AMERICAN OTOLOGICAL SOCIETY

PROGRAM, ABSTRACTS and MORE

One Hundred Fifty Ninth Annual Meeting

of the

American Otological Society

April 24-25, 2026

Sheraton Phoenix Downtown
Phoenix Convention Center
Phoenix, AZ

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AMERICAN OTOLOGICAL SOCIETY
COUNCIL MEMBERS
JULY 1, 2025 - JUNE 30, 2026

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Lurie Children's Hospital of Chicago - Chicago, IL

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Stanford University - Stanford, CA

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Duke University - Durham, NC

AMERICAN OTOLOGICAL SOCIETY

MISSION STATEMENT

The American Otological Society is a world-leading association in ear-related health care. We collaborate across institutional and international boundaries to advance otology, identify and support promising research, cultivate and disseminate excellence in effective and compassionate clinical practices, and elevate all those dedicated to the field of otology through education on cutting-edge discoveries and innovations.

VISION STATEMENT

The American Otological Society, a global association of preeminent physicians, surgeons, scientists and advocates for the advancement of otology, is dedicated to enabling optimal health, communication, and life experiences for all individuals impacted by hearing loss, balance disorders, and other diseases of the ear and lateral skull base.

OVERVIEW

Purpose

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

Target Audience

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

Activities

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

Content

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

Expected Results

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

159th Annual AOS Program Objectives & Educational Activity Details

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

1. Hearing preservation in cochlear implant surgery – how best do we preserve residual hearing in patients undergoing cochlear implantation and thereby expand candidacy criteria for the cochlear implant?
2. Can we assess the intracochlear trauma caused by cochlear implantation? What is the intracochlear trauma caused by the insertion of the cochlear implant electrode array and does that have implications for surgical technique and hearing preservation? Fibrosis? Neo-ossification?
3. Trends in Medicare reimbursement for cochlear implantation over the last decade:2012-2024 – what are the barriers and limitations of reimbursement?
4. Understanding hearing loss, dizziness, and balance disorders is limited by the inability to "biopsy" the inner. Inner ear biopsy is impossible due to lack of access and the ultimate loss of function with the biopsy itself. Human temporal bone histopathology provides a window into inner function anatomy, function, and pathophysiology. What can we understand from human temporal bone histopathology correlated to clinical phenotypes, including sudden sensorineural hearing loss, vestibular schwannoma, cochlear implantation, and genetic hearing loss?
5. Chronic ear disease/cholesteatoma remains a significant cause of morbidity for our patients. Can modern-day MR imaging techniques advance our understanding and management of cholesteatoma?
6. In-office management of chronic tympanic membrane perforation
7. The association of cognitive impairment and hearing loss has recently been identified and acknowledged. Are there cognitive performance differences in patients with unilateral audiovestibular disorders?
8. Present a genetic registry for hearing loss
9. How and where in the brain are music and musical creativity mapped?
10. Improving cochlear implant outcomes

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?

The rehabilitation of human hearing loss is at the heart of modern otologic and neurotologic practice; the cochlear implant, a miracle of modern medicine, has the potential to restore hearing to patients with severe-profound sensorineural hearing loss, even children with congenital hearing loss. As this technology has improved, the candidacy criteria – who might benefit from an implant – has expanded to include patients with residual hearing, even moderate-severe hearing loss. With new technology and new surgical technology, practitioners need to know best practices with regard to cochlear implantation – candidacy criteria, optimal insertion techniques to minimize cochlear trauma and preserve residual hearing, and optimizing cochlear implant outcomes.

Post-mortem human temporal bone histopathology can also help us understand cochlear pathology to design better treatments for common auditory pathologies including sudden sensorineural hearing loss, vestibular schwannoma, cochlear implantation, and genetic hearing loss.

Practitioners are increasingly appreciating the role of genetics in hearing loss. A genetic registry has been developed to catalogue genetic hearing loss. Practitioners need to know the existence of this registry and the potential to offer patients the opportunity to submit their genetic data to this registry to enhance our understanding of hearing loss.

It is well-known that cochlear implants, while excellent for speech and language, do not convey the same benefit in music. Practitioners need to know the central nervous system underpinnings of music translation to counsel patients on post-implant music appreciation.

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

- **Competence**:
  Identify best cochlear implant candidates. Counsel patients about the benefits and limitations of the implant.
  Understand the intracochlear trauma caused by surgical cochlear implantation.
  By reviewing human temporal bone histopathology of patients suffering sudden sensorineural hearing loss, practitioners should be able to counsel patients on this condition and develop best treatment algorithms for hearing recovery.

- **Performance**:
  Learn best surgical techniques for cochlear implantation including best techniques for preserving residual hearing.
  Know the benefits and limits of MRI imaging in cholesteatoma disease and be able to use the MRI modality for cholesteatoma surveillance.
  Practitioners can evaluate patients' movements to assess for vestibular loss.

- **Patient Outcomes**:
  Improved hearing for our patients with the greatest hearing loss.
  Better/improved management of cholesteatoma and its surveillance.
  Reduce risk of facial nerve injury in otologic surgery and minimize expense of facial nerve monitoring

How do you anticipate this activity improving health care systems?

Cochlear implants are expensive devices, with "off the shelf" pricing approaching $30,000. Practitioners must utilize healthcare resources wisely. Thus, an understanding of best candidates for cochlear implants will improve patient care and provide optimal utilization of healthcare resources.

Proper surveillance of cholesteatoma is critical in the management of this disease. How best to use imaging technology, specifically MRI, to surveil cholesteatoma will ensure wise, targeted, and careful use of healthcare resources.

