VS patients may benefit from additional interventions targeted towards central dizziness if they are still experiencing these symptoms long-term.

Professional Practice Gap & Educational Need: Post-treatment vestibulopathy remains understudied in this population.

Learning Objective: To better understand chronic dizziness in patients after treatment for vestibular schwannoma.

Desired Result: Increase awareness of the impact of vestibulopathy after vestibular schwannoma treatment, with an emphasis on the potential influence of central dizziness on this population

Level of Evidence – Level V

Indicate IRB or IACUC: The Ohio State University IRB Protocol #2024E1376, approved 1/8/2025

Comparison of 3 mm and 4 mm Implants in Percutaneous Bone Anchored Hearing Systems: Long-Term Outcomes from a Retrospective Study

Dennis Pappas, MD; Nicole Amichetti, PhD, MSc; Sara Al-Dalal, AuD
Dianna Tingle, AuD; Sara Svensson, PhD

Objective: To compare implant survival, time to loading, and postoperative outcomes between 3 mm and 4 mm implant lengths in percutaneous bone anchored hearing systems (BAHS).

Study Design: Retrospective review of medical records was conducted at a single center.

Setting: Alabama Ear Specialists

Patients: 234 adults

Interventions: Percutaneous BAHS

Main Outcome Measures: Implant survival at 3 months

Results: At 3 months post-surgery, 238 of 240 implants (99%) remained in situ, with no significant difference between implant lengths. Long-term survival was similarly high, with 232 implants (97%) in situ after an average follow-up of 43 ± 40 months. Time to loading was influenced by changes in clinical practice rather than implant length, with earlier cases averaging 70 ± 39 days and more recent cases averaging 50 ± 15 days. No significant differences were observed in the frequency of postoperative complications, including inflammation, infection, or pain, between the two groups.

Conclusions: Both 3 mm and 4 mm implant lengths demonstrated comparable survival rates, reliability, and postoperative outcomes in the adult population. These findings support the use of 3 mm implants as a viable alternative in cases where bone thickness may be a limiting factor.

Learning Objective: After this presentation, attendees will be able to consider the evidence for and against using 3mm or 4mm implant lengths in clinical practice.

Desired Result: Changes in physician knowledge.

Level of Evidence: Level V

Indicate IRB or IACUC: Exempt.

Medical Management in Superior Semicircular Canal Dehiscence Syndrome

Michael S. Castle, MD; Samantha Y. Cerasiello, MD; Kevin A. Peng, MD
William H. Slattery, MD; Hossein Mahboubi, MD, MPH

Objective: Evaluate the effectiveness of medical therapy for management of symptoms in patients with superior semicircular canal dehiscence syndrome (SSCD).

Study Design: Retrospective chart review

Setting: Tertiary referral center

Patients: Adults 18 years and older with a diagnosis of SSCD

Interventions: Medical treatment with nortriptyline, venlafaxine or topiramate prior to offering surgery.

Main Outcome Measures: Resolution or improvement of symptoms (dizziness, autophony, ear fullness and hearing loss).

Results: Seven consecutive patients were included. All had radiographic evidence of SSCD (three bilateral, four unilateral). All patients presented with vestibular complaints including episodic vertigo, imbalance, or disequilibrium. Four reported autophony, and five endorsed ear fullness. Conductive hearing loss with air–bone gaps was observed in two patients. Three of the seven patients had Cervical Vestibular Evoked Myopotential (cVEMP) testing. Two of the three had cVEMP abnormalities. Medical management strategies included nortriptyline (n=3), venlafaxine (n=2), and topiramate (n=2), selected based on whether they had other features suggestive of migraine or central sensitization. All seven patients reported improvement in vertigo and imbalance including reduced frequency and severity of dizziness. Autophony and ear fullness improved in some but not all cases. One patient, despite initial symptomatic improvement, presented at another facility and underwent SSCD repair, which resulted in worsening of dizziness and return to our office to resume medical therapy.

Conclusions: This series highlights that medical therapy may provide meaningful symptomatic relief in patients with SSCD as often comorbid conditions such as vestibular migraine exist and could be offered as an option prior to surgery. Prospective studies with larger cohorts are warranted to further define the role of conservative management in this population.

Learning Objective: Readers will become aware of a medical option for managing symptoms in patients with superior semicircular canal dehiscence syndrome, which can provide reasonable improvement/resolution given often present comorbid conditions.

Desired Result: Patients with SSCD could be offered a medical option when discussing treatment options other than surgery or observation.

Level of Evidence - V

Indicate IRB or IACUC: Exempt

Geographic Practice Cost Index (GPCI) Components and Regional Variation in Medicare Reimbursement for Cochlear Implantation and Stapedectomy

Jefferson Norwood, MBS; Layla Ali, BS; Cameron Ostroot, BS
Julia Howard, BS; Iyawna Hazzard, BS; Adedeji Okikiade, MD, PhD

Objective: To evaluate how the three Geographic Practice Cost Index (GPCI) components—Work, Practice Expense, and Malpractice—individually and collectively account for geographic variation in Medicare reimbursement for cochlear implantation (CPT 69930) and stapedectomy (CPT 69660).

Data Sources: Centers for Medicare & Medicaid Services (CMS) Physician Fee Schedule 2024B reimbursement files merged with 2025 GPCI indices across 110 Medicare Administrative Contractor (MAC) localities in the United States.

Study Selection: Two otologic CPT codes were selected for inclusion based on their relevance to neurotologic practice and consistent representation across MAC localities: cochlear implantation (69930) and stapedectomy (69660).

Data Extraction: Reimbursement and GPCI values were extracted from publicly available CMS datasets. Variables included Work, Practice Expense, and Malpractice GPCI indices. Data were standardized to allow comparison across localities.

Data Synthesis: Separate linear regressions modeled facility payment as a function of the three GPCI components. Standardized β coefficients and p-values quantified the magnitude and statistical significance of each component's contribution to reimbursement variability. For cochlear implantation, Practice Expense GPCI had the greatest influence ($\beta = 0.795$, $p < 0.001$), followed by Malpractice ($\beta = 0.391$) and Work ($\beta = 0.349$). The pattern was similar for stapedectomy, though with smaller magnitudes ($\beta_{PE} \approx 0.72$, $\beta_{Work} \approx 0.32$, $\beta_{MP} \approx 0.27$). Each 1-point increase in the respective GPCI corresponded to approximate reimbursement increases of $590, $540, and $87 for cochlear implantation.

Conclusions: Geographic disparities in Medicare reimbursement for otologic surgery are predominantly driven by Practice Expense GPCI, reflecting the outsized impact of regional overhead and facility costs. Work and Malpractice GPCIs contribute modestly but remain statistically significant. Understanding these component effects provides policy insight into how regional economic adjustments shape payment equity for neurotologic procedures.

Learning Objective: To understand how individual GPCI components drive regional variation in Medicare reimbursement for common otologic procedures and to recognize the economic factors influencing payment equity.

Desired Result: To enhance clinicians' and policymakers' ability to interpret geographic payment variation and advocate for equitable reimbursement frameworks across regions.

Level of Evidence: Level III – Cohort/Case-Control Study

IRB or IACUC: Exempt – analysis of publicly available CMS data

Age-Related Decline in Temporal Sound Processing: Insights from Envelope Steepness Map in the Mouse Auditory Cortex

Tianrui Guo; Kuniyuki Takahashi, MD, PhD; Shinsuke Ohshima, MD, PhD, Tatsuya Yamagishi, MD, PhD; Hiroaki Tsukano, MD, PhD; Arata Horii, MD, PhD

Hypothesis: The ability to sense temporal components of sounds, such as envelope steepness, would be diminished in aged mice.

Background: The mouse auditory cortex contains a tonotopic map. Recently, we identified an envelope steepness map encoding the rise-ramp steepness of sounds, which is located orthogonally to the tonotopic map. Temporal components, particularly the sound envelop defined by the rise-ramp steepness, play a crucial role in speech perceptions.

Methods: Responses to variations in rise-ramp time were investigated using transcranial macroscale calcium imaging of the auditory cortices of GCaMP6f-expressing mice. Normalized distance relative to the rise-ramp time of 0.01 msec was plotted for each rise-ramp time (0.1 msec, 1 msec, 10 msec, 100 msec) in the logarithmic scale graph: the steeper the slope of the fitted regression lines, the greater distance between the peaks of the rise-ramp time of 0.01 msec and 100 msec. The slope of this regression line was compared between the different age groups: 1/3 months and 6/9/12 months after birth.

Results: The slope of the fitted regression line for 5 kHz in bilateral anterior auditory field and 20 kHz in bilateral primary auditory field was significantly less steep in mice at 6/9/12 months after birth than at 1/3 months after birth.

Conclusion: The shorter distance from the peak of 0.01 msec to 100 msec in animals 6/9/12 months after birth suggests difficulty in the separation of the rise-ramp time in aged animals. These findings may support the cortical mechanisms underlying age-related decline in speech perception.

Learning Objective: To understand cortical mechanisms of age-related decline in speech perception.

Desired Result: Age-related alterations in cortical temporal processing will be revealed by envelope steepness mapping.

Level of Evidence - Not applicable

Indicate IRB or IACUC: Animal Care Committee of Niigata University School of Medicine (#SA00429, #SD01079)

Digital Twin-Enforced Safety Barriers for Cooperatively Controlled Robotic Skull Base Surgery

Jonathan Wang, MSE; Andy S. Ding, MD MSE; Hisashi Ishida, MSE; Adnan Munawar, PhD
Manish Sahu, PhD; Russell H. Taylor, PhD; Francis X. Creighton, MD

Hypothesis: Integrating patient-specific digital twins with cooperatively controlled robotic skull base surgery enables submillimeter virtual constraints to protect critical anatomy.

Background: Lateral skull base surgery demands submillimeter precision to safeguard critical structures embedded within dense, complex bone. While manual approaches remain the standard, they are limited by tremor, fatigue, and variability. Cooperatively controlled robots (CCRs), which allow simultaneous surgeon–robot instrument manipulation, combine robotic stability with human expertise. Furthermore, by referencing a digital twin (i.e. preoperative imaging-derived virtual reconstruction of the surgical field), CCRs can enforce safety barriers around vital anatomy. This study evaluates the feasibility and accuracy of digital twin–enforced safety barriers in CCR-assisted skull base surgery.

Methods: The CCR consisted of a 5-degree-of-freedom gantry arm coupled to an optically tracked surgical drill. Six cadaveric temporal bones were registered using bone-mounted fiducials. Preoperative CT scans were segmented to delineate critical anatomy (e.g. facial nerve, sigmoid sinus, and IAC). The robot was programmed to provide real-time positional feedback, progressively restricting drill motion as it neared critical anatomy, with a hard stop at 0.5mm. The senior author performed robot-assisted mastoidectomy followed by a translabyrinthine approach to the IAC. Accuracy was assessed by comparing postoperative CT scans with preoperative segmentations.

Results: All CCR-assisted procedures were completed without breaching critical structures. Median distances from the drilled cavity to the facial nerve, sigmoid sinus, and IAC were 0.508mm (IQR: 0.499-0.513mm), 0.520mm (IQR: 0.495-0.542mm), and 0.514mm (IQR: 0.504-0.520mm) respectively. One-sample Wilcoxon signed-rank tests confirmed no significant difference from the 0.5mm margin (facial nerve: p=0.313; sigmoid sinus: p=0.219; IAC: p=0.313).

Conclusions: Digital twin–guided CCRs enable submillimeter precision during mastoidectomy and translabyrinthine IAC exposure, suggesting a feasible, anatomy-aware platform for safer robotic skull base surgery.

Learning Objective: The learning objective was to assess the effectiveness of a CCR system in skull base surgery and to quantify the precision of robot-enforced virtual safety barriers around critical anatomy. While prior studies have explored robotic guidance for drilling in the skull base, these have largely focused on fully autonomous systems. In contrast, our CCR approach allows the surgeon and robot to jointly manipulate instruments, combining the surgeon's expertise with robotic precision to enhance safety. To our knowledge, this represents the first clinical evaluation of anatomy-specific CCR-enforced virtual barriers in skull base surgery.

Desired Result: We hope our study will highlight the potential of robotics to enhance surgical safety and precision in neurotology and stimulate discussion on advancing digital twin–guided interventions for clinical practice.

Level of Evidence - Level V

Indicate IRB or IACUC: Johns Hopkins School of Medicine IRB00264318

Long-Term Risk of Osseointegrated Implant Removal or Extrusion: Following Early and Chronic Wound Complications

Tyler J. Gathman, MD, MS; Lulia A. Kana, MD; Julio J. Roque, BS; Masanari G. Kato, MD; Hyunseo Jung, MD Rachel M. Goffeney, AuD; Sandra L. Porps, AuD; and Seilesh C. Babu, MD

Objective: Osseointegrated devices have continuously evolved, broadening indications into pediatrics and single-sided deafness. However, implantation can be complicated by wound infection or breakdown, which can be troublesome for patients and restricts long-term use.

Study Design: Retrospective cohort study.

Setting: Tertiary care academic.

Patients: The study included 1026 primary osseointegrated implant patients, both adults and children, between 2008 and 2024. The mean age was 50.7 years (range 5 – 88), and 39.6% (n = 406) were male. The most common cause of hearing loss was chronic ear disease (37.6%), followed by sudden hearing loss (18.6%) and vestibular schwannoma (17.5%).

Interventions: Wound complications, including local infection, irritation, inflammation, and incisional breakdown or dehiscence.

Main Outcome Measures: Kaplan-Meier analysis for explantation and extrusion rates in patients with early (< 30 days) and frequent (> three clinical instances) wound complications.

Results: Patients with primary osseointegrated implants exhibited a wound complication rate of 7.1% within the first 30 days post-operation and a rate of 5.9% for having more than three clinical instances. The group that experienced early complications showed significantly higher rates of explantation ($p < 0.005$; 14.1%) and equivocal extrusion rates ($p = 0.99$; 6.3%) at 5 years compared to those who did not face early complications, with explantation and extrusion rates at 5 years being 5.9% and 4.4%, respectively.

The cohort with frequent wound complications also had significantly higher rates of explantation ($p < 0.005$; 19.6%) but similar extrusion rates ($p = 0.99$; 4.6%) at 5 years compared to those who did not experience frequent complications, with explantation and extrusion rates being 4.5% and 3.7%, respectively.

Conclusions: Wound complication rates following osseointegrated implantation remain low; however, the risk of implant explantation significantly increases, though extrusion occurrence may be independent.

Learning Objective: Wound complications may occur following bone-anchored device implantation. When they happen in the early postoperative period or are frequent, they can predispose the patient to device explantation. However, the risk of extrusion may be independent of these factors.

Desired Result: Patients with early or frequent wound complications are at an elevated risk of explantation and should be followed carefully in the postoperative period.

Level of Evidence - Level III, Retrospective Cohort Study

Indicate IRB or IACUC: The study was reviewed and IRB-approved by Henry Ford Health prior to data collection on 12/19/2024 (Trends of Osseointegrated Bone Anchored Hearing Devices).

mVOR: An mHealth Solution for Remote Clinical Assessment of Gaze Stability in Unilateral Vestibular Dysfunction

Adam Thompson-Harvey, MD; Jesus Gomez, AuD; Gia Oscherwitz, BS; Masud Rabbani, MS
Bradley Kesser, MD; Sheik Iqbal Ahamed, PhD; Joel Goebel, MD

Objective: To determine whether a smartphone-based (mVOR) gaze-stabilization test (GST) can detect unilateral vestibular dysfunction (UVD) compared to a standard GST system.

Study Design: Prospective case–control pilot.

Setting: Tertiary neurotology referral center.

Patients: Thirty-five adults (18 UVD, 17 controls). UVD patients included 15 s/p surgical ablation and 3 with a caloric asymmetry ≥49%.

Interventions: Single-session testing comparing mVOR with a computerized GST system (Bertec Corporation, Columbus, OH).

Main Outcome Measures: The best GST score (maximum head velocity, °/s, sustaining visual acuity) from three trials per system, mean differences within patients (lesioned vs non-lesioned sides), and patient–control discrimination.

Results: On mVOR, lesioned vs non-lesioned sides: mean $\Delta = -16.3$ °/s ($p = 0.006$); best mean $\Delta = -22.8$ °/s ($p = 0.007$). Lesioned-side vs controls: 100.9 ± 34.0 vs 142.9 ± 12.5 °/s; $\Delta = -42.0$; $p < 0.001$; $d = 1.59$. On computerized GST, lesioned vs non-lesioned: $\Delta = -8.5$ °/s ($p = 0.042$); best $\Delta = -12.5$ °/s ($p = 0.087$). Lesioned-side vs controls: 84.0 ± 23.1 vs 111.2 ± 22.6 °/s; $\Delta = -27.2$; $p = 0.001$; $d = 1.19$. Non-lesioned patient sides scored lower than controls across devices ($p = 0.001$–0.028). Repeated-measures models showed a main effect of device (mVOR yielded higher absolute velocities) without significant device×side or device×group interactions ($p \geq 0.099$).

Conclusions: A smartphone-only GST (mVOR) differentiates lesioned-side gaze stability from the normal side and distinguishes UVD from controls, with significant effects comparable to those of a standard GST. Despite an offset in absolute velocity, the lack of device interaction supports mVOR's validity and feasibility for remote assessment and telerehabilitation.

Learning Objective: To evaluate the feasibility of using smartphone-based gaze stability testing as an accessible telehealth option for assessing vestibular function and guiding remote vestibular rehabilitation.

Desired Result: Validation of an mHealth tool that can serve as an effective, low-cost alternative for telemonitoring vestibular function and improving remote vestibular rehabilitation programs.

Level of Evidence: III

Indicate IRB or IACUC: University of Virginia IRB approval#: HSR230265, NIH NIDCD STTR Phase 1 award#: 1R41DC022209-01

Correlation of Intraoperative Electrically evoked Auditory Brainstem Responses in Bilateral Cochlear Implantation

De'Andre Warren, MD, Anna Johnson, BS, Elena Miller, MPH
Bradley Kesser, MD, Benjamin Lovin, MD

Objective: To determine the correlation of intra-operative electrically-evoked Auditory Brainstem Response (eABR) and post-operative performance between first and second cochlear implantation for bilateral cochlear implant recipients.

Study Design: Retrospective Chart Review

Setting: Tertiary Referral Center

Patients: Adult and pediatric patients with bilateral sensorineural hearing loss of any etiology who met audiologic criteria for bilateral cochlear implantation and underwent either simultaneous or sequential cochlear implantation with concurrent intra-operative eABR testing from 2015 to 2024.

Interventions: None

Main Outcome Measures: Primary outcome is change in latency, amplitude, and neural response telemetry (NRT) on eABR between primary and secondary implantation. Secondary outcome is post-implant audiologic performance.

Results: 34 patients with bilateral cochlear implants were included after inclusion and exclusion criteria. When comparing intra-operative changes in eABR from first to second implantation for all patients, there was a significant increase in latency at electrodes 6 (+18.2ms, p=0.43), 11 (+15.4ms, p=0.43), and 16 (+9.3ms, p=0.44). There was a positive correlation between patient age and hours of daily use (0.624, p=<.001), as well as patient age and time between implants (.826, p=<.001). Finally, when comparing a smaller cohort of 8 adult patients with completed pre- and post-operative AzBio data, post-operative scores were positively correlated with age at implantation (.447, p=0.13) hours of daily use (.630, p=<.001), and negatively correlated with duration of hearing loss (-.544, p=.002). There was no correlation between difference in difference between eABR data and AzBio performance.

Conclusions: There is increased latency between first and second cochlear implantation without correlation to post-implantation performance without impact on post-operative performance, which may contribute to sound localization. Additionally, increased duration of hearing loss correlated negatively with performance. Larger studies are needed for further statistical analysis.

Define Professional Practice Gap & Educational Need: Elucidating Audiometric and performance difference in timing of bilateral cochlear implantation

Learning Objective: Impact of bilateral cochlear implantation with respect to timing and performance

Desired Result: Improved understanding of potential impact and restoration of binaural audiologic phenomena from bilateral cochlear implantation.

Level of Evidence – Level III

Indicate IRB or IACUC : University of Virginia IRB Study #301908, Exempt

Stapedectomy versus Stapedotomy: A Systematic Review and Meta-Analysis

Trevor Torgerson, DO; Natasha Andreasen, BS; Leila Ledbetter, MLIS, AHIP
Kristal Riska, PhD; David Kaylie, MD

Objective: The aim of this review is to assess and compare the hearing and complication outcomes following primary stapedectomy and stapedotomy using a systematic review of the literature and meta-analysis.