Placement of a cochlear implant does not guarantee complete hearing rehabilitation, especially among children with severe-profound hearing loss or congenital hearing loss. Hospital systems must offer a multidisciplinary approach to hearing rehabilitation, to include audiologists, speech language pathologists, child-life specialists, social workers, and others to ensure optimal use of the implant for hearing habilitation.

Overall, the knowledge provided by this activity will increase the ability of physicians and surgeons to engage patients and health systems about the importance of otologic diseases as well as provide effective means of addressing hearing loss and other otologic conditions to improve public health.

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

Increased knowledge of the candidacy criteria for cochlear implantation and best practices for surgical implantation will help practitioners publicize the efficacy of the device and normalize the implant among the hard of hearing and public.

The HearGene Connect Registry, a national initiative, aims to gather genetic and clinical data for people with inherited hearing loss to advance personalized medicine, connect patients with research and new therapies like gene treatments. It functions as a research tool, collecting detailed information on genetic mutations and clinical outcomes to build a natural history of hearing loss, facilitating future trials and tailored care for rare genetic hearing conditions, making it crucial for developing inner ear therapeutics. Our audience of ear specialists must be made aware of this important initiative.

The association between hearing loss and cognitive impairment has been established; presentation at the conference addresses *unilateral* hearing loss and whether there is an association with cognitive impairment.

State the learning objectives for this activity:

1. Compare manual insertion to robotic insertion of the cochlear implant electrode array in terms of intracochlear trauma and hearing outcomes.
2. Describe the role of MRI in the surveillance of cholesteatoma.
3. Recognize the importance of the HearGene Connect registry and how it aims to gather genetic and clinical data of people with inherited hearing loss, and the implications for future, personalized treatment.
4. Appreciate the complexity of music, how it is encoded in the brain, and the challenges faced by cochlear implants in translating music to the brain.
5. Distinguish the differences between cochlear implantation in children with bilateral vs. unilateral hearing loss and describe the trajectory of speech and language development in children with single sided deafness and cochlear implantation
6. Apply concepts of a multidisciplinary approach to the care of patients with cochlear implants.

Explain why the selected educational format(s) is considered appropriate for the setting, objectives and desired results of this activity.

This program's educational formats have been successful in the past in achieving similar education objectives in similar settings based upon survey-acquired feedback from attendees. A post-activity survey was conducted at the end of last year's meeting identifying optimal learning formats for this didactic and scientific conference. The above activities were deemed best for conveying important and meaningful information in the care of patients with otologic disease.

Bradley W. Kesser, MD
AOS Education Director

Nancy M. Young, MD
AOS President

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 American Otological Society. The American College of Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

AMA PRA Category 1 Credits™

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

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.

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 AOS registration table and on the AOS website.

THE AMERICAN OTOLOGICAL SOCIETY WOULD LIKE TO THANK THE FOLLOWING MEMBERS FOR THEIR CONTRIBUTION TO THE 2026 AOS SCIENTIFIC PROGRAM AS A PROGRAM ADVISORY COMMITTEE MEMBER, PROGRAM MODERATOR and/or POSTER JUDGE.

PROGRAM ADVISORY COMMITTEE

Nancy M. Young, MD, AOS President, Chair
Bradley W. Kesser, MD, AOS Education Director
(in alphabetical order)
Yuri Agrawal, MD, MPH
Kevin D. Brown, MD, PhD
Wade W. Chien, MD
Maura K. Cosetti, MD
Sharon L. Cushing, MD, MSc
Soha N. Ghossaini, MD
Richard K. Gurgel, MD, MSCI
David S. Haynes, MD, MMHC
David M. Kaylie, MD, MS
Anil K. Lalwani, MD
Kenneth H. Lee, MD
Aaron C. Moberly, MD
Christina Runge, PhD
Erika A. Woodson, MD
Daniel M. Zeitler, MD

PROGRAM MODERATORS

Yuri Agrawal, MD, MPH
Wade W. Chien, MD
Maura K. Cosetti, MD
Sharon L. Cushing, MD, MSc
Soha N. Ghossaini, MD
Richard K. Gurgel, MD, MSCI
David S. Haynes, MD, MMHC
Michael Hoa, MD
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Aaron C. Moberly, MD
Christina Runge, PhD
Andrea Vambutas, MD
Erika A. Woodson, MD
Daniel M. Zeitler, MD

POSTER JUDGES

Wade W. Chien, MD
Maura K. Cosetti, MD
Sharon L. Cushing, MD, MSc
Anil K. Lalwani, MD

Thank You!

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 AOS 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 ANS 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 AOS 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 Otological 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"
October 16, 2026
Los Angeles, CA
JW Marriott Los Angeles

AOS 160th Annual Meeting in conjunction with COSM
April 9-11, 2027
Sheraton Grand Seattle/Convention Center
Seattle, WA

The Abstract deadline for the AOS 160th Annual meeting is Thursday, October 22, 2026, 11:59 PM PT.
Abstract Instructions and the submission form will be available on the AOS website after September 1st

ADMINISTRATIVE OFFICE
Kristen Bordignon, Administrator
Douglas Gossard, Administrator
AOS Administrative Office
5830 1st St. N.
St. Petersburg, FL 33703
Ph: 217-638-0801 / Fax: 727-800-9428
Email: administrator@americanotologicalsociety.org
Website: www.americanotologicalsociety.org

AMERICAN OTOLOGICAL SOCIETY
PRELIMINARY PROGRAM
159th Annual Meeting
April 24-25, 2026
Phoenix, AZ

FRIDAY, APRIL 24, 2026

1:00 BUSINESS MEETING and **NEW MEMBER INTRODUCTION**
(Open to registered Members and Non-members - Badge required for admittance)

1:30 SCIENTIFIC PROGRAM

1:30 WELCOME & OPENING REMARKS BY THE PRESIDENT
Nancy M. Young, MD

1:32 PRESIDENTIAL CITATIONS
Karen I. Berliner, PhD
Kevin D. Brown, MD, PhD
Teresa H. Caraway, PhD
René H. Gifford, PhD
Ronna Hertzano, MD, PhD
Karen Iler Kirk, PhD
Debara L. Tucci, MD, MS, MBA

1:42 INTRODUCTION OF GUEST OF HONOR
Nancy M. Young, MD

1:44 GUEST OF HONOR LECTURE
Using Neural Data to Predict Language Development Across Populations of Children
Patrick C.M. Wong, PhD
Director, Brain and Mind Institute
Professor of Cognitive Neuroscience & Linguistics
The Chinese University of Hong Kong

2:24 SESSION A - ADVANCES IN COCHLEAR IMPLANTATION
David S. Haynes, MD, MMHC & Kenneth Lee, MD, PhD, Moderators

Influence of Cochlear Microanatomy on Hearing Preservation in Cochlear Implant Recipients
Elena Quinonez Del Cid, BS
Ashley Micuda, BSc
Margaret T. Dillon, AuD, PhD
Sumit Agrawal, MD
Hanif M. Ladak, PhD
Kevin D. Brown, MD, PhD

Hearing Preservation Across Different Electrode Arrays: Robotic Versus Manual Insertion
Carlos A. Perez-Heydrich, MD
Elena Quinonez Del Cid, BS
Margaret T. Dillon, AuD, PhD
A. Morgan Selleck, MD
Matthew M. Dedmon MD, PhD
Kevin D. Brown MD, PhD
Nicholas J. Thompson, MD

Iowa CI Trauma Tool: A Deep Learning Approach to Cochlear Implant Trauma Assessment from CT scans
Aseem Jain, MD, MSE
Nicholas George-Jones, MD
Rachel Scheperle, AuD, PhD
Joshua Pinzour, BS
Marlan Hansen, MD
Alexander Claussen, MD

Comparing Low-Frequency Threshold Functions of Intracochlear Electrocochleography and Perioperative Pure Tone Audiometry
Jordan J. Varghese, MD, MSCI
Amit Walia, MD, MSCI
Matthew A. Shew, MD
Amanda J. Ortmann, PhD
Nedim Durakovic, MD
Jacques A. Herzog, MD
Craig A. Buchman, MD

2:47 DISCUSSION with MODERATORS

2:51 BREAK WITH EXHIBITORS

3:21 EXPERT PRESENTATION
Introduction by Moderator, Anil K. Lalwani, MD
Supporting Innovation in Human Temporal Bone Research
Debara L. Tucci MD, MS, MBA

3:31 SESSION B - HUMAN TEMPORAL BONE RESEARCH: BRIDGING BASIC SCIENCE & CLINICAL PRACTICE
Aaron C. Moberly, MD, PhD & Wade W. Chien, MD, Moderators

Whole Genome Sequencing of Archival Human Temporal Bones – Identification and Characterization of the DFNA17 Mutation
Adam Y. Xiao, MD, PhD
Achilles Kanaris, BS
Shin-ya Nishio, MD
Shin-ichi Usami, MD
Ivan A. Lopez, PhD
Gail Ishiyama, MD
Akira Ishiyama, MD

Macrophage and Schwann Cell Alterations in Sudden Sensorineural Hearing Loss: Insights from Human Temporal Bones
Drew J. Montigny BS
Soomin Myoung BS
Andrew M. Jung BS
Alex J. Lim
Jennifer O'Malley BA
Andreas Eckhard MD
Alicia Quesnel MD
Judith S. Kempfle MD

Histopathological Considerations for Indication of Cochlear Implant for Patients with Vestibular Schwannoma
Shinya Ohira, MD, PhD
Ivan Lopez, PhD
Maya Harary, MD
Maureen Laufer, AuD
Gail Ishiyama, MD
Gregory P. Lekovic, MD
Akira Ishiyama, MD

Histopathologic Diversity in Idiopathic Sudden Sensorineural Hearing Loss: A Multi-Institutional Temporal Bone Study
Diana M. Correa, MD
Michael S. Castle, MD
Rafael da Costa Monsanto, MD PhD
Abbie K. Hall, BS
Ivan A. López, PhD
William H. Slattery, MD
Sebahattin Cureoglu, MD
Meredith E. Adams, MD MS
Akira Ishiyama, MD
Alicia M. Quesnel, MD

Peri-Insertional Cochlear Implant Electrode Forces for Manual Versus Rigidly-Fixed and Handheld Robotic Insertion
Maxwell Bergman, MD
Nathan Kemper, MD
Constantinos Nikou
Zachary Urdang, MD PhD
Alexander Claussen, MD
Bruce J. Gantz, MD
Marlan R. Hansen, MD

Real-time Intracochlear Distance Sensing and Navigation using Optical Coherence Tomography
Pawina Jiramongkolchai, MD
Senyue Hao, BS
Ratul Paul, PhD

AJ Adkins, MS
Jacques Herzog, MD
Craig Buchman, MD
Chao Zhou PhD

4:05 DISCUSSION with MODERATORS

4:10 ANNOUNCEMENT OF AOS and ANS POSTER PRESENTATION WINNERS
Bradley Kesser, MD - AOS Education Director
Christine Dinh, MD - ANS Education Director