Data Sources: An October 2024 database search included MEDLINE (PubMed), Embase (Elsevier), and Web of Science (Clarivate).

Study Selection: Retrieved articles were screened at the abstract and full-text level to obtain a final sample of studies that included primary stapedectomy and stapedotomy interventions with extractable hearing and complication outcome data.

Data Extraction: Data was extracted in a blinded and duplicate fashion with resolution using a third party adjudicator where needed. Risk of bias and methodological quality assessment was completed using a modified Downs and Black checklist.

Data Synthesis: The final review included 164 studies. In the comparative meta-analyses, no significant differences were noted in the number of patients with ABG ≤10 dB (p= 0.15), postoperative AC PTA (p= 0.26), or postoperative ABG (p= 0.08) between the two interventions. A significant difference (p= 0.03) in new postoperative SNHL was found favoring stapedotomy with more events in the stapedectomy group at an odds ratio of 2.11 (1.10 - 4.07, 95% CI), pooled analysis also found an average of 2.80% (2.03% - 3.57%, 95% CI) more patients with a new postoperative SNHL in the stapedectomy group. Meta-analyses and two sample proportion tests were completed using RevMan and Stata 19.

Conclusions: Overall, this work affirms the safety and effectiveness of stapedectomy and stapedotomy techniques for the surgical management of otosclerosis with no clinically meaningful differences in hearing outcomes and a marginally increased risk of SNHL in the stapedectomy group.

Learning Objective: To understand the audiometric and complication outcome differences between primary stapedectomy and stapedotomy interventions for the surgical management of otosclerosis.

Desired Result: To enable informed intraoperative surgeon decision making and accuracy of preoperative patient counseling for the surgical management of otosclerosis.

Level of Evidence - Level 1

Indicate IRB or IACUC: Exempt

Comparison and External Validation of Vestibular Schwannoma Quality of Life Questionnaires

Samuel Cler, MD; Pawina Jiramongkolchai, MD; Matthew Shew, MD; Nedim Durakovic, MD
Jacques Herzog, MD; Craig Buchman, MD; Cameron Wick, MD

Objective: Compare the Vestibular Schwannoma Quality of Life (VSQOL) and Penn Acoustic Neuroma Quality of Life (PANQOL) questionnaires to look for survey differences and identify quality-of-life factors in vestibular schwannoma patients.

Study Design: Patients, regardless of management, were recruited from the authors' institution and Acoustic Neuroma Association. Participants completed the VSQOL and PANQOL online. Participants were asked to repeat the surveys 2-weeks later to assess retest reliability.

Setting: Tertiary academic center and national patient support group.

Patients: Patients with a vestibular schwannoma.

Interventions: VSQOL and PANQOL questionnaires.

Main Outcome Measures: QOL scores reported as mean ± standard error of means

Results: 436 participants completed the survey (67.4% institutional cohort, 66.7% female, mean age 64.0 years, mean time since diagnosis 10.1 years). Initial management included 42.7% surgery, 14.4% radiation, and 42.9% observation. Mean VSQOL and PANQOL scores were 73.2±0.84 and 61.5±0.85 respectively (scale 0-100; higher scores indicating higher QOL). Demographics and QOL scores were comparable between institutional and ANA cohorts. VSQOL and PANQOL scores were highly correlated (correlation coefficient 0.83, R^2=0.71). Initial responses were similar to retest responses in VSQOL (correlation coefficient 0.93, R^2 =0.87) and PANQOL (correlation coefficient 0.90, R^2=0.87). Lower QOL scores were reported with larger initial tumor size, initial surgical management, tumor growth, need for additional treatment, and change in work status. Change in work status had the largest negative association with QOL; 14.1±2.1 lower on PANQOL and 16.8±2.4 on VSQOL. All of the associations with QOL were observed across both questionnaires.

Conclusions: VSQOL and PANQOL scores revealed similar trends and had strong retest reliability. Change in work status had the largest negative impact on QOL scores.

Learning Objective: Describe and identify trends in vestibular schwannoma quality of life patient reported outcome measures.

Desired Result: External validation identifying a strong association between VSQOL and PANQOL scores with high retest reliability. Provides validation that findings using one questionnaire could be applicable to the other questionnaire.

Level of Evidence – level III

Indicate IRB or IACUC: Approval granted by Washington University Biomedical IRB #202303063, 8/22/2024

Stereotactic Radiosurgery for Cerebellopontine Angle Tumor Control: Long-Term Efficacy and Clinical Outcomes

Bora Agabigum, MD, MS; Tyler J. Gathman, MD, MS; Hyunseo Jung, MD
Jeffrey Turnbull, DO; Alex Lampi, BS, Rafi Hanna, BS

Objective: Stereotactic radiosurgery has proven highly effective in managing small to medium-sized skull base tumors, offering adequate tumor control as a non-invasive modality that minimizes surgical risk. Despite these advantages, long-term studies on clinical and tumor burden outcomes have been limited.

Study Design: Retrospective cohort study.

Setting: Tertiary care academic.

Patients: This study analyzed 135 patients with cerebellopontine angle tumors who received primary stereotactic radiosurgery between 2010 and 2025. The mean patient age was 63.8 years (range 41–90), and 55.5% (n = 60) were male. All patients underwent Gamma Knife treatment. Vestibular schwannoma was the most common diagnosis (94.8%; n = 128), followed by meningioma (4.4%; n = 5) and glomus tumor (0.7%; n = 1). The mean follow-up duration after primary treatment was 5.7 years.

Interventions: Stereotactic radiosurgery with Gamma Knife for primary cerebellopontine angle tumor treatment.

Main Outcome Measures: Tumor control was evaluated by magnetic resonance imaging at less than 1 year and more than 2 years after treatment. The rates of refractory tumor growth and subsequent surgical resection were also determined.

Results: Prior to radiosurgery, the mean maximal tumor dimension measured 13.2 mm. After more than 2 years, 15.5% (n = 16) exhibited persistent tumor growth or treatment failure, while 9.6% (n = 13) ultimately underwent surgical resection. Audiometric testing revealed a mean pre-radiosurgery pure tone average of 38.8 dB, with 21.4% (n = 29) of patients experiencing greater than 20 dB increase after radiosurgery.

Pre-radiosurgery, 2.8% (n = 3) of patients had facial nerve deficits defined as House-Brackman > 1, and no patients developed deficits from initial normal function following radiosurgery. Vestibular testing demonstrated 66.6% (n = 70) of patients had ipsilateral vestibular dysfunction after radiosurgery.

Conclusions: Radiosurgery offers effective tumor control with limited need for surgical resection. However, there are demonstrated risks to hearing preservation and vestibular function that require long-term monitoring.

Learning Objective: Radiosurgery continues to be an effective option for treatment cerebellopontine angle tumors and in avoiding surgical resection; however, patients require ongoing monitoring of both audiogram and vestibular function.

Desired Result: Patients undergoing radiosurgery may retain both hearing and vestibular function; however, any deficits should be promptly identified and managed.

Level of Evidence - Level III, Retrospective Cohort Study

Indicate IRB or IACUC: The study was reviewed and IRB-approved by Henry Ford Health.

Virtual Morris Water Maze Performance in Vestibular Migraine

Alexandra T. Bourdillon MD; Jeffrey D. Sharon MD

Objective: To investigate the differences in spatial navigation in vestibular migraine (VM) using a virtual reality (VR) virtual Morris Water Maze (vMWM).

Study Design: Prospective cohort study

Setting: Tertiary referral center

Patients: Subjects with a history of VM per Barany Society criteria were recruited, as well as healthy controls with no history of migraine or dizziness.

Interventions: Participants completed four replicates of VR-based vMWM tasks, including a learning trial (visible target) and three test trials (invisible targets). In each series, Trials 3 and 4 involved new starting positions. Patient-Reported Outcome Measures (PROMs) included: Dizziness Handicap Inventory (DHI), VM-Patient Assessment Tool and Handicap Inventory (VM-PATHI), Headache Impact Test (HIT), Cognitive Failures Questionnaire (CFQ), Visual Vertigo Analog Scale (VVAS), Santa Barbara Sense of Direction (SBSOD) survey, and Video Game Questionnaire (VGQ).

Main Outcome Measures: Rate of successful completion across nine testing trials, and time to trial completion (TTC) of Trials 3 and 4. Performance measures were correlated with PROMs.

Results: 24 individuals with VM and 31 controls were included. The study arms did not differ by demographics ($p>0.05$ for each) or overall video game experience ($p=0.12$). Participants with VM had a higher failure rate (53.1%) compared with controls (42.5%), a difference that was statistically significant ($p<0.01$). Average TTC of Trials 3 and 4 were longer in the VM arm (17.3±4.7s) compared with healthy controls (15.8±5.4s), which neared statistical significance ($p=0.06$). Between-group differences were statistically significant in Trial 4 ($p=0.019$), but not Trial 3 ($p>0.90$). Correlation analyses between maze performance and PROMs demonstrated that only VM-PATHI was statistically significantly correlated with completion rate ($p=0.03$) and TTC ($p<0.05$).

Conclusions: Participants with VM have higher failure rates than healthy controls in VR-based vMWM assessment. Maze performance is correlated with VM-PATHI.

Learning Objective: To examine how spatial navigation abilities may be impaired in individuals with VM and the opportunities for VR-based maze tasks to quantify such disease features.

Desired Result: To consider the utility of VR-based maze tasks in assessing spatial navigation abilities in the management of VM.

Level of Evidence - III

Indicate IRB or IACUC: 23-38758.

Radiomorphometric Analysis of Internal Auditory Canal Access: Retrolabyrinthine vs Established Hearing-Preserving Approaches

Aaron Tucker, BA; Sammy Gao, BS; Brendon Warner, MD; Arman Saeedi, MD, MPH
Lawrance Lee, MD; Nauman F. Manzoor, MD

Objective: The retrolabyrinthine approach is a presigmoid hearing preservation option for the management of IAC lesions, although its microsurgical technique offers limited lateral IAC visualization. We aim to compare internal auditory canal (IAC) volume exposure via retrolabyrinthine, retrosigmoid, and middle cranial fossa (MCF) approaches.

Study Design: Updated radiomorphometric analysis of cadaveric temporal bones.

Interventions: IAC dissections were performed on thirteen cadaveric temporal bones. High-resolution computed tomography scans were used to generate 3D segmentations of the IAC before and after dissection. 0° and 30° angles at the level of the semicircular canals were utilized to measure IAC exposure without violating the inner ear structures via retrolabyrinthine, retrosigmoid, and middle cranial fossa (MCF) approaches.

Main Outcome Measure: The percent of post-dissection accessible IAC volume for each approach.

Results: Thirteen cadaveric temporal bones (7 left, 6 right) were included. The mean IAC volume was 232.8 ± 85.1 mm^3. The retrolabyrinthine approach offered less median IAC exposure than the MCF and retrosigmoid approaches at the 0° angle (retrolabyrinthine: 65.1% [IQR 14.5%]; retrosigmoid: 90.3% [IQR 3.9%]; MCF: 95.9% [IQR 7.1%], p<.001) and 30° angle (retrolabyrinthine: 75.6% [IQR 13.5%]; retrosigmoid: 99.5% [IQR 0.6%]; MCF: 99.9% [IQR 0.7%], p<.001). Compared with 0° views, the 30° angle improved median IAC exposure of all three approaches (retrolabyrinthine: +10.5%, p=.019; retrosigmoid: +9.2%, p<.001; MCF: +4.1%, p<.001). Pre-dissected retrolabyrinthine corridor width ranged 1.1-7.1 mm (median 4.4 mm) and sinodural angle ranged 57.5°-96.5° (median 76.4°). Using log-transformed analyses, neither measure was significantly correlated with the IAC exposure of any approach.

Conclusions: Established hearing preservation approaches to the IAC remain the gold standard for maximizing lateral IAC exposure. While the key advantage of the retrolabyrinthine approach is hearing preservation without the need for craniotomy and intracranial parenchymal retraction, the approach may only be appropriate for select patients with limited involvement at the IAC fundus. The increased IAC exposure of the 30° angled view for all approaches suggests a global benefit of angled endoscopic assistance. Larger feasibility studies are needed to identify anatomical features of favorable candidates.

Learning Objective: Participants should be able to compare IAC exposure of established hearing-preserving surgical approaches versus the retrolabyrinthine approach, and to and comprehend the benefit of endoscopic assistance.

Desired Result: To improve awareness of the endoscopic-assisted retrolabyrinthine approach, and to describe which patients with IAC tumors are favorable surgical candidates.

Level of Evidence - III

IRB: Exempt

Prevalence of Magnetic Resonance Imaging Completion Among Bone Anchored Hearing Implant Patients

Malia A. Tieu, BS; Doron Sagiv, MD

Objective: To analyze the prevalence of post-implant magnetic resonance imaging (MRI) amongst patients with an implanted bone-conduction hearing device (BCD).

Study Design: Retrospective cross-sectional study

Setting: A nationwide repository of deidentified electronic health records (Epic Cosmos Database) sourced from over 300 million patients across the United States.

Patients: Adult patients who underwent BCD implantation between 2010 to 2025.

Interventions: Epic Cosmos database search using CPT codes for BCD implantation and MRI.

Main Outcome Measures: Type of MRI, Age, Race, Active Diagnoses documented in patients' problem list using Systematized Nomenclature of Medicine - Clinical Terms (SNOMED-CT).

Results: Our cohort includes 10,338 patients (43.01% males) who underwent BCD implantation, with a mean age at implantation of 53.11 years of age (range 18-100). The frequency of post-BCD MRI completion was 23.68% for any MRI, and 12.47% for brain MRI. The prevalence of post-BCD MRIs was significantly higher among patients aged 51 to 65 years at the time of implantation (*P*-value = 4.006e-02). Post-BCD MRI completion of any MRI was also positively associated with a history of neurological disorders (Odds Ratio (OR)= 2.267, p-value= 8.629e-96) or cardiovascular disorders (OR= 1.567, p-value= 7.227e-34). Specifically, patients with acoustic neuroma (OR= 6.918, p-value= 3.538e-78), hypertension (OR= 1.686, p-value= 3.018e-35), and diabetes (OR= 1.547, p-value = 1.770e-13) were more likely to complete any MRI following BCD implantation. As expected, patients with a history of acoustic neuroma were also more likely to receive a brain MRI (OR= 9.129, p-value= 1.211e-29).

Conclusions: The prevalence of post-BCD MRI is higher among patients who were ages 51-65 years at the time of implantation and among patients with neurological disorders, hypertension, and diabetes. These patient demographics should be considered when consulting patients considering a BCD.

Learning Objective: To analyze the prevalence of MRI completion among BCD implantees based on potential risk factors such as age and medical history.

Desired Result: To inform clinicians of the risk factors associated with future MRI utilization among patients undergoing BCD implantation, thereby supporting more individualized patient counseling.

Level of Evidence – Level IV

Indicate IRB or IACUC: Exempt

Intraoperative Electrocochleography and Clinical Factors Associated with Cochlear Implant Performance in Idiopathic Sudden Sensorineural Hearing Loss

Matthew J. Wu, MD; Amit Walia, MD; Jordan Varghese, MD; Doug Fitzpatrick, PhD
Matthew Shew, MD; Jacques Herzog, MD; Craig A. Buchman, MD

Objective: To identify clinical and electrophysiologic factors associated with cochlear implant (CI) performance in idiopathic sudden sensorineural hearing loss (ISSNHL) and to determine whether these factors explain variability in CI outcomes.

Study Design: Retrospective, cross-sectional study (7/2021–10/2024).

Setting: Tertiary referral center.

Patients: Adult CI recipients with unilateral ISSNHL and contralateral ear ≤35 dB hearing loss in the non-implanted ear.

Interventions: Single-manufacturer CI with intraoperative intracochlear electrocochleography (ECochG).

Main Outcome Measures: CI speech perception (AzBio in Quiet, CNC) and ECochG-total response (ECochG-TR) in relation to ISSNHL-relevant clinical factors (e.g., steroid use and vestibulopathy).

Results: Thirty-three adults underwent CI following ISSNHL. The median age was 58.0 years (range: 24.0–81.0); 51.5% were female. Prior to implantation, 27.3% (n=9) had vestibulopathies, and 81.8% (n=27) received oral/intratympanic steroids, of which 14.8% (n=4) were steroid-responsive, defined by documented hearing improvement after corticosteroid therapy. At six months, median speech perception scores were 71.0% (range: 12.0–95.0) for AzBio in Quiet and 48.0% (range: 4.0–76.0) for CNC. Older age (>50 years), female sex, duration of deafness >2 years, cardiovascular comorbidity, vestibulopathy, or steroid use alone did not affect CI speech perception at six months or ECochG-TR ($p>0.05$). Steroid-responsiveness, while not statistically significant ($p>0.05$), suggested a clinically meaningful improvement at six months for AzBioQ (median difference 16.0; 95%CI: −16.0, 29.0) and CNC (median difference 12.0; 95%CI: −8.0, 34.0). ECochG-TR was weakly associated with CI speech perception at six months for AzBioQ ($R^2=0.19$) and CNC ($R^2=0.13$).

Conclusions: Among ISSNHL CI recipients, most clinical factors did not significantly influence speech outcomes or electrophysiologic responses, except for steroid-responsiveness, which may be a positive prognosticator. Compared with non-ISSNHL patients, the weak relationship between ECochG-TR and speech performance may reflect differences in ISSNHL-related pathophysiology.

Learning Objective: To evaluate how clinical recovery features and intraoperative electrophysiologic measures relate to CI performance in ISSNHL.

Desired Result: Attendees will learn that most traditional ISSNHL factors related to hearing recovery show limited prognostic value for CI performance except for steroid-responsiveness.

Level of Evidence – Level IV

Indicate IRB or IACUC: Washington University in St. Louis (IRB#: 202507213)

Impact of Perioperative Blood Transfusion on Oncologic Outcomes after Lateral Temporal Bone Resection

Bailey H. Duhon, MS; Xiaowen Sun, PhD; Mike Hernandez, MS
Marc-Elie Nader, MD; Paul W. Gidley, MD

Objective: To evaluate the impact of perioperative blood transfusion on survival and recurrence outcomes following lateral temporal bone resection (LTBR).

Study Design: Retrospective cohort.

Setting: Tertiary academic center.

Patients: Patients diagnosed with temporal bone and parotid malignancies requiring LTBR from 2012-2023.

Interventions: Perioperative blood transfusion (intraoperatively and within 72-hours postoperatively).

Main Outcome Measures: Recurrence-free survival (RFS), disease-specific survival (DSS), and overall survival (OS).

Results: One-hundred twenty-one patients underwent LTBR. Approximately one-third required perioperative blood transfusion (n=39/121), averaging 2 units (range 1-5 units). Transfused and non-transfused patients were well-balanced on baseline characteristics including TNM staging, surgical margins, histological subtype, and adjuvant treatment. However, tumor subsite and perineural invasion differed significantly between groups and were included in multivariable models, along with T stage, to control for confounding and assess independent effect of perioperative transfusions. Despite comparable baseline risk, RFS, DSS, and OS were significantly lower in the transfusion group (median RFS, 17 vs 50 months; median DSS, 23 months vs median not reached; median OS, 22 vs 82 months; all $p<0.050$). Univariable Cox regression of all preoperative risk factors demonstrated that ASA class 4 (HR 5.6, 95% CI 1.4 - 22.9, p=0.005), transfusions (HR 1.9, 95% CI 1.1 – 3.2, p=0.015), and N1+ stage (HR 1.7, 95% CI 1.0 – 2.9, p=0.059) were associated with increased hazard of recurrence. Transfusion remained significant in the multivariable analysis (HR 2.4, 95% CI 1.1-5.2, p=0.031). Additionally, transfusions were a strong predictor of lower DSS (HR 4.5, 95% CI 2.2 – 9.2, $p<0.001$) and OS (HR 3.1, 95% CI 1.7 – 5.6, $p<0.001$) on univariable analysis.

Conclusions: Perioperative blood transfusion after LTBR is associated with poorer oncologic outcomes, including higher recurrence rates and mortality.

Learning Objectives:
1) Understand the oncologic outcomes and transfusion requirements of patients undergoing lateral temporal bone resection.
2) Interpret clinical data and individually assess the association between perioperative transfusion and oncologic outcomes, taking tumor- and patient-specific factors into account.
3) Describe predictors of poor recurrence-free, disease-specific, and overall survival using data from this large, single-institution cohort to inform management decisions for a rare subset of cancers that may be infrequently encountered elsewhere.

Desired Result: Attendees will be able to apply these learning objectives to guide perioperative management decisions aimed at optimizing oncologic outcomes and minimizing potential adverse effects of blood transfusions when performing lateral temporal bone resection.

Level of Evidence – Level III

Indicate IRB or IACUC: The MD Anderson Cancer Center IRB# PA19-0106

Concurrent Validity of the Welling and Melbourne Temporal Bone Dissection Scales Across Five Years of Resident Training

Aaron Snow, MD; Mikayla Huestis, MD; Nicholas Anthony, BS
Stephanie Moody-Antonio, MD; Peter G. Volsky, MD

Objective: To evaluate the concurrent validity of the Welling and Melbourne scales in assessing otologic surgical skill using paired ratings of temporal bone dissections completed by otolaryngology residents over five years.

Study Design: Retrospective validation study.

Setting: Tertiary academic temporal bone dissection laboratory.

Patients/Subjects: Fifty-five temporal bone specimens dissected by residents (PGY 2–5).

Interventions: Each dissection was evaluated using both the Welling and Melbourne scales by one faculty rater. Checklist items were coded as binary indicators (Agree/Disagree or Complete/Incomplete) and summed for total scores.

Main Outcome Measures: Correlation between total Welling and Melbourne scores overall and across subgroups defined by PGY year and difficulty level.

Results: The mean Welling and Melbourne total scores were 20.3 ± 7.2 and 15.3 ± 2.7, respectively. The two scales demonstrated a strong positive correlation (Pearson $r = 0.72$, $p < 0.001$; Spearman $r = 0.73$, $p < 0.001$). Correlations remained robust across subgroups: by PGY ($r = 0.63–0.78$) and by difficulty ($r = 0.69–0.82$ for "Easy–Average" dissections). The relationship persisted across five years of training, supporting consistency between the two assessment systems.

Conclusions: The Welling and Melbourne scales show strong concurrent validity in evaluating temporal bone dissection performance. Despite differences in structure and scoring emphasis, both provide comparable measures of resident skill, supporting their interchangeable use for competency assessment and educational benchmarking.

Learning Objective: To understand how the Welling and Melbourne temporal bone dissection scales align in assessing otologic surgical skill.

Desired Result: Demonstrate that both scales reliably measure similar constructs of surgical competence, enabling consistent cross-platform evaluation in simulation-based otologic training.

Level of Evidence - Level III.

Indicate IRB or IACUC: IRB # 22-04-NH-0089

Comparing 2D and 3D Magnetic Resonance Imaging-Derived Radiomic Features of Vestibular Schwannomas for Predicting Facial Nerve Outcomes After Retrosigmoid Resection

Nicole Page, BS; Murphy Kenny, BS; Sai Chandan Reddy, BS; James Feghali, MD
Christopher Jackson, MD; Francis Creighton, MD; George Liu, MD

Objective: To investigate the relationships of magnetic resonance imaging (MRI)-derived 2D and 3D features of vestibular schwannomas with facial nerve (FN) outcomes after retrosigmoid resection.

Study Design: Single-center retrospective cohort study

Setting: Tertiary referral center

Patients: Adults who underwent retrosigmoid resection of vestibular schwannoma tumors between August 2016 and January 2024. Six different surgeons were involved.

Interventions: Tumor segmentations were performed on MRI sequences using 3D Slicer software to analyze tumor volumes, elongation, surface area, and centroid displacement relative to the porus acusticus center. 2D measurements were made using radiology image software.

Main Outcome Measures: Short- (<2 weeks) and long-term postoperative FN exam scores, binarized as good (House-Brackmann I-II) and Poor (III-VI). Predictive features were assessed by area under receiver operating characteristic curve (AUC).

Results: 44 subjects with good FN baseline function ages 37-84 years were analyzed. 82% had gross total resections. Median follow-up duration was 3.6 years. Larger tumor volume and maximum diameter were associated with poor short- and long-term FN outcomes ($p<0.01$). There was no difference between volume and maximum diameter for predicting long-term FN outcomes (AUC=0.95 versus 0.94 respectively, $p=0.88$). Higher surface area (AUC=0.95, $p<0.001$) and lower elongation (more spherical shape; AUC=0.68, $p<0.05$) also predicted poor long-term FN outcomes, as did dorsal and medial tumor centroid position relative to the porus acusticus (AUC=0.83 and 0.79, $p<0.01$). In analysis of only gross total resections (n=31), surface area, tumor volume, and max diameter remained significant predictors of FN function (AUC>0.93, $p<0.001$), while elongation did not (AUC=0.7, $p=0.19$).

Conclusions: Tumor volume and maximum diameter were similar predictors of short- and long-term FN outcomes. Large multi-institutional prospective studies are needed to validate these findings.

Learning Objective: To understand how 3D radiomic features such as tumor volume, surface area, and elongation may influence facial nerve outcomes following resection of vestibular schwannomas.

Desired Result: To affirm that maximum tumor diameter is an adequate proxy for tumor volume and to demonstrate that novel 3D radiomic features may provide insight into facial nerve prognosis in resection of vestibular schwannomas.

Level of Evidence: III

Indicate IRB or IACUC: IRB00322104, Johns Hopkins University

Postoperative Hearing Recovery in Vestibular Schwannoma: A Case Series

Clifford J. He, BA; Hayley A. Granberg, BA; Krish Suresh, MD, Marc Schwartz, MD; Rick Friedman, MD, PhD

Objective: Characterize patients demonstrating postoperative hearing improvement following vestibular schwannoma resection using Thornton and Raffin's 95% critical-difference model for word-recognition scores (WRS).

Study Design: Retrospective case series.

Setting: Single tertiary academic center

Patients: Nine of 442 patients (2.0%) undergoing hearing preservation microsurgery with postoperative WRS improvement beyond test variability thresholds.

Interventions: Microsurgical resection via retrosigmoid (n=7) or middle-fossa (n=2) approaches with postoperative nimodipine.

Main Outcome Measures: Change in tumor-side WRS using Thornton and Raffin's model, all obtained from standardized pre- and postoperative institutional audiograms. This model treats speech discrimination performance as a binomial variable, accounting for retest variability and inherent variability in percentage of correct responses across 50-word tests, to define the minimum change required for statistical significance ($p<0.05$) based on test length and baseline score.

Results: Patients' mean age was 50 years old (SD=9); six had left-sided tumors. Mean maximal linear diameter was 18.2 mm (SD=4.7). All were NF2-negative. Postoperatively, all patients received nimodipine. Mean tumor-side WRS improved from 51.6% (SD=11.2%) to 82.0% (SD=9.7%) ($p<0.001$, Thornton & Raffin model), while mean PTA improved from 45 dB (SD=8) to 40 dB (SD=6). Eight had postoperative follow-up audiogram within two weeks (mean 8.9 days, SD=2.2), and one on postoperative day 78. Five achieved gross-total resections, two near-total, and two subtotal.

Conclusions: Statistically significant hearing recovery following vestibular schwannoma resection is rare but possible. Incorporating binomial critical-difference model provides a framework for distinguishing true auditory improvement from test variability. Factors associated with hearing recovery are difficult to study given the rarity of this phenomenon; it may be due to relief of mass effect on the cochlear nerve. Regardless we wish to draw attention to this rare and underreported phenomenon.

Learning Objective: Recognize measurable postoperative hearing recovery in vestibular schwannoma and apply Thornton and Raffin's model for accurate outcome interpretation.

Desired Result: Enhance clinician awareness of statistically validated hearing improvement with vestibular schwannoma surgery.

Level of Evidence: Level V

Indicate IRB or IACUC: UC San Diego Health (#161794)

Longitudinal Study of Non-Traditional Cochlear Implant Indications Practice Impacts and Referral Trends

Shawn M. Stevens, MD; Frances Nowlen, BS; Michael A. Roarke, BS; Samuel Barber, MD
Marine Prevost, AuD; Jaysen Moreno, AuD; Nancy Flores, AuD

Objectives: Compare practice composition, referral patterns, surgical conversion rates, and causes of failed conversion for non-traditional CI candidates (nonTradCI) vs. traditional CI candidates (TradCI).

Study Design: Prospective cohort study. Longitudinally captured every CI encounter at our institution from 2021-July 2025 (program inauguration-endpoint).

Setting: Single tertiary care center.

Patients: Adult patients (>18yrs) pursuing TradCI or nonTradCI. NonTradCI defined as asymmetric hearing loss (AHL) or single side deafness (SSD). AHL criteria: PTA4 >60dB HL and aided CNC <50% in implanted ear; PTA4 30-60dB and word score 50-80% in better ear. Established SSD criteria.

Interventions: Candidacy workup, surgical referrals, CI surgery.

Main Outcome Measures: Demographics, referral patterns, surgical conversion rates, conversion failures.

Results: 709/731 patients/ears were evaluated for CI. Breakdown by indication was: 7.3%SSD (52 patients/ears), 30.7%AHL (218 patients/ears), and 62.0%TradCI (416/439 patients/ears). The relative distribution of nonTradCI vs. TradCI remained constant from 2021-2025. SSD patients were significantly younger (mean 53.5+/-16.5 yr) than AHL (69.1+/-15.5 yr, $p<0.0001$) and TradCI (62.7+/- 22.5 yr; $p=0.0005$). NonTradCI were less likely to be referred by an outside group than TradCI (22%vs34.4%; $p=0.0004$). Further, SSD patients were the least likely to be referred [6/52 (11.5%)], compared to AHL [53/218 (24.3%); $p=0.04$] and Trad CI [143/416 (34.4%); $p=0.0009$]. Overall, 589 patients have reached a conversion endpoint (70.9% surgery). The surgical conversion rate was significantly higher for TradCI vs nonTradCI (76%v62%; $p<0.0003$). Conversion rates improved from 2021-23 (42-52%) to 2024-25 (75%) in NonTradCI candidates. Assessing conversion failures, the most common causes among nonTradCI were: loss to followup, candidate choice to not continue, and insurance denial.

Conclusions: NonTradCI indications comprise roughly a third of our adult CI practice. Surgical conversion and referral rates were lower for nonTradCI candidates. This trend may be improving.

Learning Objective: Describe the impact of nonTradCI indications on practice makeup and referral patterns.

Desired Result: Increase awareness of non-traditional CI indications and their expanding impact on surgical practices.

Level of Evidence - III

Indicate IRB or IACUC: PHXU-24-500-074-73-12. St. Joseph's Dignity Health

Iatrogenic Third Window Syndrome following Retrosigmoid Trigeminal Microvascular Decompression in a Patient with Malformed Vestibular Aqueduct

Simon D. Beatty, MD; John I. Lane, MD; Nicholas L. Deep, MD

Objective: To report the first documented case of iatrogenic induced third window syndrome in a patient with a malformed vestibular aqueduct following trigeminal nerve microvascular decompression (MVD) managed successfully with surgery.

Study Design: Case Report

Setting: Single Tertiary Center

Patients: 34-year-old female underwent retrosigmoid MVD for trigeminal neuralgia. Immediately postoperatively, she developed autophony for voice, eyes, footsteps, pulsatile tinnitus, and Tulio phenomenon. Otoscopy was normal. Post-MVD audiogram demonstrated ipsilateral low frequency conductive hearing loss with a suprathreshold bone conduction and intact acoustic reflexes. Cervical VEMP testing showed lowered threshold on the effected side. Temporal bone CT demonstrated normal superior canals without dehiscence but revealed a malformed vestibular aqueduct with two apparent openings intracranially caused by hyperostosis of the posterior petrous bone. Notably, on review of the operative note from her MVD surgery, the neurosurgeon commented that the left cerebellar hemisphere was unusually adherent to the petrous dura requiring significant dissection to release it.

Interventions: Transmastoid ligation of the endolymphatic duct and sac and obliteration of the mastoid with bone cement.

Main Outcome Measures: Resolution of third window symptoms

Results: Patient reported immediate resolution of third window symptoms after surgery, with preservation of normal hearing thresholds.

Conclusions: In a patient with a malformed vestibular aqueduct, microdissection around the endolymphatic sac during retrosigmoid MVD likely unmasked a previously auto-occluded cochlear third window fistula. This resulted in acute onset of third window symptoms postoperatively. Surgical ligation of the endolymphatic duct and sac with mastoid obliteration successfully resolved her symptoms.

Learning Objective: Recognize how vestibular aqueduct malformations can contribute to third window physiology.

Desired Result: To increase awareness that malformed vestibular aqueducts, including enlarged vestibular aqueduct, may present with third window symptoms. Preoperative imaging review can help identify at-risk patients. Surgical obliteration of the endolymphatic duct and sac with mastoid cavity closure is an effective management strategy in select cases.

Level of Evidence - Level V

Indicate IRB or IACUC: Exempt

National Trends in Bone Conduction Hearing Implants in the Last 10 Years

Christopher Z. Wen, MD; Rishi Katragadda, BS; Emily Chow, MD; Daniel Karasik, MD
Audrey Lawrence, BS; Marcelina Puc, MS; Adam C. Kaufman, MD, PhD

Objective: To describe national trends in patients receiving bone conduction hearing implants (BCHI)

Study Design: Retrospective cohort study

Setting: US institutions participating in the Epic Cosmos database

Patients: Adult and pediatric patients undergoing BCHI placement between January 2015 and December 2024

Main Outcome Measures: Sociodemographic factors, device type, and changes in implantation rate over time

Results: 10,767 patients received percutaneous BCHI (p-BCHI) placement and 1,506 received transcutaneous BCHI (t-BCHI). p-BCHI rates fell sharply in 2020 during the COVID pandemic, and after a brief recovery declined from 1.36 to 0.94 per 100,000 between 2021 and 2024. Since device-specific coding began**,** t-BCHI doubled from 0.29 to 0.59 per 100,000. By 2024, the t-BCHI rise outpaced the reduction in p-BCHI since 2021, supporting partial substitution rather than persistent volume loss. Substitution was uneven; t-BCHI uptake was higher in pediatric vs adult patients (0.74 vs 0.59 per 100,000) and rural vs urban residents (0.98 vs 0.53), and lower in Black vs White patients (0.20 vs 0.73). Recipient-level models showed higher odds of t-BCHI for pediatric (OR 1.26, 95% CI 1.12–1.42; $p<0.0001$) and rural patients (OR 1.26, 95% CI 1.11–1.43; $p<0.001$); sex, race, and ethnicity did not differ by device type among recipients, consistent with access-driven gaps. Compared with p-BCHI, t-BCHI had lower odds of replacement (OR 0.69, 95% CI 0.55–0.86; $p<0.001$) but higher odds of removal/explantation (OR 3.94, 95% CI 3.03–5.11; $p<0.0001$).

Conclusions: U.S. practice is shifting from p-BCHI to t-BCHI. Growth in t-BCHI likely explains a substantial share of the recent p-BCHI decline, but substitution is inequitable—faster in pediatric and rural populations and slower among Black patients—highlighting targets for equitable diffusion.

Learning Objective: To describe the disparities that exist for patients receiving bone conduction hearing implants.

Desired Result: Greater understanding of the healthcare disparities that exist for patients receiving a bone conduction hearing implant and how recent events have impacted who receives these interventions.

Level of Evidence - IV

Indicate IRB or IACUC: Exempt

Identifying Geographic Regions with the Lowest Cochlear Implant Incidence: Where to Direct Outreach Resources

Ashley M. Nassiri, MD, MBA; Theresa B. Hennesy, MD; Matthew L. Carlson, MD, MBA
Bridget Mosley, MPH; Liza Creel, PhD; Vinaya Manchaiah, AuD, PhD

Objectives: In an effort to focus outreach and to direct programmatic changes to effectively reach at-risk patient populations, this study examines zip-code level data to determine the effect size of various patient factors in cochlear implant (CI) incidence across regions in the U.S.

Study Design: Deidentified CI data were acquired from prospectively collected patient registries from two CI manufacturers (Cochlear Americas and Advanced Bionics), which supply an estimated 85% of CIs in the U.S.

Setting: U.S. CI centers.

Patients: Adults ≥20 years old who underwent CI between 2015 and 2023.

Interventions: Cochlear implantation.

Main Outcome Measures: Percentages of White population, poverty, and higher education; Rural Urban Commuting Areas (RUCA) categorization.

Results: The study cohort included 69,947 adults ≥20 years old who underwent CI between 2015 and 2023. CI candidates residing in zip codes with the lowest percentage of White residents (<66% of the population), highest poverty rates (>17% of the population), and lowest rates of associate degrees (<24% of the population) were at higher risk for untreated CI candidates ($p<0.0001$ for all). Metropolitan areas had lower CI incidence compared to rural zip codes (334 vs. 390 per 100,000 person-years, respectively, $p<0.0001$). Multivariate analysis identified non-White race as an independent factor associated with a 34% increased risk of untreated CI candidates (relative risk 1.34, $p<0.0001$). Living in a high poverty or metropolitan zip code presented 15% and 7% increased risks, respectively ($p<0.0001$).

Conclusions: Metropolitan zip codes with the highest rates of non-White populations have the lowest incidence of CI. This study identifies the most at-risk geographic locations for low CI incidence and can guide resources more effectively to reach the greatest number of CI candidates.

Learning Objectives:

- Describe the patient factors that affect risk of untreated hearing loss.
- Understand the effect of urban-rural determination on incidence of CI.
- Appreciate that non-White race has the highest relative risk of untreated hearing loss when compared with poverty rate, higher education rate, and urban-rural determination.

Desired Result: Physicians, audiologists, and researchers would better understand geographic factors influencing incidence of CI and thus adapt more efficient strategies for increasing access to CI.

Level of Evidence: III

Indicate IRB or IACUC: Exempt

Understanding Facial Nerve Recovery in Skull Base Osteomyelitis: The Role of Severity and Surgical Treatment

Hetal Lad, BS; Lucy Revercomb, BS; Emma Thompson, BA; Joseph Chong, BS
Devanshi Patel, MD; Michael Ray Moentmann, MD; Yu-lan Mary Ying, MD

Objective: Skull base osteomyelitis (SBO) is a rare, aggressive complication of malignant otitis externa. Facial nerve paralysis is considered to be a marker of advanced disease and portends poor prognosis. However, it is uncertain how severity of facial nerve paralysis at presentation and surgical interventions for SBO influence recovery of facial nerve function.

Methods: Retrospective chart review.

Setting: Tertiary academic healthcare system.

Patients: Patients treated for SBO at Rutgers Health between 2011 and 2025.

Intervention: Mastoidectomy with pressure-equalization tube placement for intraoperative tissue culture.

Main Outcome Measure: Facial nerve paralysis was graded using the House-Brackmann (HB) scale and categorized as mild (HB1-II) or severe (HB ≥ III). Recovery was defined as improvement by at least one HB grade or complete resolution on a subsequent visit. Analyses were conducted in R, significance at $p<0.05$.
Results: Among 48 patients with confirmed SBO, 19 (38.8%) presented with facial nerve palsy. 13 patients had severe paralysis while 4 had mild paralysis, 2 were ungraded. Over a median follow up of 255.7 days, 35.3% (6/17) demonstrated partial recovery. 30.8 % (4/13) recovered from severe facial nerve palsy while 50% (2/4) recovered from mild facial nerve palsy ($p=0.58$). 57.9% (11/19) of patients with facial nerve paralysis underwent surgical intervention, 90% of whom demonstrated severe facial nerve palsy. 57.1% of patients who did not undergo surgical intervention demonstrated severe facial nerve palsy. 30% (3/10) of patients that underwent surgery demonstrated recovery of facial nerve function compared with 42.9% (3/7) of patients without surgical management ($p=0.64$).

Conclusions: Facial nerve palsy occurs frequently in patients with SBO, with a majority having severe paralysis if any deficit is present. Surgical intervention does not significantly impact recovery.
Learning Objective: To understand the impact of severity of facial nerve paralysis and surgical management on the recovery of facial nerve function in patients with skull base osteomyelitis.

Desired Result: Clinicians will recognize the importance of evaluating facial nerve function throughout SBO management and benefits of early identification.

Level of Evidence - III

Indicate IRB or IACUC: Rutgers University Pro2024002225

Assessing the Effectiveness of an Artificial Intelligence Language Model in Improving Patient Counseling in Otolaryngology Surgery

Ha Eun Kim, BS; Alex W. Yang, MD; Gregory S. Hill, MD
David Holovac, BS; Jason Peart, BS; Charles A. Riley, MD; Anthony M. Tolisano, MD

Objective: To assess whether integrating a large language model (ChatGPT) into pre-operative counseling improves patient understanding, satisfaction, and communication in otolaryngology surgery, and to examine how pre-operative preparedness relates to post-operative satisfaction and engagement.

Study Design: Prospective randomized controlled trial.

Setting: Tertiary military academic center.

Patients: 31 adults scheduled for otolaryngology surgery.