4:13 EXPERT PRESENTATION
Introduction by Maura K. Cosetti, MD
Cellular-level Imaging of the Inner Ear
Konstantina M. Stankovic, MD, PhD

4:26 PANEL
Can Today's MRI Technology Transform Cholesteatoma Clinical Practice?
Andrea Vambutas, MD, Moderator
Nikolas H. Blevins, MD
Maura E. Ryan, MD
Brandon Isaacson, MD
Samantha Anne, MD, MS

5:06 CLOSING REMARKS/ADJOURN
Nancy M. Young, MD

5:15 AOS MEMBER PHOTOGRAPH

5:30 MEET THE AUTHORS POSTER RECEPTION *(CONVENTION CENTER)*
AOS, ANS, ARS & ASPO

6:00 WiN RECEPTION (WOMEN IN NEUROTOLOGY) *(SHERATON)*

7:00 ANS PRESIDENT'S RECEPTION *(SHERATON)*

SATURDAY, APRIL 25, 2026

7:00 BUSINESS MEETING *including Committee Reports*
(All welcome – Coffee, tea and continental breakfast for all registered AOS attendees)

7:30 SCIENTIFIC PROGRAM
(Open to registered Members and Non-members – Badge required for admittance)

7:30 WELCOME & OPENING REMARKS BY THE PRESIDENT
Nancy M. Young, MD

7:32 INTRODUCTION OF CLINICIAN SCIENTIST AWARD LECTURE
David M. Kaylie, MD, MS, Moderator

Spatiotemporal Dynamics and Mechanism of Intracochlear Fibrosis & Neo-ossification after Cochlear Implantation
Alexander D. Claussen, MD
University of Iowa
AOS Clinician Scientist Award Recipient, 2023-2025

7:40 DISCUSSION with MODERATOR

7:42 SESSION C - A MIDDLE & MASTOID MATTERS: REGENERATION, CHOLESTEATOMA & FACIAL NERVE MONITORING
Erika Woodson, MD & Soha Ghossaini, MD, Moderators

Randomized Double-Blinded Placebo-Controlled Clinical Trial of In-Office Regeneration of Chronic Tympanic Membrane Perforations: Preliminary Results
David R. Friedmann, MD, MSc
Ashley Feng, BS
Emmanuel Garcia-Morales, PhD
Victoria Lancaster, RN
Daniel Jethanamest, MD
J. Thomas Roland Jr., MD

Efficacy of Tympanic Membrane Regeneration Therapy for Secondary Cholesteatoma with Tympanic Membrane Perforation
Shin-ichi Kanemaru, MD, PhD
Tomoya Yamaguchi, MD
Rie Kanai, MD
Eriko Otonari, MD
Maki Yamasoba, MD
Yuki Fujii, MD
Toshiki Maetani, MD, PhD

Single-Cell RNA Sequencing Reveals Heterogeneity and Cell-Cell Interactions of Cholesteatoma Keratinocytes
Daniel R. Romano, MD
Song-Zhe Li, MD, PhD
Richard A. Chole, MD, PhD
Michael Hoa, MD
Sidharth V. Puram, MD, PhD
Keiko Hirose, MD

Cost of Facial Nerve Monitoring
Sammy Y. Gao, BS
Warren B. Chun, MD
Tyler M. Rist, MD
Robert F. Labadie MD, PhD

8:05 DISCUSSON with MODERATORS

8:09 SESSION D - NEW APPROACHES & FINDINGS TO ADVANCE MANAGEMENT OF AUDIOVESTIBULAR DISEASE

Christina Runge, PhD & Michael Hoa, MD, Moderators

Machine Learning Identification of Hearing Loss from Natural Speech
Peter R. Dixon, MD, MSc
Paul Heider PhD
Carl Ehrett PhD
Theodore R. McRackan, MD
Judy R. Dubno, PhD
Leslie A. Lenert, MD, MS

Electron Microscopy of Otoconia in a Hypercalcemic Mouse Model
Andriy O. Grynyk, BS
Callie S. Burke, BS
Richard Pellegrino, MS
Jessia Costa, DMD, PhD
Andrew Arnold, MD
Kourosh Parham, MD, PhD

Kinematic Methods for Identification of Moderate Vestibular Loss
Morgan A. Terry, MD
Hannah R. Smith, BS
Camellia K. Liu, BS
Daniel B. Putterman, AuD
Jae W. Lee, PhD
Timothy E. Hullar, MD
Angela C. Garinis, PhD

Cognitive Performance Differs Among Adults with Unilateral Audiovestibular Disorders: A Pilot Study
Maura K. Cosetti, MD
Carly Feist, BA
Liraz Aire, PhD
Jen Kelly, DPT
Anat Lubetzky, PT, PhD

Surgical Treatments Decrease the Association Between CHL Pathologies and Depression in the All of Us Research Program
Hannah N. W. Weinstein, BA
S. Dillon Powell, ME (Presenter)
Ramzi K. Elased, BA
Lauren H. Tucker, MD
Justin S. Golub, MD, MS

8:38 DISCUSSION with MODERATORS

8:42 INTRODUCTION OF SAUMIL N. MERCHANT MEMORIAL LECTURE
Nancy M. Young, MD

8:44 SAUMIL N. MERCHANT MEMORIAL LECTURE
Hearing in High Definition: Cochlear Implants and Gene Therapy Unplugged

Catherine Birman, OAM, MBBS, PhD FRACS
Clinical Professor, Sydney University Faculty of Medicine and Health
Macquarie University Faculty of Medicine and Health Sciences
Children's Hospital at Westmead, Sydney, Australia
Royal Prince Alfred Hospital & Macquarie University Hospital, Sydney, Australia
NextSense, Sydney, Australia