Interventions: After standard counseling, intervention arm participants interacted with ChatGPT to ask additional surgery-related questions. Both groups completed pre- and post-operative surveys using a 5-point Likert scale.

Main Outcome Measures: Pre-operative satisfaction and confidence metrics (Q1-Q8), post-operative satisfaction measures (Q1.1-3.1), correlation between pre- and post-op understanding and confidence metrics between the control and intervention groups. Counseling duration, ChatGPT interaction time, and number of questions asked.

Results: The average physician encounter lasted 10.9 minutes in the intervention group and 10.7 minutes in the control group. ChatGPT interactions averaged 6.2 minutes with 4.5 questions per patient. Pre-operative confidence, preparedness, and communication ratings (Q1, Q2, Q6, Q7) were strongly correlated ($p < 0.05$), confirming internal consistency of the counseling measures. Pre- and post-operative composite satisfaction scores did not differ between groups ($p > 0.10$), but the control group showed greater understanding of surgical risks ($p = 0.012$) and satisfaction in communication ($p = 0.034$). Patients whose questions were fully answered pre-operatively reported significantly higher post-operative satisfaction in both groups ($p < 0.05$).

Conclusions: Both groups demonstrated that thorough pre-operative communication and resolution of patient questions were key predictors of post-operative satisfaction. ChatGPT integration did not improve overall post-op satisfaction.

Learning Objective: To understand how a conversational AI model (ChatGPT) influences pre-operative communication, patient confidence and satisfaction in otolaryngology surgical settings.

Desired Result: To guide structured deployment of AI-assisted counseling as a complement to physician communication, emphasizing its use for question clarification and expectation management.

Level of Evidence: Level II

Indicate IRB or IACUC: Walter Reed National Military Medical Center IRB was obtained WRNMMC-2023-0423 (approval date 07/31/2024).

The Interaction between Cognition and Balance Differs by Clinical Diagnosis

Anat Lubetzky, PT, PhD; Maura Cosetti, MD (presenter); Carly Feist BA
Brittani Morris, DPT; Jen Kelly, DPT

Objective: Cognitive decline is known to be associated with balance dysfunction however, since both balance and cognition are multidimensional, this relationship is not straightforward. We investigated the relationship between cognition function and measures of balance among three clinical groups: unilateral vestibular hypofunction (UVH), unilateral hearing loss (UHL) and definite Meniere's Disease (MD.)

Study Design: cross-sectional

Setting: outpatient academic center

Patients: 30 patients (10 UVH, 10 UHL, 10 MD) completed a computerized neurocognitive battery and tests of balance function.

Interventions: We evaluated the Pearson's correlations between balance measures and cognitive performance.

Main Outcome Measures: Static balance: Duration standing on foam with eyes closed (seconds, longer is better), Dynamic balance: gait speed (m/s, higher is better), Self-reported: Activities-Specific Balance Confidence Scale (%, higher is better). Cognitive Domains: age-adjusted standardized scores (higher is better): Cognitive flexibility, composite memory, executive function, reaction time, sustained attention, verbal, visual and working memory.

Results: Unique patterns emerged per group. MD: Patients with better static balance (longer hold) showed better cognitive flexibility (R=0.51) and executive function (R=0.49). Faster walking was associated with better sustained attention (R=0.5) and verbal memory (R=0.6). Higher ABC (balance confidence) was correlated with better composite memory (R=0.63), sustained attention (R=0.6) and verbal memory (R=0.74). UHL: Better static balance showed better sustained attention (R=0.6); Higher balance confidence was associated with better composite memory (R=0.61), sustained attention (R=0.44), verbal memory (R=0.62), visual memory (R=0.56) and working memory (R=0.43). Vestibular: no correlations were observed. When the 3 groups were combined, no correlations above 0.2 were observed between cognitive domains and balance function.

Conclusions: The relationship between balance performance and cognition is nuanced and may be disease-specific. Balance function in isolated vestibular loss appears independent of domain-specific cognitive performance.

Learning Objective: Participants will explain the relationship between various domains of neurocognitive function (e.g., executive function, reaction time) and balance function.

Desired Result: Increased understanding and appreciation for the complex relationship between cognitive performance and balance function in patients with unilateral vestibular hypofunction (UVH), unilateral hearing loss (UHL) and definite Meniere's Disease (MD.)

Level of Evidence – IV

Indicate IRB or IACUC: STUDY-21-01026, Mount Sinai

What Factors Matter in Approach Selection for CSF Leak Repair? A Cohort Analysis of Safety and Efficacy

Zheng Hong Tan, PhD; Vivienne E. Pham, BS; Ada Sher, MD; Oliver F. Adunka, MD, MBA
Desi P. Schoo, MD; Robert J. Macielak, MD; Yin Ren, MD, PhD

Objective: To assess the factors influencing the surgical approach for the repair of lateral skull base cerebrospinal fluid (CSF) leak and its subsequent outcomes.

Study Design: Retrospective case series.

Setting: Academic tertiary referral center.

Patients: Patients with a lateral skull base CSF leak who underwent repair via an either transmastoid or MCF approach between January 2017 and August 2024.

Interventions: CSF leak repair via either a transmastoid or MCF approach.

Main Outcome Measures: Persistent leakage (defined as continued CSF leak within 3 months of surgery), long-term recurrence (defined as a new leak > 3 months after surgery).

Results: Sixty-six patients were identified, of which 21 (32%) underwent a transmastoid repair and 45 (68%) underwent a MCF approach. The average age at surgery for the transmastoid cohort was 59.6 years (Standard Deviation [SD]±14.5) while average for the MCF cohort was 58.4 years (SD±12.1). There were no associations between surgical approach and age (p=0.728), sex (p=0.956), race (p=0.382), prior skull base surgery (p=0.967), pre-operative hearing loss (p=0.215), or the number of tegmen defects (p=0.061). In the transmastoid cohorts, there were 10 patients (48%) with tegmen tympani defects and 10 patients (48%) with tegmen mastoideum defects and 1 patient (5%) with defects in both locations. For the MCF approach, there were 5 patients (11%) with tegmen tympani defects, 29 patients (64%) with tegmen mastoideum defects, and 11 patients (24%) with defects in both locations. This resulted in a significant difference in dehiscence location between the transmastoid and MCF cohorts (p=0.0052). There were no immediate post-operative complications in either cohort. No patients in the transmastoid cohort had persistent leakage compared to 2 patients (4.4%) in the MCF cohort (p>0.999). The average length of hospital stay for the transmastoid cohort was 1.28 days (SD±1.3) compared to 3.06 days (SD±2.12) for the MCF cohort (p<0.0001). There was not a significant difference in long-term CSF leak recurrence rate, with 3 patients (14.2%) in the transmastoid cohort having recurrence compared to 2 patients (4.4%) in the MCF cohort (p=0.159).

Conclusions: Despite standard preconceptions, there were no demographic, efficacy, or safety differences between the two approaches to temporal bone CSF leak repair, showing clinical success no matter the scenario. Rather than patient demographics, these data suggest that leak location and provider experience are better decision-points regarding approach selection.

Learning Objective: To identify the prevalence of demographic, efficacy, and safety differences between different approaches to CSF leak repair

Desired Result Providers will be educated on the viability of the MCF approach on older patients and appreciate the role of the defect location on approach selection, improving clinical decision making and patient counseling.

Level of Evidence - Level IV

Indicate IRB or IACUC: The Ohio State University IRB #2024H0277

Comparison of Audiometric Outcomes Between Different Surgical Approaches Following Lateral Skull Base Repair of Cerebrospinal Fluid Leaks

Dhillon R. Advano, BS; Antara Gupta, BS; Ritu R. Trivedi, BA
J. Walter Kutz Jr., MD; Rance J.T. Fujiwara, MD, MBA

Objective: To investigate the differences between audiometric outcomes following lateral skull base repair of cerebrospinal fluid (CSF) leaks using a transmastoid, middle fossa craniotomy, or combined approach.

Study Design: Retrospective review

Setting: Single-institution tertiary care center

Patients: 183 adult patients who underwent 202 lateral skull base repairs for CSF leaks between May 2013 and June 2024 were included. 66 (36%) patients were male, and the median age was 59 years [IQR: 50-68].

Interventions: CSF leak repairs via transmastoid and/or middle fossa craniotomy

Main Outcome Measures: Audiologic data included pure tone average (PTA), air-bone gap (ABG), mean air conduction, word recognition score (WRS), and tympanogram type.

Results: 183 patients underwent 202 lateral skull base repairs via transmastoid (n = 52), middle fossa craniotomy (n = 98), or combined approach (n = 52) for spontaneous CSF leaks (n =161), traumatic CSF leaks (n = 7), or iatrogenic CSF leaks (n = 15). Postoperatively, PTA increased by 1.67 dB (p = 0.007) and mean ABG decreased by 3.33 dB (p = 0.028) when compared to their pre-operative values. There was no significant change in median WRS postoperatively. Tympanogram distributions shifted postoperatively with Type A increasing from 24% to 45%, Type B decreasing from 64% to 42%, and Type C increasing from 12% to 13%. There were no significant differences in ABG, PTA, and WRS between different operative approaches.

Conclusions: Postoperatively, patients who underwent lateral skull base repair for CSF leaks had improved hearing with no differences in outcomes between three surgical approaches: transmastoid, middle fossa craniotomy, or combined approaches.

Learning Objective: To learn about the audiometric implications of using different surgical approaches to a lateral skull base CSF leak repair

Desired Result: To guide decision-making for clinicians when choosing the type of approach for lateral skull base CSF leak repair

Level of Evidence - Level IV

Indicate IRB or IACUC: University of Texas Southwestern Institutional Review Board; STU-2024-0631

Migraine History is a Risk Factor for Revision Surgery after Lateral Skull Base Cerebrospinal Fluid Leak Repair.

Antara Gupta, BSA; Dhillon R. Advano, BS; Ritu R. Trivedi, BA
J. Walter Kutz Jr, MD; Rance J.T. Fujiwara, MD, MBA

Objective: To identify the risk factors for revision surgeries after lateral skull base cerebrospinal fluid (CSF) leak repair

Study Design: Retrospective review

Setting: Single-institution tertiary care center

Patients: 183 adult patients who underwent lateral skull base CSF leak repair between May 2013 and June 2024 were included. 66 (36%) patients were male, and median age was 59 years [IQR: 50-68].

Interventions: CSF leak repair via transmastoid and/or middle fossa craniotomy

Main Outcome Measures: Incidence of revision surgery following primary repair

Results: Among 183 patients who had lateral skull base cerebrospinal fluid (CSF) leak repair, 50 (27%) underwent a transmastoid approach, 93 (51%) underwent middle fossa craniotomy, and 40 (22%) underwent a combined approach. Revision surgery was required in 21 patients (12%). A history of migraines was present in 43 of the 183 patients (24%), of whom 10 (23%) required revision surgery. 48% of patients who underwent revision had a history of migraines. On multivariate binary logistic regression analysis, a history of migraines was a significant predictor of revision surgery (OR=3.67, 95% CI [1.15, 12.0]; p=0.028). A combined surgical approach was also associated with increased risk of revision surgery (OR=7.16, 95% CI [1.31, 60.7]; p=0.037). We found no significant association between revision surgery risk and patient demographics, comorbidities (including diabetes, hypertension, hyperlipidemia, obstructive sleep apnea, idiopathic intracranial hypertension), history of meningitis, or history of prior surgery or leak etiology.

Conclusions: Patients with a history of migraines are at increased risk of revision surgery after lateral skull base CSF leak repairs.

Learning Objective: To learn about common factors identified in patients who undergo revision surgeries after lateral skull base CSF leak repairs

Desired Result: To inform clinician decision making when counseling operative candidates for lateral skull base CSF leak repairs

Level of Evidence - Level IV

Indicate IRB or IACUC: University of Texas Southwestern Institutional Review Board; STU-2024-0631

Pre-operative Facial Nerve Tractography of Vestibular Schwannomas: A Systematic Review of the Impact of Acquisition Schemes and Analysis Pipelines

Yunjia Ni, MD; Shawn M. Stevens, MD; Anthony M. Asher, MD; Randall W. Porter, MD
Kaith K. Almefty, MD; Michael T. Lawton, MD; Richard D. Dortch, PhD

Objective: Evaluate how diffusion-MRI (dMRI) acquisition and processing choices influence the accuracy and clinical utility of pre-operative CN VII tractography in vestibular schwannoma (VS), especially in large VS (i.e., Koos Grade III/IV). Literature often cites ≥87% "success rate" of tractography, yet in reality its role falls short of standard of care, motivating a neuroimaging methodology-focused re-appraisal.

Study Design: Systematic review of PubMed articles (1990–2024) per PRISMA 2020; risk of bias assessed with QUADAS-2 (patient selection, index test, reference standard, flow/timing) by two independent reviewers; no meta-analysis due to heterogeneity.

Setting: Not applicable.

Patients: Adults with sporadic VS undergoing microsurgical resection; *in-vivo* MRI; sample size ≥5; intra-operative validation required. Excluded: non-English articles, review articles, NF-2.

Interventions: Pre-operative dMRI tractography of CN VII with intra-operative stimulation/visual confirmation as reference.

Main Outcome Measures: Primary outcome was concordance rate between pre-op CN VII tractography and intra-operative localization. Secondary outcomes are: sensitivity, PPV, and false discovery rate (FDR) derived from TP/FP/FN; optionally the rate of CN VII shape agreement and CN VIII visualization where reported.

Results: Twenty-two studies met inclusion/exclusion criteria. Protocols varied widely across field strength, acquisition, preprocessing, signal modeling, tracking algorithms, validation methods, and reporting, precluding robust quantitative synthesis. QUADAS-2 flagged high bias across studies.

Conclusions: The practical reliability and repeatability of CN VII tractography in VS remain undetermined. Standardized reporting using sensitivity/PPV/FDR is recommended, alongside prospective work to optimize acquisition, preprocessing, modeling, tracking, and validation.

Learning Objective: Recognize how acquisition-to-validation choices impact CN VII tractography reliability and apply standardized metrics when interpreting or designing protocols.

Desired Result: Improve reporting consistency, enable realistic patient counseling, and inform protocol optimization for safer skull-base surgery.

Level of Evidence – III.

Indicate IRB or IACUC: Exempt.

Motion Sickness Susceptibility and Stroop Performance Predict Mal de Débarquement Syndrome (MdDS) Risk: A Machine Learning Approach

Jae Joon Kim, BS; Hudson Liu, BS; Kiersten R. Russ, BS; Charlotte K. Hughes, MD, MPH
Jong Bin Lee, MD, PhD; Michael J. Eliason, MD; Akihiro J. Matsuoka, MD, DMSc, PhD

Objective: To identify predictive factors for Mal de Débarquement Syndrome (MdDS) risk using machine learning approaches and develop a risk stratification model for individuals susceptible to persistent phantom motion sensations following prolonged travel.

Study Design: Predictive modeling study using logistic regression and random forest machine learning algorithms.

Setting: USNS Mercy (T-AH 19) during its Pacific Partnership 2024 deployment across the Indo-Pacific region

Patients: 38 Active-Duty U.S. Navy personnel

Interventions: Assessment of motion exposure history, motion sickness susceptibility (Simulator Sickness Questionnaire, SSQ), and cognitive performance testing (Stroop test and Symbol Digit Modalities Test, SDMT).

Main Outcome Measures: MdDS criteria score (0-5); participants scoring ≥4 were classified as high-risk for MdDS.

Results: Motion sickness susceptibility (SSQ scores) and Stroop test performance emerged as the strongest predictors of MdDS tendency in both models. Higher SSQ scores and poorer Stroop performance significantly increased odds of MdDS score ≥4. Greater motion exposure showed modest association with increased risk. SDMT and other cognitive metrics demonstrated minimal predictive value.

Conclusions: Machine learning–driven modeling indicates that high motion sickness susceptibility and reduced cognitive flexibility are strongly linked to MdDS symptom development. These findings offer insight into risk stratification, enabling targeted screening and preventive strategies for individuals susceptible to MdDS.

Learning Objective: To understand risk factors for MdDS development; to recognize the role of motion sickness susceptibility and cognitive flexibility in vestibular disorder onset; to apply machine learning techniques in clinical risk prediction

Desired Result: Development of a validated screening tool for early identification of individuals at high risk for MdDS to enable preventive interventions

Level of Evidence - III

Indicate IRB or IACUC: UC San Diego IRB (#810413); Naval Medical Center San Diego IRB (#NMCSD.2023.0033)

Audiometric Outcomes Following Surgical Repair of Temporal Bone Cerebrospinal Fluid Leaks with and without Ossicular Chain Reconstruction

Savannah Nicks, DO; Gabriele Noreikaite, DO; Rebekkah Lee, DO
Bora Agabigum, MD; Robert Conway, DO; Seilesh Babu, MD

Objective*:* To identify if there is a difference in audiometric outcomes between patients who underwent lateral temporal bone resection via the following approaches: transmastoid, transmastoid with ossicular chain reconstruction, and middle cranial fossa.

Study Design*:* Retrospective Chart Review

Setting: Tertiary Care Institute

Patients: Patients from 2009 to 2024 that underwent a lateral temporal bone CSF leak repair at a tertiary institute

Interventions: Intervention was based on approach at time of surgery: transmastoid without ossicular chain reconstruction (TM without OCR), transmastoid with ossicular chain reconstruction (TM with OCR), and middle cranial fossa (MCF).

Main Outcome Measures: Post-operative audiogram testing (i.e. pure tone average (PTA), word recognition score (WRS), or air bone gap (ABG).

Results: A total of 72 patients (n = 72) were included. There were 46 patients with TM approach without OCR, 15 with TM approach with OCR, and 11 with MCF approach. There was a -2.6 dB change in PTA for TM approach without OCR, there was a -2.3 dB change for TM with OCR, and a -4.8 dB change for MCF approach. There was little change in WRS or ABG across groups.

Conclusions: In summary, hearing outcomes were similar across all groups regardless of approach or OCR at time of transmastoid approach.

Learning Objective: To determine if surgical approach or OCR at time of surgery changes hearing outcomes in patients after repair of lateral temporal bone CSF leak repair

Desired Result: To determine is surgeon choice of approach for repair or choice to perform OCR at time of surgery changes patient hearing outcomes

Level of Evidence: *Level V*

Indicate IRB or IACUC: *Exempt*

Degree of Hearing Loss is Associated with Subjective Tinnitus Severity

Grace A. Anania, BS; Elizbeth A. Bader, BS, MSc; Elizabeth A. Dinces, MD, MS; Howard S. Moskowitz, MD, PhD; Sarah Bracker, PA; Rachel F. Held, PhD; Joshua J. Sturm, MD, PhD

Objective: To explore the relationship between degree of hearing loss and subjective tinnitus severity.

Study Design: Survey study and retrospective chart review.

Setting: Academic medical center.

Patients: 24 adult patients (>18 years old) with chronic (>3 months) subjective tinnitus.

Interventions: Questionnaires collected included the Tinnitus Handicap Inventory (THI) and the Tinnitus Functional Index (TFI). Hearing loss was quantified with pure tone audiometry.

Main Outcome Measures: Correlation coefficients between subjective tinnitus severity (THI, TFI) and pure tone averages (PTA) calculated for the right and left ears across 500Hz to 4000Hz. Correlation analyses were performed separately for PTA in the ear experiencing the most significant tinnitus (PTA-tin) and PTA in the contralateral ear (PTA-contra).

Results: Positive correlations were found between both TFI and THI scores and PTA in the ear experiencing the most significant tinnitus (TFI x PTA-tin; r= 0.47, p= 0.03, 95% CI: 0.07 to 0.74, THI x PTA-tin; r= 0.49, p= 0.02, 95% CI: 0.11 to 0.75). No significant correlations were found between THI/TFI scores and PTA in the contralateral ear (TFI x PTA-contra; p=0.22, TFI x PTA-contra; p= 0.31). A subscale analysis of the THI questionnaire subdomains revealed that PTA-tin was more strongly correlated with *Functional* domain scores (r= 0.54, p= 0.007, 95% CI: 0.17 to 0.77) than *Emotional* (r= 0.47, p= 0.02, 95% CI: 0.08 to 0.74) or *Catastrophic* (r= 0.17, p= 0.42, 95% CI: -0.25 to 0.54) scores.

Conclusions: Higher levels of tinnitus handicap were associated with higher degrees of hearing loss in the ear most affected by tinnitus. This was particularly the case for tinnitus handicap in the functional domain, which relates to areas of mental, social and physical functioning.

Professional Practice Gap & Educational Need: Degree of hearing loss may be an underappreciated contributor to subjective tinnitus severity, thereby supporting the dual utility of amplification in managing hearing loss and tinnitus.

Learning Objective: To explore the relationship between subjective tinnitus distress and degree of hearing loss.

Desired Result: To improve physician knowledge of the interplay between hearing impairment and tinnitus handicap.

Level of Evidence - III

Indicate IRB or IACUC: This study is IRB approved under protocol 2025-16851 at Montefiore Einstein

Predictive Value of Intraoperative Electromyography Parameters for Postoperative Facial Nerve Function: A Systematic Review

Sonaal Verma, BS; Sriprachodaya Gaddam, BS; Paritosh Coomar, BS
Zachary Schwam, MD; George Wanna, MD; Enrique Perez, MD

Objective: To identify intraoperative electromyography (EMG) parameters most frequently associated with postoperative facial nerve outcomes in otologic and skull base surgeries

Study Design: Systematic review.

Setting: Systematic review of studies indexed in PubMed, Web of Science, and Embase from 2000 through 2025.

Patients: Not applicable (systematic review).

Interventions: Not applicable (systematic review).

Main Outcome Measures: Intraoperative EMG parameters associated with or predictive of postoperative facial nerve function.

Results: Forty studies met inclusion criteria. Thirty-nine focused on skull base procedures, and one addressed middle ear surgery. The House-Brackmann scale was the most used outcome measure. Stimulation threshold was the parameter most frequently reported and correlated with post-op facial nerve outcomes (n = 32), followed by free-run train time (n = 13) and amplitude ratio (n = 12). Medtronic NIM was the most used device. All studies were rated as low risk of bias.

Conclusions: Stimulation threshold and free-run EMG train time were the parameters most frequently associated with postoperative facial nerve outcomes. However, wide variability in intraoperative EMG techniques limits standardization and cross-study comparison. The single middle ear study underscores a gap in understanding EMG use in this surgical context. Given that Medtronic NIM was the most frequently reported system, and concerns have been raised by the AAO-HNS regarding its reliability, future studies should assess device validity. Future investigations should aim to establish standardized EMG protocols, expand research in middle ear surgery, and compare monitoring systems to optimize clinical utility.

Professional Practice Gap & Educational Need: There is a lack of standardized intraoperative EMG practices and techniques, underrepresentation in the literature of facial nerve EMG monitoring in middle ear surgery, and limited comparative data on facial nerve monitoring systems.

Learning Objective: Describe the EMG parameters most associated with facial nerve outcomes, recognize the limited data in middle ear surgeries, and understand the need for validation of facial nerve monitoring systems.

Desired Result: To improve clinical decision making by encouraging standardized EMG practices, expanding investigation of facial nerve monitoring in middle ear surgery, and studying the validity of monitoring systems.

Level of Evidence: Level V

Indicate IRB or IACUC: Exempt

From Residency to Fellowship: Gender and Race in Neurotology Fellowship Compared with Otolaryngology Residency

Jazlyn A. Selvasingh, BA; Taral K. Jella, BA; Tara P. Menon, BS; Grace M. Hambelton, BA
Theodore Huang, MS; Justin R. Shinn, MD; Eric R. Oliver, MD

Objective: Quantify gender and race trends in neurotology fellowships, using otolaryngology residency as a benchmark.

Study Design: Retrospective, cross-sectional study.

Setting: Accreditation Council for Graduate Medical Education (ACGME) trainee counts across academic years 2011-2012 to 2023-2024 for race and 2007-2008 to 2023-2024 for gender.

Participants: All Neurotology and Otolaryngology trainees reported to ACGME.

Interventions: None.

Main Outcome Measures: Annual proportions by gender and race (White; Asian/Pacific Islander; Hispanic; African American; American Indian/Alaska Native; Unknown/Other). Race trends tested with Cochran–Armitage; gender compared between 2007–2008 and 2023–2024 by χ^2.

Results: Among neurotology fellows, female representation increased from 13.0% to 41.0% (χ^2=5.33, p=0.021), and a significant increase in Hispanic fellows was observed (p=0.026); changes in White, Asian/Pacific Islander, African American, and American Indian/Alaska Native were not significant (p>0.05). For comparison, otolaryngology residency showed broader diversification: females rose from 27.8% to 44.3% (χ^2=89.5, p<0.001) and proportions of Asian/Pacific Islander, Hispanic, and African American trainees increased (all p<0.001), with a small decrease in American Indian/Alaska Native (p<0.01).

Conclusions: Neurotology fellowships demonstrate meaningful gains in female representation, but more limited race shifts relative to otolaryngology residency. Because fellowships feed the future academic and leadership pipeline, stagnation at the subspecialty stage may blunt upstream residency gains. Focused outreach, mentorship, and holistic selection in neurotology could help align fellowship demographics with the evolving resident pool.

Learning Objective: Identify where diversity gains are and are not occurring within neurotology and interpret simple trend and comparison tests to guide program strategy.

Desired Result: Provide actionable data for the Neurotology Society to inform recruitment and mentorship.

Level of Evidence: Level IV.

Indicate IRB or IACUC: Exempt

Barriers to Increasing Cochlear Implant Surgical Volume – A Survey-Based Study

Mana Espahbodi, MD; Rebecca Rosenzweig, BS; Terry Zwolan, AuD; Weston Adkins, AuD
Karl Doerfer, MD; Richard Gurgel, MD, MSCI; Maura Cosetti, MD

Objective: This study surveyed surgeons regarding cochlear implant (CI) surgical volume to determine factors that impact CI surgical caseload in order to identify barriers that may be impacting access to care.

Study Design: The survey included demographic questions (i.e. age, years in practice, etc.), number of CI surgeries performed the past year, factors that impact CI surgery caseload, surgical confidence, if they train residents and fellows, and patient wait times for CI surgery.

Setting: The survey was emailed to 1500 physicians using a manufacturer "opt-in" email list and was posted on social media networks. It was open for completion from August 23 – October 3, 2025.

Patients: N/A

Interventions: Participation in the IRB-approved survey was voluntary.

Main Outcome Measures: Responses provided by participants about their CI practice.

Results: 228 attending physicians completed the survey. Most report that they perform CI surgeries (96%, 204/212) and most (47%, 108/228) perform 10–25 CIs each month. The average number of CIs per month per surgeon is 3.6 with adults accounting for 81%. 47% (107/228) indicate they would like to perform more CIs, with the greatest limiter to performing more CIs cited as low patient demand (i.e. low referrals, 34%, 78/228) and institutional barriers (28%, 64/228). Surgeons who do not perform CI (4%, 8/212) indicated that other surgeons in their practice perform CIs (63%, 5/8). Most report patients wait 4-8 weeks for surgery.

Conclusions: Barries to increase CI surgical volume require continued effort to overcome in order increase the number of patients who are able to benefit from this life-changing technology.

Professional Practice Gap & Educational Need: Factors that impact CI surgical caseload are unknown.

Learning Objective: To determine factors that impact CI surgical volume.

Desired Result: To address areas for intervention on to increase CI surgical volume and CI utilization.

Level of Evidence – N/A

Indicate IRB or IACUC: Mount Sinai (IRB Protocol #: STUDY-25-00413)

Dynamic Intraoperative Interpretation of TIM Heatmaps: Fluoroscopic Correlation of Skip and Central Heat TIM Patterns in Cochlear Malformation

Jacob Mabey, MD; Natasha Tillett, MD; Sam Schild, MD; Justin Cottrell, MD

Objective: To describe intraoperative fluoroscopic and trans-impedance matrix (TIM) findings during cochlear implantation in a patient with bilateral cochlear malformations, highlighting the dynamic relationship between electrode position and evolving TIM heatmap patterns.

Study Design: Case report

Setting: Tertiary academic center.

Patients: A patient with a right Incomplete Partition type I malformation and a left common cavity malformation undergoing cochlear implantation.

Interventions: Real-time intraoperative fluoroscopy was used to guide electrode placement. TIM analysis was performed following complete electrode insertion, and after adjustments to optimize final electrode positioning.

Main Outcome Measures: TIM heatmap morphology, fluoroscopic electrode position, and correlation between electrode position and subsequent TIM heatmap patterns.

Results: Initial insertion produced a previously characterized TIM skip heat pattern seen in patients with Incomplete Partition Type II and deficient interscalar septal width. This prompted partial electrode withdrawal under fluoroscopy, which subsequently resulted in a TIM central heat pattern, representing a symmetric voltage concentration around the mid-array region. Advancing the array slightly resulted in a skip heat pattern with more defined current delineation and more favorable x-ray profile. Interestingly, SmartNav analysis interpreted the TIM data as a tip foldover, despite good positioning.

Conclusions: This case visually demonstrates which small positional changes of electrodes within malformed cochleae can transform TIM morphology, helping to elucidate why certain patterns occur, and next steps to study clinical relevance.

Professional Practice Gap & Educational Need: Understanding current behavior within the cochlea can help elucidate better ways of stimulating neural elements and placing electrodes. Different current spread patterns utilizing TIM have been identified in patients with cochlear malformations, however why patterns occur is not well understood.

Learning Objective: To better understand why TIM heatmap patterns occur, highlighted by a case in which real-time fluoroscopic guidance was utilized in a patient with cochlear malformations.

Desired Result: A deeper understanding of TIM technology, and potential critical angles of electrode proximity that translate to current spread between electrodes that can undergo future study to evaluate physiologic correlate.

Level of Evidence - Level V

Indicate IRB or IACUC: Exempt.

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*(established in 2014***)**

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 finding 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

Douglas M. Bennion, MD, PhD – 2024
"*Characterizing the Translational Treatment Potential of Losartan After Acoustic Trauma*"
University of California San Diego

Alexander Chern, MD – 2024
"Psychometric Validation of an Item Bank and Development of a Profile Instrument Assessing Music Enjoyment in Individuals with Hearing Loss."
John Hopkins University, Baltimore, MD

Ankita Patro, MD, MS – 2024
"*Developing a Validated Adult Cochlear Implant Referral Guideline Using Machine Learning.*"
Vanderbilt University Medical Center, Nashville, TN

Ryan Anderson, MD – 2025
"*Role of Endocochlear Potential in TMPRSS3 Cochlear Hair Cell Degeneration*"
Indiana University, Indianapolis, IN

Aparna Govindan, MD – 2025

"Next-Generation Sequencing: A MicroRNA Profile of Cholesteatoma of the Middle Ear."
University of Miami, Miami, FL

Joshua J. Sturm, MD, PhD – 2025
"Defining Central Auditory Biomarkers of Tinnitus Perception and Distress."
Montefiore Einstein, Bronx, NY

Many thanks to the ANS Research Committee, led by Dr. Aaron K. Remenschneider

Aaron K. Remenschneider, MD, MPH, Chair
Renee Banakis Hartl, MD
Divya Chari, MD
David Friedmann, MD, MSc
Marlan Hansen, MD
Ana H. Kim, MD
Hossein Mahboubi, MD
Andrew A. McCall, MD
Rick F. Nelson, MD, PhD
Yin Ren, MD, PhD
James Saunders, MD
Daniel Sun, MD

Charlotte Hughes, MD*
(**Community Engagement and Workforce Development representative*)
Tim Hullar, MD**
(***VeDA representative*)

ANS COMMUNITY ENGAGEMENT AND WORKFORCE DEVELOPMENT IN OTOLOGY AND NEUROTOLOGY GRANT

The ANS invites proposals that address components of inclusive excellence within Otology and Neurotology across the domains of patient care, education, research, and membership engagement. These activities align with the Society's mission by supporting excellence in clinical practice, advancing scientific knowledge, and improving alignment between professional activities and the needs of the patient populations served.
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. Alternatively, an applicant who is not a member of the ANS must be sponsored by an ANS member in good standing. At least one member of the grant proposal must be a member of the ANS in good standing.

Jonathan D. Neukam, AuD & Terrin Tamati, PhD - 2025
"Assessing Barriers to Adult Cochlear Implantation in Underserved Populations"
Vanderbilt University, Nashville, TN

MICHAEL E. GLASSCOCK SCIENTIFIC MERIT AWARD

Award established in 2024 (oral presentation)

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

Hannah N. W. Weinstein, BA – 2025
Conductive Hearing Loss is Associated with Dementia in the All of Us Research Program
Columbia University, New York, NY

Kaitlyn A. Brooks, MD - 2026
Neoadjuvant Immune Checkpoint Inhibitor Therapy in Temporal Bone Squamous Cell Carcinoma
The University of Texas MD Anderson Cancer Center
Baylor College of Medicine, Houston, TX

HERBERT SILVERSTEIN AWARD FOR RESEARCH EXCELLENCE IN OTOLOGY/NEUROTOLOGY

Award established in 2024 (oral presentation)

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 - 2024
Expression of TGFÎ²-1 and CTGF in the Implanted Cochlea and its Implication on New Tissue Formation
UCLA, Los Angeles, CA

Benjamin T. Ostrander, MD, MSE - 2025
Whole Genome Sequencing of Sporadic Vestibular Schwannoma Identifies Novel Molecular Pathways
University of California San Diego, CA

Justin Cottrell, MD - 2026
Apical Electrode Placement to Optimize Cochlear Implant Performance in Patients with an Ossified Cochlea and Incomplete Electrode Array Insertion
Yale University, New Haven, CT

NEUROTOLOGY FELLOWSHIP AWARD

First awarded: 1998 (oral presentation)
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

Ankita Patro, MD – 2024, Chicago, IL

John P. Marinelli, MD – 2025, New Orleans, LA

Kaitlyn A. Brooks, MD – 2026, Houston TX

ANS TRAINEE AWARD

First awarded: 1990 (oral presentation)
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
University of Minnesota, Minneapolis, MN

Jennifer L. Maw, MD - 1999, Palm Desert, CA
Hearing Institute for Children & Adults, San Jose, CA

Wayne E. Berryhill, MD - 2000, Orlando, FL
University of Minnesota, Minneapolis, MN

Dmitriy Niyazov - 2001, Palm Desert, CA
Medical Student, Los Angeles, CA

Stacey L. Halum, MD - 2003, Nashville, TN
Medical College of Wisconsin

Norman N. Ge, MD - 2004, Phoenix, AZ
Davis Medical Center, Sacramento, CA

Ritvik P. Mehta, MD - 2005, Boca Raton, FL
Massachusetts Eye & Ear; Harvard Medical School

Wade Chien, MD - 2006, Chicago, IL
Massachusetts Eye & Ear, Harvard Medical School

Heidi Nakajima, MD, PhD - 2009, Phoenix, AZ
Massachusetts Eye & Ear; Harvard Medical School

Yuri Agrawal, MD - 2012, San Diego, CA
Johns Hopkins University, Baltimore, MD

Samuel A. Spear - 2013, Orlando, FL
The Ohio State University, Columbus, OH

Christine T. Dinh, MD - 2014, Las Vegas, NV
University of Miami, Miami, FL

James Naples, MD - 2015, Boston, MA
University of Connecticut, Farmington, CT

Jacob B. Hunter, MD - 2016, Chicago, IL
Vanderbilt University, Nashville, TN

Yarah M. Haidar, MD – 2017, San Diego, CA
University of California at Irvine, Orange, CA

Ashley M. Nassiri, MD - 2018, National Harbor, MD
Vanderbilt University Medical Center, Nashville, TN

Matthew Shew, MD – 2019, Austin, TX
Washington University, St Louis, MO

Armine Kocharyan, MD - 2020, Virtual Meeting
Case Western Reserve University

John P. Marinelli, MD – 2020, Virtual Meeting
Mayo Clinic

Susan E. Ellsperman, MD – 2021, Virtual Meeting
University of Michigan

Douglas M. Bennion, MD, PhD – 2021, Virtual Meeting University of Iowa

Hunter L. Elms, MD – 2022 - Dallas, TX
Duke University

Amit Walia, MD – 2022 - Dallas, TX
Washington University

Lisa Zhang, MD – 2023 - Boston, MA
The Ohio State University

Ankita Patro, MD – 2023 - Boston, MA
Vanderbilt University

Ryan T. Judd, MD – 2024 – Chicago, IL
The Ohio State University

Krish Suresh MD – 2025 – New Orleans, LA
UC San Diego, San Diego, CA

Madison Epperson, MD – 2026 – Phoenix, AZ
Mayo Clinic, Rochester, MN

Anthony Thai, MD – 2026 – Phoenix, AZ
Stanford University, Palo Alto, CA

NICHOLAS TOROK VESTIBULAR AWARD

First awarded: 1990 (oral presentation)
Funding provided by: Dr. & Mrs. Nicholas Torok & the American Neurotology Society

Stephen P. Cass, MD - l990, Palm Beach, FL
Michigan Ear Institute, Farmington Hills, MI

P. Ashley Wackym, MD - 1992, Palm Desert, CA
University of Iowa Hospitals and Clinics, Iowa City, IA

Robert P. Muckle, MD - 1993, Los Angeles, CA
University of Minnesota, Minneapolis, MN

Thomas A. Salzer, MD - 1994, Palm Beach, FL
Baylor College of Medicine, Houston, TX

Akira Ishiyama, MD - 1995, Palm Desert, CA
UCLA School of Medicine, Los Angeles, CA

Anil K. Lalwani, MD - 1998, Palm Beach, CA
University of California, San Francisco, CA

Lloyd B. Minor, MD - 1999, Palm Desert, FL
Johns Hopkins University, Baltimore, MD

Vincent B. Ostrowski, MD - 2000, Orlando, FL
Northwestern University Medical School, Chicago, IL

D. Bradley Welling, MD, PhD - 2001, Palm Desert, CA
The Ohio State University, Columbus, OH

John P. Carey, MD - 2003, Nashville, TN
Johns Hopkins University, Baltimore, MD

John C. Li, MD - 2005, Boca Raton, FL
Loyola University Medical Center, Chicago, IL

Judith A. White, MD, PhD - 2006, Chicago, IL
The Cleveland Clinic, Cleveland, OH

Abraham Jacob, MD - 2007, San Diego, CA
The Ohio State University - Columbus, OH

Rahul Mehta, MD - 2014, Las Vegas, NV
Louisiana State University - New Orleans, LA

Benjamin T. Crane, MD, PhD - 2015, Boston, MA
University of Rochester Medical Center - Rochester, NY

Jeffrey D. Sharon, MD - 2016, Chicago, IL
Johns Hopkins University - Baltimore, MD

Anne K. Maxwell, MD – 2017, San Diego, CA
University of Colorado Hospital – Aurora, CO

Renee M. Banakis Hartl, MD – 2018, National Harbor, MD
University of Colorado Hospital – Aurora, CO

Tiffany P. Hwa, MD – 2020, Virtual
University of Pennsylvania- Philadelphia, PA

Steven D. Curry, MD, MPH – 2021 - Virtual
University of Nebraska Medical Center

Miriam R. Smetak, MD, MS – 2022 - Dallas, TX
Vanderbilt University

Eric J. Formeister, MD, MS – 2023 - Boston, MA
Duke University

D. O'Neil Danis, III, MD – 2024 – Chicago, IL
Tufts Medical Center, Boston, MA

Graham D. Cochrane, MD, PhD – 2025 - New Orleans, LA
University of North Carolina, Durham, NC

Adam Y. Xiao, MD, PhD – 2026 - Phoenix, AZ
UCLA – Los Angeles, CA

VeDA VESTIBULAR RESEARCH AWARD

This annual travel grant established in 2025 is generously funded by VeDA, Vestibular Disorders Association, to promote innovation and excellence in vestibular outcomes research. The award will be presented to the best abstract submitted in this area of research and selected for oral presentation at the annual ANS Spring meeting.