9:24 EXPERT PRESENTATION
Introduction by Yuri Agrawal, MD, MPH
HearGene Connect Registry for Personalized Healthcare
Ronna Hertzano, MD, PhD

9:39 DISCUSSION with MODERATOR

9:42 BREAK WITH EXHIBITORS

10:12 EXPERT PRESENTATION
Introduction by Richard K. Gurgel, MD, MSCI
Imaging Imagination: Musical Creativity & the Brain
Charles Limb, MD

10:29 DISCUSSION with MODERATOR

10:32 SESSION E - COCHLEAR IMPLANTATION - OUTCOMES & ACCESS
Sharon L. Cushing, MD, MSc & Daniel Zeitler, MD, Moderators

Timing of Cochlear Implantation Influences Neuropsychiatric Outcomes in Sensorineural Hearing Loss
Atri Bhattacharyya, BA
Judith S. Kempfle, MD

Tinnitus Improvement Predicts Domain-Specific Quality of Life Gains after Cochlear Implantation
Sophia Chehade, BS
Tamara Mijovic, MD
Emily Kay-Rivest, MD

Temporal and Spectral Contributions to Music Perception Among Hearing-Assistive Device Users
Emmeline Y. Lin, BS
Brooke Barry, BS, BA
Patpong Jiradejvong, MS
Karen C. Barrett, PhD
Nicole T. Jiam, MD

Downstream Effects of Regulatory and Reimbursement Expansion on Cochlear Implantation: A 2012-2024 Medicare Analysis
Akshay Warrier, BA
Ryan Bartholomew, MD
Liliya Benchetrit, MD

Daniel J. Lee, MD

Binaural Hearing and Language Development after Cochlear Implantation in Children with Congenital Single-Sided Deafness
Piotr H. Skarzynski, MD, PhD, MSc
Dorota Pastuszak, MSc
Anita Obrycka, PhD
Artur Lorens, Prof
Anna Ratuszniak, PhD
Henryk Skarzynski, Prof

Spoken Language Outcomes after Early Cochlear Implantation in a Diverse, Multi-Institutional Cohort of Congenitally Deaf Children
Evan J. Patel, MD
Samantha Anne, MD
Daniela Carvalho, MD
Laura Covello, MA, CCC-A
Jason Park, MD, PhD
Patricia Yoon, MD
Dylan K. Chan, MD, PhD

11:06 DISCUSSION with MODERATORS

11:10 PANEL
Beyond the OR - Multidisciplinary Care to Improve CI Outcomes
Nancy M. Young, MD, Moderator
Kevin D. Brown, MD, PhD
René H. Gifford, PhD
Jace Wolfe, PhD

11:55 INTRODUCTION OF INCOMING PRESIDENT
Nikolas H. Blevins, MD

CLOSING REMARKS
Nancy M. Young, MD

12:00 ADJOURN

6:00 AOS PRESIDENT'S RECEPTION & BANQUET *(MEMBERS & INVITED GUESTS ONLY)*
Advance ticket purchase required on the AOS website

SELECTED ABSTRACTS

ORAL PRESENTATIONS

IN ORDER OF PRESENTATION

159th Annual Meeting
AMERICAN OTOLOGICAL SOCIETY

April 24-25, 2026
Sheraton Phoenix Hotel
Phoenix Convention Center
Phoenix, AZ

Influence of Cochlear Microanatomy on Hearing Preservation in Cochlear Implant Recipients

Elena Quinonez Del Cid, BS; Ashley Micuda, BSc; Margaret T. Dillon, AuD, PhD
Sumit Agrawal, MD; Hanif M. Ladak, PhD; Kevin D. Brown, MD, PhD

Objective: Identify cochlear microanatomic variables that influence hearing preservation in adult cochlear implant (CI) recipients

Study Design: Retrospective review

Setting: Tertiary academic referral center

Patients: 42 adult CI recipients with preoperative unaided thresholds ≤45 dB hearing level (dB HL) at 250 Hz

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

Main Outcome Measures: Preoperative computed tomography (CT) scans were automatically segmented using deep learning to extract scala tympani (ST) volume, cochlear duct length (CDL), and cross-sectional measurements (height, width, area, diameter) at 15° increments. Pre- and post-operative CTs were aligned to determine cross-sectional measures at the most apical electrode (E1) and angular insertion depth (AID). Low frequency pure tone average (LFPTA) was calculated from unaided thresholds at 125, 250, and 500 Hz. Change in LFPTA was computed for each subject at activation and at 6 months.

Results: A linear mixed effects model analyzed the effects of cochlear microanatomy (i.e., ST volume, CDL, AID), cross-sectional measurements at E1 (height, width, area, and diameter), as well as interval, age at surgery, and biological sex on the postoperative shift in LFPTA. This model demonstrated significant effects of non-anatomic variables including age ($p=0.05$) and sex ($p=0.01$). Interval ($p=0.26$) did not affect LFPTA change. Of the anatomic variables, only ST volume demonstrated a significant effect ($p=0.005$). CDL ($p=0.80$) and AID ($p=0.40$) did not affect hearing preservation. Metrics computed at the apical electrode including ST height ($p=0.71$), width ($p=0.65$), diameter ($p=0.56$) and cross-sectional area ($p=0.14$), did not significantly affect change in LFPTA.

Conclusions: ST volume is significantly predictive of hearing preservation. Together, these data suggest that hearing preservation may be less affected by interactions of the electrode with the local environment of the walls of the cochlea and may instead be more affected by the overall volume of the cochlea. This finding implies that indirect mechanisms of trauma, such as hydraulic pressure as the electrode is inserted, may predominate.