Our first recipient is:

Alexandra T. Bourdillon MD – 2026 – San Francisco, CA
UCSF, San Francisco, CA

RECIPIENTS OF THE HERBERT SILVERSTEIN/ANS/AAO-HNS/F OTOLOGY/NEUROTOLOGY RESEARCH AWARD

Funding provided by Dr. Herbert Silverstein/ANS/AAO

Lawrence R. Lustig, MD - 7/1999
Johns Hopkins University

David R. Friedland, MD - 7/00-6/02
Johns Hopkins University

Rose Mary Stocks, MD - 7/02-6/204
University of Tennessee

Clifford R. Hume, MD, PhD - 7/03-6/05
University of Washington

Alan G. Micco, MD - 7/04-6/06
Northwestern University

Romaine Johnson, MD - 7/05-6/07
Children's Hospital Cincinnati

Joseph P. Roche, MD - 7/08-6/10
University of North Carolina

Alan Cheng, MD - 07/10 - 06/12
Stanford University

Yuri Agrawal, MD - 07/10 - 06/12
Johns Hopkins University

Nathan Schularick, MD - 07/12 - 06/14
The University of Iowa

Dylan Chan, MD, PhD - 07/14 - 06/16
University of California-SF

David H. Jung, MD, PhD - 07/16 - 06/18
Harvard University/ MEEI

Elliot D. Kozin, MD - 7/18 - 6/20
MEEI/Harvard Medical School

NO AWARD GIVEN - 7/20-6/22

Lindsay Scott Moore, MD - 7/22-6/24
Stanford University

Adam Y. Xiao, MD, PhD - 7/24-6/26
University of California, Los Angeles

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

Richard T. Miyamoto, MD, MS – 2024 – Indianapolis, IN, Indiana University

Susan B. Waltzman, PhD – 2025 – New York, NY, NYU Grossman School of Medicine

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

American Neurotology Society Research Grant, Brief Progress Report
Date: 1/27/2026
Principal Investigator: Ryan Anderson, MD
Mentor: Rick Nelson, MD, PHD
Institution: Indiana University, Department of Otolaryngology, Head & Neck Surgery
Project Title: Role of Endocochlear Potential in *TMPRSS3* Cochlear Hair Cell Degeneration

Background:
TMPRSS3 is the most common causative hearing loss gene in adults undergoing cochlear implantation and is associated with human congenital deafness. Despite its significance, the function of *TMPRSS3* in the inner ear remains unclear. *Tmprss3*-mutant mice display normal inner and outer hair cell (HC) development followed by rapid and complete hair cell degeneration between postnatal days 12-14. Temporally, the HC degeneration corresponds to the rapid rise in the endocochlear potential (EP). To investigate the contribution of endolymph factors (high EP and high potassium (K+)) in hair cell death, our data has shown that organ of Corti explants from *Tmprss3*-mutant mice exhibit complete preservation of both inner and outer hair cells. In addition, crossing *Tmprss3*-mutant mice with *Pou3f4* mice with low EP and K+ in vivo, also reveals complete preservation of cochlear HCs. In this study, we will investigate the role of potassium in HC death in *Tmprss3* mutant mice. This will be accomplished by 1) Assess HC survival in *Tmprss3*-mutant mice when crossed with *Cldn11*-mutant mice, and 2) Explore the therapeutic effects of pharmacologic reduction on EP and its potential to rescue hair cells in vivo. *Cldn11*$^{-/-}$ mice, which fail to generate normal EP, yet have normal levels of K in the cochlea, will be crossed with *Tmprss3*-mutant mice and hair cells will be assessed at P14, P21 and P28 in vivo. Furosemide blocks the Na-K+-ATPase channels and leads to a temporary reduction of EP by intravenous and/or direct round window application. We will perform trans-tympanic injections of furosemide in *Tmprss3*-mutant mice at P11 and assess HC survival at P14. This study will elucidate the direct role of K+ in the pathophysiology of HC death and will be the first therapeutic trial to rescue HCs in *Tmprss3*-mediated hearing loss.

Specific Aim 1: Assess the role of EP and scala media K+ in hair cell degradation in *Tmprss3*$^{Y260X/Y260X}$ mice in vivo.

Tmprss3-mutant mice have been successfully crossed with *Cldn11*-mutant mice. Cochlea of these mice have been harvested and fixed at p11, p14, p21, p28 & p48. All cochleae were then stained and mounted for analysis. Hair cell counts for each successive postnatal day above have been performed for apex and middle cochlear inner and outer hair cells. Quantification of these hair cells have been performed, and recounts have been verified for each count. Statistical analysis has been compared with these mice hair-cell counts compared to *Tmprss3*$^{Y260X/Y260X}$, and *Tmprss3*$^{Y260X/Y260X}$*:Pou3f4*$^{del-J}$. This data showed promising results with *Tmprss3*$^{Y260X/Y260X}$*:Pou3f4*$^{del-J}$, (low EP & low endolymph {K^+}), demonstrating rescue of

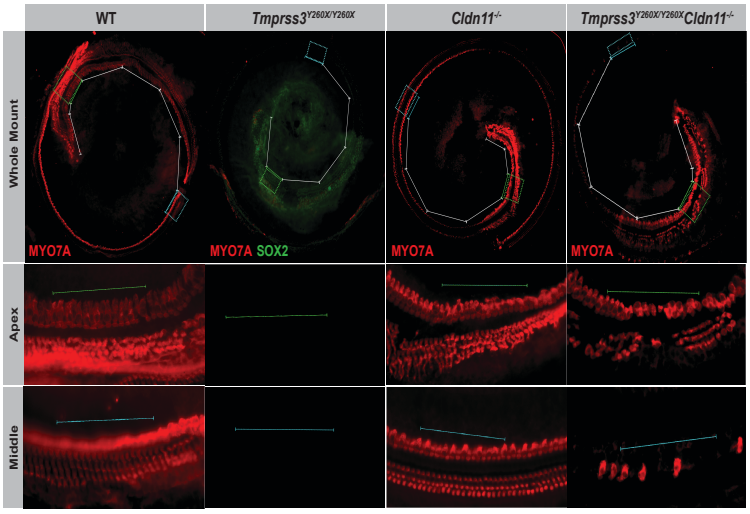

Figure 1: P28 WT, *Tmprss3*$^{Y260X/Y260X}$, *Cldn11*$^{-/-}$, and *Tmprss3*$^{Y260X/Y260X}$*:Cldn11*$^{-/-}$ at 100x magnification.

hair cells and *Tmprss3*$^{Y260X/Y260X}$*:Cldn11*$^{-/-}$, (low EP & normal endolymph {K^+}), demonstrating only partial rescue of hair cells. This data suggests that high endolymph K^+ is the primary factor causing hair cell death in *Tmprss3* mutants.

Future: Four additional mice cochlea of *Tmprss3*$^{Y260X/Y260X}$*:Cldn11*$^{-/-}$ intend to be analyzed with hair cell counts for apex and middle cochlear hair cells to increase power of the study.

Specific Aim 2: Explore the effects of pharmacologic reduction on EP and its potential to rescue hair cells in vivo

Tmprss3 wild-type mice were bred and maintained under standard laboratory conditions. To validate the intratympanic injection technique prior to experimental interventions, wild-type mice were euthanized at P11 and P14. Intratympanic injections of local dye were performed to confirm successful delivery into the middle ear space and visualization of compound distribution (Figure 2). This feasibility assessment established optimal injection volumes, needle gauge, and anatomical landmarks for consistent transtympanic membrane penetration while minimizing trauma to surrounding structures.

Future: *Tmprss3*$^{Y260X/Y260X}$ mutant mice will undergo transtympanic membrane injections with furosemide. Daily intratympanic injections will be performed beginning at P11 and continuing through P14. The dosing regimen will be designed to maintain sustained reduction in EP during the critical period of cochlear maturation. Six cochleae will be harvested at P15, and the efficacy of furosemide treatment on hair cell survival will be quantitatively assessed using cochlear whole mount preparations and immunofluorescence staining, as described in Aim 1.

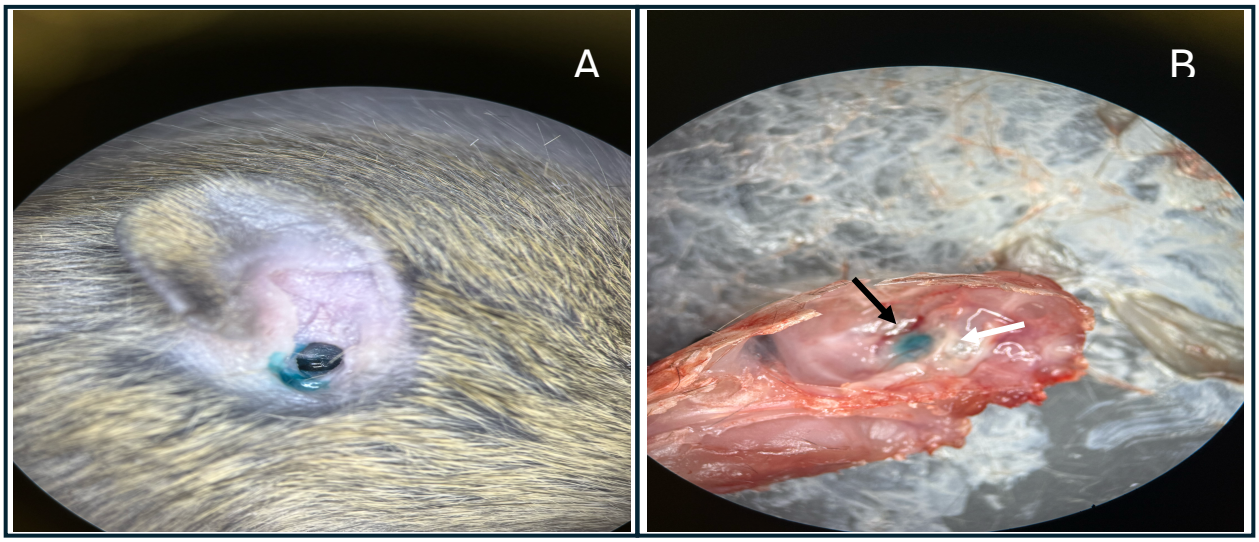

Figure 2: A) View of p11 *Tmprss3* WT mouse ear after injection of colored dye. B) Dissection of mouse skull base with black arrow demonstrating blue dye within the middle ear space. White arrow pointing towards otic capsule.

American Neurotology Society Research Grant Progress Report
Date: 2/1/2026
Principal Investigator: Aparna Govindan, MD
Mentors: Simon I. Angeli, MD and Xue Zhong Liu, MD, PhD, FACS
Institution: University of Miami / Jackson Memorial Hospital
Project Title: Next-Generation Sequencing: A MicroRNA Profile of Cholesteatoma of the Middle Ear

Background: Cholesteatoma is a benign lesion consisting of a keratinizing squamous epithelial matrix enveloping an accumulation of keratin with a surrounding inflammatory perimatrix. Cholesteatoma can cause ossicular erosion leading to conductive hearing loss, and can progress to erode the fallopian canal, labyrinth, tegmen, or sigmoid sinus leading to facial palsy, vertigo, or extra-temporal intracranial complications including meningitis, brain abscesses, and dural venous thrombosis. Surgery is the only effective method of treating cholesteatoma, however recurrence after surgery is common, without any non-surgical, alternative management strategies. Elucidating biomarkers of aggressive disease can guide prognostic counseling on extent of surgery, rates of recidivism or recurrence, and lay the foundation for development of pharmaceutical therapeutics.

Currently, the molecular mechanisms of cholesteatoma pathogenesis are not well known. While microRNA (miRNA) pathways associated with cell proliferation, apoptosis, the cell cycle, bone resorption and remodeling have been identified, none have been causally established. Furthermore, studies do not often specify the layer of cholesteatoma tissue analyzed, thus findings may be heterogeneous with a mixture of keratin, epithelium and perimatrix connective tissue. Contributing to the complexity, miRNA can regulate multiple downstream target pathways, and many different miRNAs can regulate one target pathway. Given the convoluted regulatory interplay of miRNA, and limitations of the more commonly performed microarray analysis, we do not understand the complete library of miRNA expression in cholesteatoma.

Most studies identify miRNA regulators of keratinocyte differentiation and hyperproliferation, and the epidermal cell division processes in the matrix, while the cholesteatoma perimatrix has scarcely been evaluated. Matrix metalloproteinases (MMPs) are zinc-dependent enzymes that degrade extracellular matrix (ECM) in response to inflammatory cytokines, and are thought to contribute to the bone erosion seen in cholesteatoma. We suspect that an upregulation in miRNAs that regulate ECM degradation contribute to the aggressiveness and invasiveness of cholesteatoma, and that these are found in higher abundance in the perimatrix of the cholesteatoma. We hypothesize that miRNA-423-5p, a known ECM degrader, will have a higher expression in the perimatrix of later stage cholesteatoma compared to earlier stages.

Study Aims:
Aim 1. Determine if the perimatrix of late stage cholesteatoma (EAONO/JOS Stage 3&4) expresses more miRNA-423-5p than that of early stage cholesteatoma (EAONO/JOS Stage 1&2).

Sub-Aim 1A. Determine if other miRNAs regulating ECM degradation are differentially expressed in the perimatrix, matrix and ear canal skin of later vs earlier stage cholesteatoma.

Aim 2. Determine if the miRNA expression of other non-ECM regulators differ between the cholesteatoma perimatrix, matrix and ear canal skin, when stratified by cholesteatoma stage.

Progress: The minimum required sample size for this comparison of perimatrix, matrix and ear canal skin between early and late-stage cholesteatoma is seven patients per group. Although the minimum requirement is 14 patients, we aimed to recruit 20 patients to account for an attrition rate in the event of sample degradation, inadequate RNA yield or integrity, or technical

artifact in the next generation sequencing library. To date, we have recruited 13 participants, including 10 with early-stage disease and 3 with late-stage disease. We anticipate completing recruitment within the next 2 months.

To validate our tissue collection and processing protocols, we conducted a pilot analysis using matrix, perimatrix, and ear canal skin samples from two patients. RNA extraction was performed at the John P. Hussman Institute for Human Genomics (HIHG), followed by miRNA library preparation and next generation sequencing at the Center for Genome Technology Services at the University of Miami. Sequencing data were analyzed by our collaborating bioinformatician using the miRDeep2 algorithm to assess differential miRNA expression. These analyses yielded promising results. As shown in the principal component analysis scatter plot below (Figure 1), distinct miRNA expression profiles were observed across the three tissue types, demonstrating detectable differences. These findings provide proof of concept for our tissue collection, RNA extraction, and sequencing workflow.

Upon completion of patient recruitment we will perform stratified analyses of miRNA expression, including miRNA-423-5p as well as additional miRNAs that regulate ECM degradation and other cellular functions. We will subsequently conduct functional gene classification to identify relevant target genes and biological pathways, and correlate identified miRNAs with the corresponding gene modulators of late vs early stage cholesteatoma.

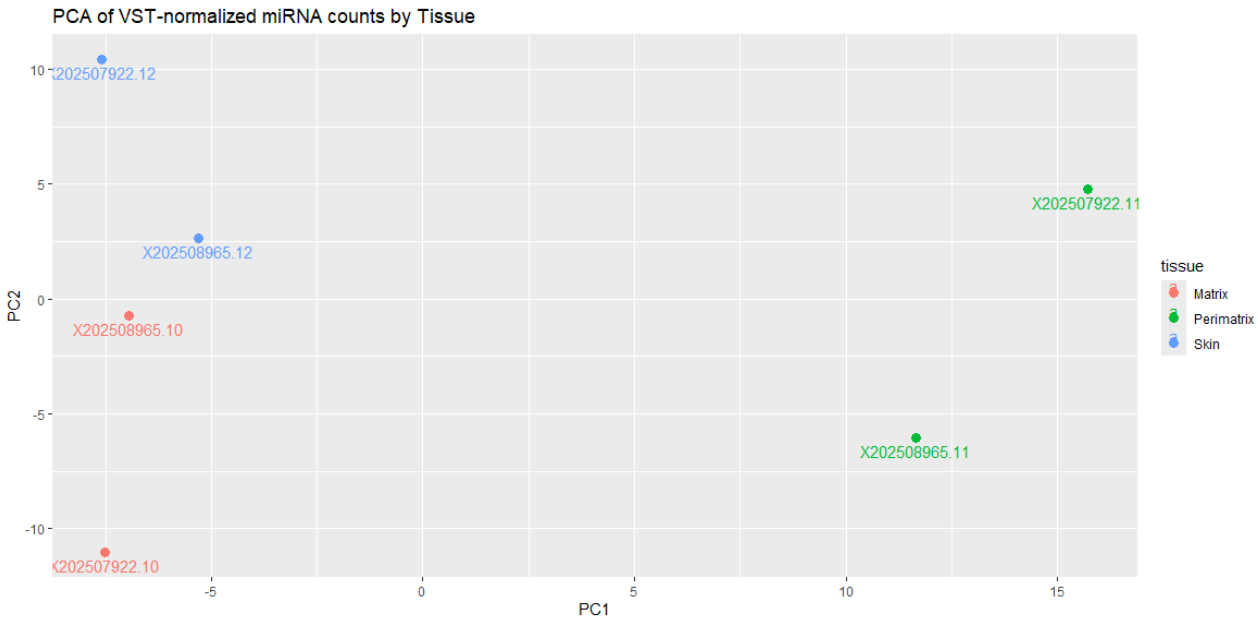

Figure 1. Principal Component Analysis Plot
PCA= Principal component analysis, VST= variant stabilized transformation, PC= principal component

American Neurotology Society Research Grant
Progress Report Date: Jan 26, 2026
Project Title: Defining Central Auditory Biomarkers of Tinnitus Perception and Distress
Principal Investigator: Joshua J. Sturm, MD PhD
Institution: Montefiore Einstein, Bronx, NY, 10467

Background:
Tinnitus, the perception of phantom sounds in the absence of an external stimulus, is a highly prevalent source of morbidity that lacks effective treatments. A major research bottleneck in the development of effective treatments for tinnitus has been the lack of objective biomarkers that can be used to detect tinnitus-specific neural activity patterns and to monitor treatment responsiveness. Tinnitus is known to be driven by an abnormal central nervous system response to peripheral hearing loss, but it is not known what auditory processes are disrupted or how these aberrant processes relate to subjective functional impairment. The central goal of this proposal is to test the hypothesis that central biomarkers of auditory perceptual processing, assessed via electroencephalography (EEG), can be used to predict tinnitus perception and distress.

To accomplish this goal, we propose to record event-related potentials (ERP) during auditory processing tasks that involve automatic and attention-mediated discrimination of sound events. In AIM 1, we will determine the impact of tinnitus on the brain's ability to process sound events by comparing ERPs between individuals with hearing loss and reported tinnitus (Tinnitus) and individuals with hearing loss and no reported tinnitus (Hearing Loss*)*. In AIM 2, we will explore the relationship between ERPs and validated, patient-reported outcomes measures (PROMs) of tinnitus distress including the Tinnitus Handicap Inventory (THI) and the Tinnitus Functional Index (TFI).

Specific Aim 1: Characterize the Impact of Tinnitus on Central Processing of Auditory Change Detection.

Progress: Auditory change detection (ACD) is the ability to detect differences in the spectrotemporal properties of sounds. It is a fundamental skill for extracting salient information in complex acoustic environments. ACD is impaired in individuals with tinnitus, making it an intriguing focus for biomarker discovery. We have successfully designed and implemented a novel experimental paradigm to behaviorally and neurophysiological assess ACD in human subjects (Fig 1). The paradigm separately assesses passive (automatic) and active (attention-mediated) ACD for low-frequency and high-frequency sound events. In the *Passive* condition of the paradigm, participants listen to a combination of *standard* (80%) and *deviant* (20%) sounds while watching a silent movie. The mismatch negativity (MMN) component of ERPs is measured to identify and quantify how the brain automatically detects sound changes. In the *Active* condition, participants listen to the same sounds, but instead of watching a silent movie, they are asked to attend to and discriminate frequency differences between the sounds. The P3b component of ERPs is used as a central marker of attentional control. The accuracy (hit rate) and speed (reaction time) of participant responses are also measured to behaviorally characterize frequency discrimination abilities during active listening.

After building and refining our paradigm, we then piloted it in 10 normal hearing *Control* participants. We found that we were able to reliably collect high-quality behavioral and neurophysiologic data, including specific ERP components of interest (MMN and P3b). We have since recruited and collected data from 10 participants in the *Tinnitus* group. Our preliminary findings suggest that compared to the *Control* participants, the *Tinnitus* group exhibits enhanced MMN responses during passive listening. Additionally, the *Tinnitus* group exhibits reduced accuracy in actively detecting sound frequency changes, along with a reduction in P3b responses. Recruitment and data collection are ongoing towards the goal of collecting data from 16 patients in the *Tinnitus* group and 16 patients in the *Hearing Loss* group. With the previously filed no-cost extension of this award through September 30th, 2026 (to account for unanticipated laboratory renovations), we anticipate completing our data collection, analysis, and presentation activities on time.

Specific Aim 2: Determine the Link between Aberrant Central Processing and Tinnitus-Related Distress

Progress: An ideal central biomarker for tinnitus would not only be sensitive to the presence or absence of the phantom sound percept but would also be predictive of functional impairment. To address this, we will quantify tinnitus distress using THI/TFI scores and evaluate the relationship between tinnitus distress and ERP data.

Individuals with tinnitus exhibit impaired performance on tasks that require executive and sustained attention, and tinnitus distress may therefore relate to dysfunctional attention-mediated sound processing. We therefore predict that the strength of attention-based ERP components (P3b) in the *Tinnitus* group will be inversely related with tinnitus severity scores (THI/TFI). Thus far, we have collected PROM and ERP data from 9 participants in the *Tinnitus* group. Once we complete our cohort 16 patients in the *Tinnitus* group, we will calculate P3B ERP amplitudes and THI/TFI scores for each individual and perform a regression analysis to determine the relationship between P3b strength and THI/TFI scores.

Summary: The ANS funding for this project has facilitated essential support for a research technician and covered participant and data acquisition costs. This support has also catalyzed the PI's pursuit of additional funding for future work, with applications currently under review at the American Otology Society (ANS), the Hearing Health Foundation (HHF), as well for an internal career development award at Albert Einstein College of Medicine (K12). Additional planned applications for funding include an NIH career development award (K23) to be submitted in June 2026. We are very encouraged by our preliminary findings, and we greatly appreciate the ongoing support of the ANS.

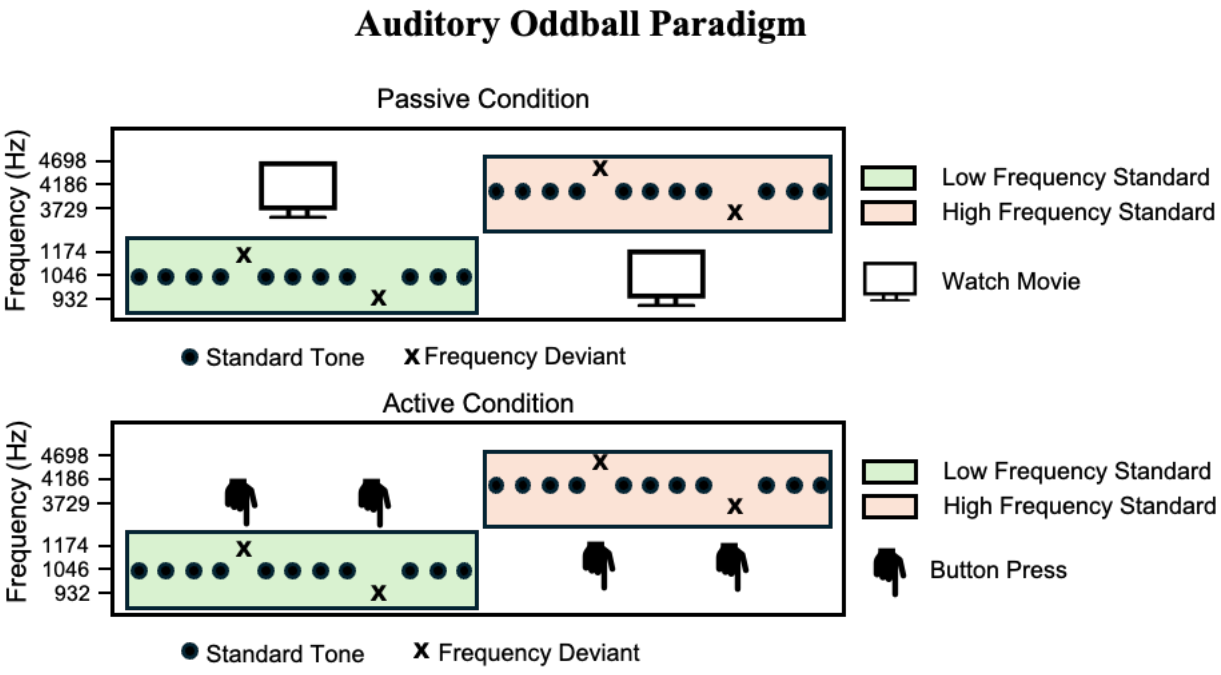

Fig 1. Auditory Oddball Paradigm to Evaluate Passive and Active ACD. In the passive condition (top), participants watch a silent movie while listening to sound events consisting of standard tones (80%) and frequency deviants that are above (10%) or below (10%) the standard tone frequencies. In the active condition (bottom), the same sounds are presented, but participants are asked to press a button each time they detect a deviant tone**.** Standard and frequency deviant tones are denoted for High and Low Frequency standard conditions.

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William P. R. Gibson, MD
Birchgrove, Australia
Senior Fellow

Neil A. Giddings, MD
Spokane, WA
Senior Fellow

Paul W. Gidley, MD
Houston, TX
Fellow

Martin Gizzi, MD, PhD
Paramus, NJ
Fellow

Michael B. Gluth, MD
Chicago, IL
Fellow

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Clackamas, OR
Fellow

Joel A. Goebel, MD
Saint Louis, MO
Emeritus

Robert A. Goldenberg, MD
Dayton, OH
Emeritus

M. Miles Goldsmith, MD
Savannah, GA
Senior Fellow

Hernan Goldsztein, MD
San Diego, CA
Fellow

Justin S. Golub, MD, MSc
New York, NY
Fellow

Stefania Goncalves, MD
Birmingham, AL
Fellow

Michael A. Gordon, MD
West Hempstead, NY
Senior Fellow

Steven A. Gordon, MD, MPH
Cincinnati, OH
Fellow

Malcolm Graham, MD
Atlanta, GA
Emeritus

J. Douglas Green, Jr., MD
Jacksonville, FL
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Lawrence R. Grobman, MD
Miami, FL
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Samuel P. Gubbels, MD
Aurora, CO
Fellow

A. Julianna Gulya, MD
Locust Grove, VA
Senior Fellow

Sachin Gupta, MD
seattle, WA
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Richard K. Gurgel, MD, MSCI
Salt Lake City, UT
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Cleveland, OH
Senior Fellow

Rex S. Haberman, MD
Gainesville, FL
Fellow

Kevin S. Hadley, MD
Aiea, HI
Fellow

Yoav Hahn, MD
Dallas, TX
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G. Michael Halmagyi, MD
Sydney, Australia
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Mickie J. Hamiter, MD
Tampa, FL
Associate

Paul E. Hammerschlag, MD
New York, NY
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Marlan R. Hansen, MD
Iowa City, IA
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Matthew B. Hanson, MD
Hackensack, NJ
Fellow

Lee Harker, MD
Omaha, NE
Emeritus

Stephen G. Harner, MD
Rochester, MN
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Jeffrey P. Harris, MD
San Diego, CA
Senior Fellow

Michael S. Harris, MD
Milwaukee, WI
Fellow

Erin A. Harvey, MD
Charleston, SC
Trainee

Steven A. Harvey, MD
Milwaukee, WI
Fellow

George T. Hashisaki, MD
Charlottesville, VA
Senior Fellow

Jonathan Hatch, MD
West Jordan, UT
Fellow

David S. Haynes, MD, MMHC
Nashville, TN
Fellow

Katherine Do Heidenreich, MD
Ann Arbor, MI
Associate

Edward Hendershot, MD
Lodi, OH
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Theresa B. Hennesy, MD
Aurora, CO
Trainee

Giovanni R. Henry, MD
Kingston, Jamaica
Trainee

Ronna Hertzano, MD, PhD
Bethesda, MD
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St. Louis, MO
Fellow