Learning Objective: Understand the role of cochlear microanatomy in hearing preservation outcomes

Desired Result: Attendees will enhance their understanding of which features of cochlear morphology most impact hearing preservation

Level of Evidence - III

Indicate IRB or IACUC: IRB#09-2328, University of North Carolina

Hearing Preservation Across Different Electrode Arrays:
Robotic Versus Manual Insertion

Carlos A. Perez-Heydrich, MD; Elena Quinonez Del Cid, BS; Margaret T. Dillon, AuD, PhD
A. Morgan Selleck, MD; Matthew M. Dedmon MD, PhD
Kevin D. Brown MD, PhD; Nicholas J. Thompson, MD

Objective: Robotic-assisted cochlear implantation using a controlled and slow insertion of the electrode array may preserve hearing function compared to manual insertion. This study aimed to determine if there is a benefit in early hearing preservation outcomes for robotic insertion with iotaSoft Insertion System from iotaMotion as compared to manual insertion and assess whether outcomes differed as a function of electrode array length.

Study Design: Retrospective study

Setting: Tertiary Care Center

Patients: Adults who underwent cochlear implantation with a straight electrode array from January 2024 to October 2025.

Main Outcome Measures: Unaided thresholds were measured preoperatively and at device activation. A low-frequency pure-tone average (LFPTA; 125, 250, and 500 Hz) was calculated for each visit.

Results:
Data were available for 79 cases at the time of review. Robotic insertion was used for 21 cases (mean age= 69.3 yrs ±11.7) and manual insertion was used for 58 cases (mean age=66 yrs ±15.0). Patients were recipients of an Advanced Bionics SlimJ (20 mm; robotic=3, manual=8), or MED-EL Flex24 (24 mm, robotic=11, manual=17), Flex26 (26 mm; robotic=2, manual=4), or Flex28 (28 mm; robotic=5, manual=29) electrode array. The groups did not differ significantly in preoperative LFPTA (p=0.336; robotic = 41.6±12.9 dB HL, manual = 45.0 dB HL ±15.6). At CI activation, the LFPTA for the robotic insertion group was significantly lower (67.5 dB HL ±24.8) compared to the manual insertion group (82.3 dB HL ± 24.6; p=0.024). When stratified by electrode array, significantly better hearing preservation was observed for recipients of the longer array (28 mm) with the use of robotic insertion (mean LFPTA shift: 23.3 dB HL ±12.5) as compared to manual insertion (mean LFTPA shift: 43.4 dB HL ±20.7; p=0.016). This difference was not observed for shorter arrays (p≥0.471).

Conclusions: Robotic-assisted cochlear implantation may support better hearing preservation at initial CI activation compared to manual insertion with greater benefit observed for longer electrode arrays.

Learning Objective: To describe the difference in early hearing preservation for CI recipients of straight electrode arrays using a manual versus robotic insertion and the discuss the differences in observed outcomes by electrode array length.

Desired Result: To determine early hearing outcomes based on robotic assisted insertion of CI electrodes compared to manual insertion of electrodes.

Level of Evidence – Level IV; Retrospective Cohort Study

Indicate IRB or IACUC: IRB 09-2328 from UNC Medical Center

Iowa CI Trauma Tool: A Deep Learning Approach to Cochlear Implant Trauma Assessment from CT scans

Aseem Jain, MD, MSE; Nicholas George-Jones, MD; Rachel Scheperle, AuD, PhD
Joshua Pinzour, BS; Marlan Hansen, MD; Alexander Claussen, MD

Hypothesis/Aim: To develop a tool that captures electrode array position relative to intracochlear structures and quantifies distances between these structures for cochlear implant (CI) trauma assessment from CT scans.

Background: Recent studies have shown the impact of CI position on post-operative hearing outcomes. We present a fully automated tool that segments the CI and cochlea within post-operative CT scans (poCT), individually labelling the scala-tympani (ST), scala vestibuli/media (SVM), lateral wall (LW), modiolus, and basilar membrane (BM). Segmentations are used to compute electrode array position relative to the intracochlear structures outlined above.

Methods: The tool utilizes two pipelines that generate: 1) Cochlea and CI segmentations derived from poCT; 2) Intracochlear segmentations derived from pre-operative CT. Pipeline 1 was created by training a neural network (nnUNet) on 50 labeled poCTs. Pipeline 2 was developed using five co-registered micro-CT and CT pairs of the cochlea, augmented synthetically to train a separate nnUNet. The result of pipeline 2 is registered to pipeline 1 for CI position analysis. For both pipelines, using cross validation, 20% of the training data was randomly isolated to create a testing dataset.

Results: Accuracy was assessed on the testing dataset using Dice similarity coefficients (DSC), which measure overlap between predicted and ground-truth labels (1 = perfect overlap). Pipeline 1 achieved DSCs of 0.94 (cochlea) and 0.87 (electrode). Pipeline 2 had DSC scores of 0.96, 0.95, 0.83, 0.86, 0.91 for ST, SVM, BM, modiolus, and LW, respectively.

Conclusion: Using neural networks and image registration techniques, we created an accurate, open-source CI trauma assessment tool that is manufacturer and electrode-agnostic. This platform enables large-scale CI analysis and aids in surgical planning and postoperative hearing evaluation.

Learning Objective:

- To understand the importance of key quantitative metrics such as electrode-to- intracochlear structure distances and electrode location in CI trauma assessment.
- Demonstrate how neural networks and image registration techniques can be leveraged to automatically extract features such as intracochlear regions and electrode position from CT scans
- Discuss how open-source automation can facilitate large-scale, standardized cochlear implant outcome analysis and improve surgical planning and post-surgical audiological management.