Thomas P. Hester, MD
Charleston, SC
Fellow

George Hicks, MD
Indianapolis, IN
Fellow

Michelle K. Higgins, MD, PhD
Iowa City, IA
Trainee

Douglas M. Hildrew, MD
New Haven, CT
Fellow

Todd A. Hillman, MD
Wexford, PA
Fellow

Christopher W. Hilton, MD
St. Paul, MN
Fellow

Barry E. Hirsch, MD
Pittsburgh, PA
Senior Fellow

Michael Hoa, MD
Washington, DC
Fellow

Candace E. Hobson, MD
Atlanta, GA
Fellow

Sarah E. Hodge, MD
Augusta, GA
Fellow

Michael E. Hoffer, MD
Miami, FL
Fellow

Ronald A. Hoffman, MD
New York, NY
Senior Fellow

Dick L. Hoistad, MD
Seattle, WA
Fellow

James J. Holt, MD
Marshfield, WI
Senior Fellow

Robert S. Hong, MD, PhD
Novi, MI
Fellow

Vicente Honrubia, MD
Los Angeles, CA
Senior Fellow

Arata Horii, MD
Niigata, Japan
Fellow

Karl L. Horn, MD
Santa Fe, NM
Senior Fellow

Melton J. Horwitz, MD
Houston, TX
Senior Fellow

John W. House, MD
Los Angeles, CA
Senior Fellow

James R. House, III, MD
Jackson, MS
Fellow

Tina C. Huang, MD
Minneapolis, MN
Fellow

Victoria Weyu Huang, MD
Cleveland Heights, OH
Trainee

May Y. Huang, MD
Seattle, WA
Fellow

Charlotte K. Hughes, MD, MPH
San Diego, CA
Associate

Dominic W. Hughes, PhD
West Linn, OR
Senior Associate

Timothy E. Hullar, MD
Portland, OR
Fellow

Jacob B. Hunter, MD
Philadelphia, PA
Fellow

Tiffany P. Hwa, MD
Princeton Junction, NJ
Fellow

Nadine I. Ibrahim, MD
Nashville, TN
Trainee

Makoto Igarashi, MD
Tokyo, Japan
Senior Associate

Takao Imai, MD
Sakai-City, Japan
Fellow

Terence E. Imbery, MD
Chicago, IL
Fellow

Jon E. Isaacson, MD
Hershey, PA
Fellow

Brandon Isaacson, MD
Dallas, TX
Fellow

Akira Ishiyama, MD
Los Angeles, CA
Fellow

Huseyin Isildak, MD
Stony Brook, NY
Fellow

Robert K. Jackler, MD
Stanford, CA
Senior Fellow

Carol Jackson, MD
Newport Beach, CA
Fellow

Neal M. Jackson, MD
New Orleans, LA
Fellow

Lance E. Jackson, MD
San Antonio, TX
Fellow

Abraham Jacob, MD
Tucson, AZ
Fellow

Taha A. Jan, MD
Nashville, TN
Fellow

Herman A. Jenkins, MD
Aurora, CO
Senior Fellow

Daniel Jethanamest, MD, MSc
New York, NY
Fellow

Nicole T. Jiam, MD
San Francisco, CA
Fellow

Pawina Jiramongkolchai, MD
St. Louis, MO
Associate

J. Dixon Johns, MD
New York, NY
Trainee

Benjamin R. Johnson, MD
Raleigh, NC
Associate

Alan J. Johnson, MD
Temple, TX
Fellow

Raleigh O. Jones, MD
Lexington, KY
Fellow

Timothy T. K. Jung, MD
Riverside, CA
Fellow

David H. Jung, MD, PhD
Boston, MA
Fellow

Hyunseo Jung, MD
Novi, MI
Trainee

Jacob Kahane, MD
Albuquerque, NM
Fellow

Olivia A. Kalmanson, MD, MSc
Miami, FL
Trainee

Donald B. Kamerer, MD
Pittsburgh, PA
Emeritus

Romain E. Kania, MD
Paris, France
Associate

Vivek Kanumuri, MD
Miami, FL
Fellow

Howard M. Kaplan, MD
Plantation, FL
Senior Fellow

Elina Kari, MD
La Jolla, CA
Fellow

Jack Kartush, MD
Bloomfield Hills, MI
Senior Fellow

Athanasios Katsarkas, MD
Montreal, Quebec
Emeritus

Adam C. Kaufman, MD, PhD
Baltimore, MD
Fellow

David M. Kaylie, MD
Durham, NC
Fellow

Emily Kay-Rivest, MD, MSc
Montreal, QC
Fellow

Ken Kazahaya, MD, MBA
Miami Beach, FL
Associate

Brian Kellermeyer, MD
Morgantown, WV
Associate

Robert Kellman, MD
Syracuse, NY
Senior Fellow

Elizabeth A. Kelly, MD
Elkhorn, NE
Fellow

David C. Kelsall, MD
Englewood, CO
Associate

Catherine L. Kennedy, MD
Cherry Hill, NJ
Associate

Bradley W. Kesser, MD
Charlottesville, VA
Fellow

Paul Kileny, PhD
Ann Arbor, MI
Senior Associate

Daniel E. Killeen, MD
Dallas, TX
Fellow

Hung Jeffrey Kim, MD
Washington, DC
Fellow

Ana H. Kim, MD
New York, NY
Fellow

Harold H. Kim, MD
Portland, OR
Fellow

Susan Marenda King, MD
San Antonio, TX
Fellow

Matthew L. Kircher, MD
Maywood, IL
Fellow

Ruwan Kiringoda, MD
Fremont, CA
Fellow

Laura A. Kirk, PA-C
Dallas, TX
Affiliate

Tadashi Kitahara, MD
Kashihara-city, Japan
Fellow

Glenn W. Knox, MD
Jacksonville, FL
Senior Fellow

Pelin Kocdor, MD, PhD
Istanbul, Turkey
Associate

Armine Kocharyan, MD
St. Paul, MN
Associate

Darius Kohan, MD
New York, NY
Fellow

Gavriel D. Kohlberg, MD
Seattle, WA
Fellow

Robert Kohut, MD
Woodleaf, NC
Emeritus

Ron Konrad, MD
Naples, FL
Emeritus

Richard D. Kopke, MD
Oklahoma City, OK
Senior Fellow

Harold W. Korol, MD
Palo Alto, CA
Senior Fellow

Ali Kouhi, MD
Tehran, Iran
Associate

Elliott D. Kozin, MD
Cambridge, MA
Fellow

Wesley W.O. Krueger, MD
San Antonio, TX
Senior Fellow

Thomas C. Kryzer, MD
Wichita, KS
Senior Associate

Jeffery J. Kuhn, MD
Kissimmee, FL
Fellow

Brian Kung, MD
Las Vegas, NV
Fellow

J. Walter Kutz, Jr., MD
Dallas, TX
Fellow

John Kveton, MD
New Haven, CT
Fellow

Jed Kwartler, MD
South Orange, NJ
Senior Fellow

Robert F. Labadie, MD, PhD
Charleston, SC
Fellow

Anil K. Lalwani, MD
New York, NY
Fellow

Paul R. Lambert, MD
Charleston, SC
Emeritus

Alan W. Langman, MD
Naples, FL
Senior Fellow

Michael J. LaRouere, MD
Northville, MI
Senior Fellow

Michael Larson, MD
Knoxville, TN
Associate

John M. Lasak, MD
Wichita, KS
Fellow

Lorenz F. Lassen, MD
Suffolk, VA
Senior Fellow

Daniel J. Lee, MD
Brookline, MA
Fellow

David Lee, MD
Saint Louis, MO
Trainee

Eric Lee, MD
Chapel Hill, NC
Trainee

Lawrance Lee, MD
Richmond, VA
Trainee

Joel F. Lehrer, MD
Teaneck, NJ
Senior Fellow

John P. Leonetti, MD
Maywood, IL
Senior Fellow

S. George Lesinski, MD
Cincinnati, OH
Emeritus

Samuel C. Levine, MD
Eden Prairie, MN
Senior Fellow

John C. Li, MD
Jupiter, FL
Fellow

Daqing Li, MD
Philadelphia, PA
Fellow

Charles J. Limb, MD
San Francisco, CA
Fellow

Harrison W. Lin, MD
Irvine, CA
Associate

James Lin, MD
Kansas City, KS
Fellow

Brian Lin, MD
Boston, MA
Fellow

Vincent Yu-Wen Lin, MD
Toronto, ON
Fellow

Kenny F. Lin, MD
Houston, TX
Fellow

Roger Lindeman, MD
Seattle, WA
Senior Fellow

Cameron B. Lindemann, DO
Prairieville, LA
Trainee

Nathan R. Lindquist, MD
Houston, TX
Fellow

Alan F. Lipkin, MD
Englewood, CO
Senior Fellow

Philip D. Littlefield, MD
San Diego, CA
Fellow

George S. Liu, MD
Baltimore, MD
Trainee

Benjamin D. Lovin, MD
Charlottesville, VA
Fellow

Charles M. Luetje, MD
Olathe, KS
Senior Fellow

Larry B. Lundy, MD
Ponte Vedra Beach, FL
Senior Fellow

Michal Luntz, MD
Tel Aviv, Israel
Associate

J. Eric Lupo, MD
Englewood, CO
Fellow

Lawrence R. Lustig, MD
New York, NY
Fellow

William Luxford, MD
Los Angeles, CA
Fellow

Maria C. Machala, APRN
Denver, CO
Affiliate

John D. Macias, MD
Phoenix, AZ
Fellow

Robert J. Macielak, MD
Powell, OH
Associate

Hossein Mahboubi, MD
Los Angeles, CA
Fellow

Tomoko Makishima, MD, PhD
Galveston, TX
Associate

Bulent Mamikoglu, MD
Valhalla, NY
Fellow

Charles A. Mangham, Jr., MD
Hailey, ID
Emeritus

Sudhir Manickavel, MD
Los Angeles, CA
Trainee

Gauri Mankekar, MD, PhD
Shreveport, LA
Associate

Wolf J. Mann, MD
Mainz, Germany
Senior Associate

RaviSankar Manogaran, MD
Lucknow, India
Associate

Nauman F. Manzoor, MD
Richmond, VA
Fellow

John P. Marinelli, MD
Rochester, MN
Trainee

Robert Marlan, MD
Dupont, WA
Senior Associate

Michael A. Marsh, MD
Fort Smith, AR
Fellow

Hannah L. Martin, MD
Durham, NC
Trainee

Sam J. Marzo, MD
Maywood, IL
Fellow

Theodore P. Mason, MD
Springfield, MA
Fellow

Adam Master, MD, MSc
New Orleans, LA
Fellow

Kenneth Mattucci, MD
Orient, NY
Senior Fellow

Jennifer L. Maw, MD
San Jose, CA
Fellow

Anne K. Maxwell, MD
Loma Linda, CA
Fellow

John May, MD
Winston Salem, NC
Senior Fellow

Jacob S. McAfee, MD
Neptune City, NJ
Fellow

Andrew A. McCall, MD
Pittsburgh, PA
Fellow

Don E. McCleve, MD
Monte Sereno, CA
Senior Fellow

John T. McElveen, MD
Raleigh, NC
Fellow

William J. McFeely Jr, MD
Huntsville, AL
Fellow

Michael McGee, MD
Oklahoma City, OK
Senior Fellow

Benjamin M. McGrew, MD
Birmingham, AL
Fellow

Larry D. McIntire, MD
Joplin, MO
Senior Associate

Michael J. McKenna, MD
Boston, MA
Fellow

Kevin X. McKennan, MD
Sacramento, CA
Fellow

Brian J. McKinnon, MD, MPH
Hagerstown, MD
Fellow

Sean McMenomey, MD
New York, NY
Fellow

Gorden T. McMurry, MD
Louisville, KY
Senior Fellow

Beth N. McNulty, MD
Lexington, KY
Fellow

Robert D. McQuiston, MD
Indianapolis, IN
Emeritus

Theodore R. McRackan, MD, MSc
Charleston, SC
Fellow

Cliff A. Megerian, MD
Cleveland, OH
Fellow

Rahul Mehta, MD
Jackson, MS
Fellow

Lawrence Z. Meiteles, MD
Yorktown Heights, NY
Fellow

Ted A. Meyer, MD, PhD
Charleston, SC
Fellow

Alan G. Micco, MD
Chicago, IL
Fellow

Elias Michaelides, MD
Elmhurst, IL
Fellow

Mia E. Miller, MD
Los Angeles, CA
Fellow

Josef M. Miller, MD
Ann Arbor, MI
Senior Associate

Lloyd B. Minor, MD
Stanford, CA
Fellow

Richard T. Miyamoto, MD
Indianapolis, IN
Senior Fellow

Aaron C. Moberly, MD
Brentwood, TN
Fellow

Aage R. Moller, MD
Dallas, TX
Senior Fellow

Timothy B. Molony, MD
New Orleans, LA
Fellow

Ashkan Monfared, MD
Washington, DC
Fellow

Edwin M. Monsell, MD
Issaquah, WA
Senior Fellow

Stephanie Moody Antonio, MD
Norfolk, VA
Fellow

Lindsay Scott Moore, MD
Menlo Park, CA
Fellow

Dennis M. Moore, MD
Maywood, IL
Senior Associate

Gary F. Moore, MD
Omaha, NE
Senior Fellow

William H. Moretz, MD
Augusta, GA
Senior Fellow

William Morgan, MD
Charleston, WV
Emeritus

Daniel Morrison, MD
Charlotte, NC
Fellow

Howard S. Moskowitz, MD, PhD
Bronx, NY
Fellow

Sarah Mowry, MD
Beachwood, OH
Fellow

Robert Muckle, MD
Englewood, CO
Fellow

Thomas J. Muelleman, MD
Shawnee, KS
Fellow

Tina Munjal, MD
Boston, MA
Trainee

Terrence P. Murphy, MD
Baton Rouge, LA
Senior Fellow

Euan Murugasu, MD
Clementi Park, Singapore
Associate

Marc-Elie Nader, MD
Houston, TX
Fellow

James G. Naples, MD
Needham, MA
Fellow

Ashley M. Nassiri, MD, MBA
Aurora, CO
Fellow

Julian M. Nedzelski, MD
Toronto, Ontario
Senior Fellow

Brian A. Neff, MD
Rochester, MN
Fellow

James Nelson, MD
La Jolla, CA
Emeritus

Erik G. Nelson, MD
Lake Forest, IL
Senior Fellow

Rick F. Nelson, MD, PhD
Indianapolis, IN
Fellow

Ralph Nelson, MD
Manchester, WA
Senior Fellow

Matthew Ng, MD
Las Vegas, NV
Fellow

Quyen T. Nguyen, MD, PhD
La Jolla, CA
Fellow

Anh T. Nguyen-Huynh, MD
Shaker Heights, OH
Fellow

Brian D. Nicholas, MD
Syracuse, NY
Fellow

Carrie Nieman, MD, MPH
Baltimore, MD
Associate

Alan J. Nissen, MD
Lincoln, NE
Senior Fellow

Evan Nix, MD
Chapel Hill, NC
Trainee

Yasuya Nomura, MD
Tokyo, Japan
Honorary

Kathryn Y. Noonan, MD
Boston, MA
Fellow

Michael A. Novak, MD
Champaign, IL
Fellow

Obinna I. Nwosu, MD
Winchester, MA
Trainee

Brendan O'Connell, MD
Charlotte, NC
Fellow

Lars Odkvist, MD
Linkoping, Sweden
Senior Associate

John S. Oghalai, MD
Los Angeles, CA
Fellow

Michael J. Olds, MD
Spokane, WA
Associate

Dennis P. O'Leary, MD
Temecula, CA
Senior Associate

Eric R. Oliver, MD
Roanoke, VA
Fellow

Robert C. O'Reilly, MD
Philadelphia, PA
Fellow

Benjamin T. Ostrander, MD, MSc
Minneapolis, MN
Trainee

Vincent B. Ostrowski, MD
Indianapolis, IN
Fellow

Robert M. Owens, MD
Plano, TX
Fellow

Levent N. Ozluoglu, MD
Ankara, Turkey
Senior Fellow

Joshua C. Page, MD
Dallas, TX
Fellow

Dorothy W. Pan, MD, PhD
Rochester, NY
Associate

Dennis G. Pappas, MD
Birmingham, AL
Senior Fellow

James J. Pappas, MD
Little Rock, AR
Senior Fellow

Dennis G Pappas, Jr., MD
Birmingham, AL
Fellow

Simon C. Parisier, MD
New York, NY
Senior Fellow

Steven M. Parnes, MD
Albany, NY
Senior Fellow

Lorne S. Parnes, MD
London, ON
Senior Fellow

Evan Patel, MD
San Francisco, CA
Trainee

Tirth Patel, MD
Ann Arbor, MI
Trainee

Varun S. Patel, MD
Hershey, PA
Associate

Aneesh Patel, MD
Pittsburgh, PA
Trainee

Neil S. Patel, MD
Salt Lake City, UT
Fellow

Ankita Patro, MD
Dallas, TX
Associate

Stanley Pelosi, MD
New Hyde Park, NY
Fellow

Kevin A. Peng, MD
Los Angeles, CA
Fellow

Angela Peng, MD
Houston, TX
Fellow

Myles L. Pensak, MD
Cincinnati, OH
Emeritus

Enrique R. Perez, MD
New York City, NY
Fellow

Philip L. Perez, MD
Pittsburgh, PA
Fellow

Rodney Perkins, MD
Woodside, CA
Emeritus

Elizabeth L. Perkins, MD
Nashville, TN
Fellow

Brian P. Perry, MD
McAllen, TX
Fellow

Brian R. Peters, MD
Dallas, TX
Fellow

Bradley P. Pickett, MD
Albuquerque, NM
Fellow

Harold C. Pillsbury, MD
Banner Elk, NC
Senior Fellow

Dennis S. Poe, MD, PhD
Boston, MA
Fellow

Marc Polanik, MD
Hummelstown, PA
Trainee

Ryan G. Porter, MD, MBA
Urbana, IL
Fellow

Kayla Powell, MD
Pasadena, TX
Trainee

W. Hugh Powers, MD
Simi Valley, CA
Senior Fellow

Sanjay Prasad, MD
Rockville, MD
Fellow

Leonard R. Proctor, MD
Baltimore, MD
Emeritus

Seth E. Pross, MD
San Jose, CA
Fellow

James C. Prueter, DO
Dayton, OH
Associate

Roy Wang Qu, MD
Loma Linda, CA
Trainee

Alicia M. Quesnel, MD
Boston, MA
Fellow

Alexandra E. Quimby, MD, MPH
Halifax, NS
Fellow

Steven D. Rauch, MD
Claremont, CA
Fellow

Mallory J. Raymond, MD
Jacksonville, FL
Fellow

Miriam I. Redleaf, MD
Chicago, IL
Fellow

Aaron K. Remenschneider, MD, MPH
Boston, MA
Fellow

Yin Ren, MD, PhD
Columbus, OH
Fellow

Bradford D. Ress, MD
Bigfork, MT
Senior Fellow

Graciela M. Reyes, APRN
Miami, FL
Affiliate

William J. Rice, MD
Grosse Pointe, MI
Emeritus

Alejandro Rivas, MD
Cleveland, OH
Fellow

Arnaldo L. Rivera, MD
Columbia, MO
Fellow

Habib Rizk, MD
Charleston, SC
Fellow

Joseph B. Roberson, MD
E. Palo Alto, CA
Fellow

Daniel S Roberts, MD
Farmington, CT
Fellow

Mendell Robinson, MD
Rehoboth, MA
Emeritus

Joseph Roche, MD
Middleton, WI
Fellow

Grayson Rodgers, MD
Birmingham, AL
Fellow

Brian Rodgers, MD
Dallas, TX
Fellow

Pamela C. Roehm, MD
Philadelphia, PA
Fellow

Peter S. Roland, MD
Eden, UT
Senior Fellow

J. Thomas Roland, Jr., MD
New York, NY
Fellow

Max L. Ronis, MD
Philadelphia, PA
Senior Fellow

Seth I. Rosenberg, MD
Sarasota, FL
Senior Fellow

Steven D. Rowley, MD
Lehi, UT
Senior Fellow

Robert J. Ruben, MD
New York, NY
Emeritus

Allan M. Rubin, MD, PhD
Holland, OH
Senior Fellow

Jay T. Rubinstein, MD, PhD
Seattle, WA
Fellow

Michael J. Ruckenstein, MD, MSc
Philadelphia, PA
Fellow

Douglas S. Ruhl, MD, MPH
DuPont, WA
Fellow

Christina L. Runge, PhD
Los Angeles, CA
Affiliate

Leonard P. Rybak, MD
Springfield, IL
Emeritus

Doron Sagiv, MD
Davis, CA
Associate

Hamed Sajjadi, MD
Los Gatos, CA
Fellow

Masafumi Sakagami, MD
Hyogo, Japan
Fellow

Hitomi Sakano, MD
Dallas, TX
Fellow

Ravi N. Samy, MD
Allentown, PA
Fellow

Peter L. Santa Maria, MD, PhD
Pittsburgh, PA
Fellow

Felipe Santos, MD
Boston, MA
Fellow

Joshua M. Sappington, MD
Saint Louis, MO
Fellow

Eric W. Sargent, MD
Farmington Hills, MI
Fellow

Robert Sataloff, MD
Philadelphia, PA
Senior Fellow

James E. Saunders, MD
Lebanon, NH
Fellow

Zahra Sayyid, MD, PhD
Baltimore, MD
Trainee

David G. Schall, MD, MPH
Colorado Springs, CO
Senior Associate

Natalie Schauwecker, MD
Nashville, TN
Trainee

William R. Schmitt, MD
Spokane, WA
Associate

Desi P. Schoo, MD
Columbus, OH
Fellow

David R. Schramm, MD, MSc
Ottawa, ON
Fellow

Arnold G. Schuring, MD
Warren, OH
Senior Fellow

Mitchell K. Schwaber, MD
Nashville, TN
Senior Fellow

Zachary G. Schwam, MD
New York, NY
Fellow

Nofrat Schwartz, MD
New Haven, CT
Associate

Seth R. Schwartz, MD, MPH
Seattle, WA
Fellow

Michael D. Seidman, MD
Celebration, FL
Fellow

Samuel H. Selesnick, MD
New York, NY
Fellow

Maroun T. Semaan, MD
Moreland Hills, OH
Fellow

Levent Sennaroglu, MD
Sihhiye, Turkey
Fellow

Mark A. Severtson, MD
Louisville, KY
Fellow

Joshua Sevier, Aud
Chicago, IL
Affiliate

Alexander B.G. Sevy, MD
Union City, CA
Fellow

Mohammad Seyyedi, MD
Atlanta, GA
Associate

Wayne T. Shaia, MD
Henrico, VA
Fellow

Fred T. Shaia, MD
Richmond, VA
Emeritus

Weiru Shao, MD
Auburndale, MA
Fellow

Scott B. Shapiro, MD
New Brunswick, NJ
Fellow

Jeffrey D. Sharon, MD
San Francisco, CA
Fellow

Edward F. Shaver, Jr., MD
Charlotte, NC
Senior Fellow

Paul F. Shea, MD
Memphis, TN
Fellow

M. Coyle Shea, MD
Memphis, TN
Emeritus

Clough Shelton, MD
Walla Walla, WA
Senior Fellow

Neil T. Shepard, MD
Missoula, MT
Emeritus

Matthew Shew, MD
St. Louis, MO
Fellow

Lucy Shih, MD
Pasadena, CA
Senior Fellow

Michael J. Shinners, M.D., MD
Fargo, ND
Fellow

Jack A. Shohet, MD
Newport Beach, CA
Fellow

Nael Shoman, MD
Halifax, NS
Fellow

Arthur K. Shukuryan, MD, PhD
Nalbandian, Armenia
Associate

Abraham Shulman, MD
Hollis Hills, NY
Emeritus

Jonathan Sillman, MD
Brookline, MA
Fellow

Herbert Silverstein, MD
Sarasota, FL
Senior Fellow

L. Clark Simpson, MD
Birmingham, AL
Fellow

George T. Singleton, MD
Gainesville, FL
Emeritus

Pedrom C. Sioshansi, MD
Winston-Salem, NC
Fellow

Aristides Sismanis, MD
Richmond, VA
Senior Fellow

Piotr H. Skarzynski, MD, PhD
Warsaw, Poland
Associate

Henryk Skarzynski, MD
Warsaw, Poland
Associate

Patrick W. Slater, MD
Austin, TX
Fellow

William H. Slattery III, MD
Los Angeles, CA
Fellow

Eric L. Slattery, MD
Salt Lake City, UT
Fellow

Miriam S. Smetak, MD, MSc
Orange, CA
Associate

Peter G. Smith, MD
Grover, MO
Senior Fellow

Eric E. Smouha, MD
New York, NY
Fellow

Samuel A. Spear, MD
Palm Beach Gardens, FL
Fellow

Gershon J. Spector, MD
St. Louis, MO
Emeritus

Neil M. Sperling, MD
New York, NY
Fellow

Jeffrey P. Staab, MD
Rochester, MN
Associate

Hinrich Staecker, MD, PhD
Kansas City, KS
Fellow

Konstantina M. Stankovic, MD, PhD
Palo Alto, CA
Fellow

Ted O. Steffen, MD
Louisville, KY
Senior Fellow

Shawn M. Stevens, MD
Phoenix, AZ
Fellow

C. Matthew Stewart, MD, PhD
Baltimore, MD
Fellow

Katrina R. Stidham, MD
Tuckahoe, NY
Fellow

Ian S. Storper, MD
New York, NY
Fellow

Barry Strasnick, MD
Norfolk, VA
Fellow

Kaytlyn B. Strawser, APRN
Lexington, KY
Affiliate

Emily Z. Stucken, MD
Ann Arbor, MI
Fellow

Joshua Sturm, MD, PhD
New York, NY
Associate

Daniel R. Sun, MD
Cincinnati, OH
Fellow

Krish Suresh, MD
San Diego, CA
Trainee

Jun-Ichi Suzuki, MD
Tokyo, Japan
Emeritus

Maja Svrakic, MD
New Hyde Park, NY
Fellow

Alex D. Sweeney, MD
Houston, TX
Fellow

Mark J. Syms, MD
Phoenix, AZ
Fellow

Donald Tan, MD
Dallas, TX
Trainee

Kareem O. Tawfik, MD
Nashville, TN
Fellow

Michael T. Teixido, MD
Newark, DE
Fellow

Steven A. Telian, MD
Dexter, MI
Senior Fellow

Fred F. Telischi, MD
Miami, FL
Fellow

Idit Tessler, MD, PhD
Ramat Gan, Israel
Trainee

Nirmal Thapa, MD
Saint Augustine, FL
Associate

Bradley S. Thedinger, MD
Kansas City, MO
Senior Fellow

Britt A. Thedinger, MD
Omaha, NE
Fellow

Nicholas J. Thompson, MD
Chapel Hill, NC
Fellow

Scott W. Thompson, MD
Columbia, SC
Fellow

Adam Thompson-Harvey, MD
Washington, DC
Associate

Jens Thomsen, MD
Hellerup, Denmark
Senior Associate

Elizabeth H. Toh, MD, MBA
Boston, MA
Fellow

Anthony M. Tolisano, MD
Kensington, MD
Fellow

Douglas J. Totten, MD, MBA
Indianapolis, IN
Trainee

Joseph B. Touma, MD
Huntington, WV
Senior Associate

B. Joseph Touma, MD
Huntington, WV
Associate

Betty Tsai Do, MD
Danville, CA
Fellow

Nathan C. Tu, MD
Albany, NY
Fellow

Debara L. Tucci, MD, MBA
Bethesda, MD
Senior Fellow

Aaron Tward, MD, PhD
San Francisco, CA
Fellow

Safter A. Ulubil, MD
Istanbul, Turkey
Associate

Joseph A. Ursick, MD
Kansas City, MO
Fellow

Carla V. Valenzuela, MD, MSc
Fairfax, VA
Fellow

Galdino E. Valvassori, MD
Wilmette, IL
Senior Associate

Andrea Vambutas, MD
New Hyde Park, NY
Fellow

Mark J. Van Ess, DO
Springfield, MO
Associate

Varun Varadarajan, MD
Sacramento, CA
Fellow

Jordan J. Varghese, MD
St. Louis, MO
Trainee

David M. Vernick, MD
West Roxbury, MA
Senior Fellow

Adam S. Vesole, MD
Philadelphia, PA
Trainee

Eloy Villasuso III, MD
Miami, FL
Fellow

Christophe G. Vincent, MD
Lille, France
Associate

Esther X. Vivas, MD
Atlanta, GA
Fellow

Courtney C. J. Voelker, MD, PhD
Los Angeles, CA
Fellow

Peter G. Volsky, MD
Norfolk, VA
Fellow

Peter G. Von Doersten, MD
Missoula, MT
Fellow

Richard Voorhees, MD
Seattle, WA
Senior Fellow

Nopawan Vorasubin, MD
Los Angeles, CA
Fellow

Jeffrey T. Vrabec, MD
Houston, TX
Fellow

P. Ashley Wackym, MD
New Brunswick, NJ
Fellow

David D. Walker, MD
Chicago, IL
Fellow

Erika M. Walsh, MD
Birmingham, AL
Fellow

Hayes H. Wanamaker, MD
Syracuse, NY
Senior Fellow

George Wanna, MD, MHCM
New York, NY
Fellow

Bryan K. Ward, MD
Baltimore, MD
Fellow

Frank M. Warren III, MD
Portland, OR
Fellow

Theodore A. Watson, MD
Anderson, SC
Senior Fellow

Jack J. Wazen, MD
Sarasota, FL
Senior Fellow

Peter Weber, MD, MBA
Boston, MA
Fellow

Roger E. Wehrs, MD
Tulsa, OK
Senior Fellow

Heather M. Weinreich, MD
Wilmette, IL
Fellow

Alfred Weiss, MD
Meadville, PA
Senior Fellow

Peter A. Weisskopf, MD
Phoenix, AZ
Fellow

Christopher M. Welch, MD, PhD
Ann Arbor, MI
Fellow

D. Bradley Welling, MD, PhD
Boston, MA
Fellow

Brian D. Westerberg, MD
Vancouver, BC
Fellow

Stephen J. Wetmore, MD
Morgantown, WV
Emeritus

Mark E. Whitaker, MD
Hershey, PA
Fellow

Thomas White, MD
Walnut Creek, CA
Fellow

David W. White, MD
Tulsa, OK
Senior Fellow

Helena Wichova, MD
Tucson, AZ
Fellow

Cameron C. Wick, MD
Cleveland, OH
Fellow

Mark H. Widick, MD
Delray Beach, FL
Fellow

R. Mark Wiet, MD
Winfield, IL
Fellow

Richard J. Wiet, MD
Sawyer, MI
Emeritus

Brent J. Wilkerson, MD
Piedmont, SC
Fellow

Eric P. Wilkinson, MD
Meridian, ID
Fellow

Thomas O. Willcox, MD
Philadelphia, PA
Fellow

Robert A. Williamson, MD
Austin, TX
Fellow

Arianna Winchester, MD
New York, NY
Trainee

Mark L. Winter, MD
Lubbock, TX
Senior Fellow

Sean R. Wise, MD
Lyme, NH
Fellow

Marc Wong, MD
Honolulu, HI
Senior Associate

Kevin Wong, MD
Newark, NJ
Associate

Emily C Wong, MD
Dallas, TX
Trainee

Matthew Wong, MD
Medina, WA
Fellow

Charles I. Woods, MD
Syracuse, NY
Fellow

Erika A. Woodson, MD
Poway, CA
Fellow

Benjamin J. Wycherly, MD
Farmington, CT
Associate

Adam Y. Xiao, MD, PhD
Los Angeles, CA
Trainee

Takao Yabe, MD
Tokyo, Japan
Associate

Kristen L. Yancey, MD
New York, NY
Fellow

Charles W. Yates, MD
Indianapolis, IN
Fellow

Robert J. Yawn, MD, MBA
Germantown, TN
Fellow

Yu-Lan Mary Ying, MD
Millburn, NJ
Fellow

Noriko Yoshikawa, MD
Oakland, CA
Fellow

Nancy M. Young, MD
Chicago, IL
Fellow

Dayton L. Young, MD
Galveston, TX
Fellow

John W. Youngblood, MD
Fredericksburg, TX
Senior Fellow

Heng-Wai Yuen, MD
Singapore
Fellow

John J. Zappia, MD
Farmington Hills, MI
Fellow

Daniel M. Zeitler, MD
Seattle, WA
Fellow

Kevin Y. Zhan, MD
Chicago, IL
Fellow

Lisa Zhang, MD
Columbus, OH
Trainee

Michael Zoller, MD
Savannah, GA
Senior Fellow

Steven A. Zuniga, MD
Huntington Beach, CA
Fellow

in Memoriam

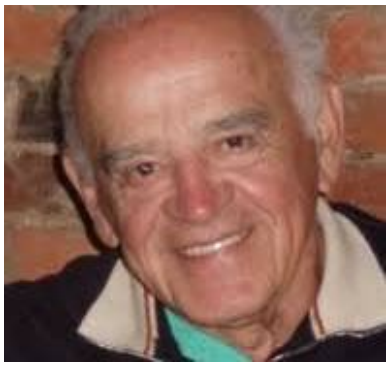
The ANS Administrative office was notified of the following members passing since the last Spring meeting.

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

Jack M. Kartush, MD
Inducted in 1985
ANS President 1996-97
ANS Secretary/Treasurer 92-95
Passed June 22, 2025

Thomas J. Balkany, MD
Inducted in 1982
1st Recipient of the Noel Cohen Award for Contributions to Otology & Neurotology
Passed July 29, 2025

Joseph B. Nadol Jr., MD
Inducted in 1983
AOS President 2009
Award of Merit 2012
Passed August 2, 2025



Richard R. Gacek, MD
Inducted in 1970
ANS President 1983-84
AOS President 1988
Award of Merit 1991
Passed September 5, 2025

Fredric W. Pullen, MD
Inducted in 1974
ANS President 1992-93
Passed October 1, 2025

George T. Singleton, MD
Inducted in 1974
Passed January 31, 2026