Desired Result: To create and validate an accurate, open-source tool that automatically segments cochlear and electrode structures from CT imaging and generates quantitative metrics for cochlear implant position and potential trauma assessment. Ultimately, this tool will be integrated to support large-scale CI research that enhance understanding of electrode placement effects on hearing outcomes and informs data-driven surgical decision-making and audiological management.

Level of Evidence – Level III

Indicate IRB or IACUC: IRB P50 VIII 202210440 Approved: 3/13/2023; IRB P50 VII 201805740 Approved: 6/22/2018

Comparing Low-Frequency Threshold Functions of Intracochlear Electrocochleography and Perioperative Pure Tone Audiometry

Jordan J. Varghese, MD, MSCI; Amit Walia, MD, MSCI; Matthew A. Shew, MD; Amanda J. Ortmann, PhD
Nedim Durakovic, MD; Jacques A. Herzog, MD; Craig A. Buchman, MD

Objective: To evaluate the relationship between minimal stimulation levels for intracochlear electrocochleography during implantation and pure tone audiometric thresholds at both cochlear implant (CI) candidacy and residual hearing testing.

Study Design: Prospective case series

Setting: Tertiary referral center

Patients: 41 post-lingual adult CI recipients undergoing intraoperative monitoring with electrocochleography threshold function testing

Interventions: Intracochlear electrocochleography responses to 250 and 500 Hz tone bursts during implantation of the slim modiolar electrode array. Recordings were from the best responding internal electrode for each frequency. Stimulus intensity was incrementally decreased to identify the threshold for minimal electrocochleography response observable above the noise floor.

Main Outcome Measures: Pure tone audiometry tested at CI candidacy evaluation and 1-month post-implantation.

Results: Electrocochleography thresholds were higher than pre-operative pure tone thresholds (mean difference in dB HL [SD]; 250 Hz: 25.7 [16.5]; 500 Hz: 21.4 [14.4]) and lower than post-operative pure tone thresholds (250 Hz: -10.4 [27.4]; 500 Hz: -16.1 [25.0]). When evaluating a combined low-frequency (LF) average of 250 and 500 Hz, there was a strong positive correlation between LF-electrocochleography thresholds and candidacy LF-PTA ($r = 0.53$, 95% CI [0.35 to 0.76]), and a weak positive correlation to residual hearing LF-PTA ($r = 0.23$, 95% CI [-0.09 to 0.50]). There were similar relationships seen when independently evaluating 250 and 500 Hz electrocochleography thresholds.

Conclusions: Intraoperative electrocochleography thresholds correlate well with candidacy pure tone thresholds but are less predictive of residual acoustic hearing. This may further support the mechanism that residual hearing loss is less related to the immediate electroacoustic alterations of the inner ear from CI implantation and more driven by delayed fibrotic changes. Candidacy LF-PTA could guide selection of optimal stimulus intensity levels to improve signal quality during intracochlear electrocochleography monitoring.

Learning Objective: 1) To recognize the utility of electrocochleography for evaluating clinical and audiometric outcomes for CI recipients. 2) To consider the potential for intracochlear electrocochleography as an electrophysiologic model to better characterize properties of the inner ear.

Desired Result: Clinicians and researchers will appreciate the relationship between intracochlear electrocochleography and perioperative pure tone thresholds for CI recipients. This knowledge can support the utility of incorporating electrophysiologic measurements into routine clinical care for CI recipients and provide insight into future research investigation on the complexities of the CI neural interface.

Level of Evidence - V

Indicate IRB or IACUC: Washington University in St. Louis IRB #202007087 (04/30/2024)

Whole Genome Sequencing of Archival Human Temporal Bones – Identification and Characterization of the DFNA17 Mutation

Adam Y. Xiao, MD, PhD; Achilles Kanaris, BS; Shin-ya Nishio, MD; Shin-ichi Usami, MD
Ivan A. Lopez, PhD; Gail Ishiyama, MD; Akira Ishiyama, MD

Hypothesis: Whole genome sequencing (WGS) technology can be successfully applied to archival human temporal bones (HTB) to identify pathogenic genetic variants.

Background: WGS has enhanced the detection of mutations underlying genetic hearing loss. However, correlating genetic findings with otopathology remains difficult due to the inaccessibility of inner ear tissues. Archival HTBs offer a unique opportunity to link genotype with histopathologic phenotype, but their harsh processing conditions impede genomic analysis. DFNA17, characterized by cochleosaccular degeneration, is associated with a known myosin 9 (MYH9) mutation.

Methods: Genomic DNA was extracted from a celloidin-embedded HTB with DFNA17 and processed using a FFPE DNA Library Prep Kit. WGS was performed on the NovaSeq X Plus 10B platform. Secondary analysis utilized the DRAGEN pipeline, and variant annotation was performed with wANNOVAR. MYH9 expression was evaluated by immunofluorescence in histologic sections.

Results: Extracted DNA was highly fragmented (<100 bp). WGS generated 848 million unique reads (43.16%), with a mean coverage of 6.12x. Genome coverage was 87.13% at ≥1x and 15.16% at ≥10x. A total of 9,824 single-nucleotide variants were identified at >10x depth. The known MYH9 G→A mutation at nucleotide 2114 was confirmed with 25x read depth, minimal strand bias (FS = 4.632), and high mapping quality (MQ = 235.34). MYH9-immunofluorescence localized to atrophic vessels of the saccular macula, spiral ganglion, stria vascularis, and spiral ligament.

Conclusions: This study demonstrates the first successful application of WGS to a celloidin-embedded archival HTB by confirming the MYH9 mutation in a DFNA17 specimen. Although sequencing depth and library complexity remain limited, these findings establish proof of concept for performing WGS on archival HTBs, enabling future genotype–phenotype correlations in otopathology and advancing understanding of molecular mechanisms of hearing loss.

Learning Objective: To understand the application of WGS to archival temporal bones as well as the histopathology of DFNA17.

Desired Result: Participants should better appreciate the potential use of WGS on archival temporal bones and the expression pattern of MYH9.

Level of Evidence – Not applicable

Indicate IRB or IACUC: UCLA IRB # 22-001587

Macrophage and Schwann Cell Alterations in Sudden Sensorineural Hearing Loss: Insights from Human Temporal Bones

Drew J. Montigny, BS; Soomin Myoung, BS; Andrew M. Jung, BS; Alex J. Lim
Diana Correa, MD; Jennifer O'Malley, BA; Andreas Eckhard, MD
Alicia Quesnel, MD; Judith S. Kempfle, MD

Hypothesis: Sudden sensorineural hearing loss (SSNHL) is associated with alterations in non-neuronal cells—specifically Schwann cells and macrophages—compared with normal-hearing human temporal bones.

Background: The etiology of SSNHL remains poorly defined. Current treatments focus on suppressing inflammation with corticosteroids. IBA1 (ionized calcium-binding adaptor molecule 1) labels tissue-resident and monocyte-derived macrophages, whose morphology can indicate pro-inflammatory states. SOX2 (SRY-box transcription factor 2) marks Schwann cells and is upregulated in Schwann cells after injury. Characterizing these cell populations may help to clarify additional non-neural mechanisms underlying SSNHL.

Methods: Immunohistochemistry was performed on celloidin-embedded archival human temporal bones from four individuals with short- or long-standing SSNHL and three normal-hearing controls, using antibodies against SOX2 and IBA1. Quantification of $SOX2^+$ Schwann cells and $IBA1^+$ macrophage ramification indices were compared between SSNHL and control samples.

Results: $SOX2^+$ Schwann cells were significantly increased in SSNHL compared with controls (0.103 ± 0.105 vs. 0.008 ± 0.005 $SOX2^+/100\ \mu m^2/DAPI$; $p = 0.00026$). One SSNHL case, corresponding to death within one year of onset, exhibited reduced $IBA1^+$ macrophage ramification (3.76 ± 1.12 vs. 4.23 ± 1.27; $p = 0.0017$), indicating more acute immune activation. Cases with longer SSNHL-death intervals (19-48 years) showed no difference from controls, suggesting only transient macrophage response early after onset, but persistent $SOX2^+$ Schwann cell activation.

Conclusions: SSNHL is associated with sustained activation of Schwann cells after damage and transient macrophage reactivity during the acute phase. These findings highlight dynamic non-neuronal responses and plasticity to cochlear injury in SSNHL pathology.

Learning Objective: To recognize macrophage and Schwann cell responses in human temporal bone samples with sudden sensorineural hearing loss, specifically increased SOX2 expression and macrophage activation.

Desired Result: Learners will gain improved knowledge of the cellular mechanisms underlying SSNHL, enhancing discourse regarding future therapeutic approaches targeting Schwann cells and macrophages.

Level of Evidence: III (Cohort and case-control studies)

Indicate IRB or IACUC: Massachusetts Eye and Ear Infirmary, IRB#2021P000332, Exempt

Histopathological Considerations for Indication of Cochlear Implant for Patients with Vestibular Schwannoma

Shinya Ohira, MD, PhD; Ivan Lopez, PhD; Maya Harary, MD; Maureen Laufer, AuD
Gail Ishiyama, MD; Gregory P. Lekovic, MD, PhD; Akira Ishiyama, MD

Objective: To conduct clinicopathological correlations of audiological data and histopathology in archival human temporal bones of vestibular schwannoma (VS) for potential auditory rehabilitation with cochlear implant (CI).

Study Design Clinicopathological study

Setting: National archival human temporal bone bank

Patients: 34 temporal bones from 28 patients with a history of VS. Five patients had neurofibromatosis.

Interventions: Clinical data included: surgical history and audiometry of pure tone average (PTA) and speech discrimination score (SDS). Residual tumor, tumor invasion into the fundus, cochlear ossification, and spiral ganglion cells (SGCs) and cochlear hair cells.

Main Outcome Measures: Correlation between pathological findings and audiometric data.

Results: Of the 28 patients, seven were managed non-operatively; the remaining underwent VS resection: middle fossa approach (MFA = 4), retrosigmoid/retrolabyrinthine approach (RSA/RLA = 5) or translabyrinthine approach (TLA = 15) approach. SGCs were sometimes preserved despite severe hearing loss on PTA and low SDSs were associated with significant SGC loss. TLA surgery was associated with cochlear ossification and severe loss of hair cells and SGCs. All cases with tumor invasion into the fundus demonstrated marked SGC degeneration. Post-surgical cases without residual tumor at the fundus exhibited preservation of SGCs corresponding with hearing preservation.

Conclusions: High SDSs reflected the preservation of SGCs in VS patients, likely indicating CI candidacy. Fundal invasion was associated with SGC and neural degeneration. TLA was associated with cochlear ossification, loss of hair cells and SGN, and should be avoided in hearing rehabilitation. Early intervention may be indicated when the tumor invades near the fundus using a non-TLA and aiming for eradication of fundal tumor.

Learning Objective: To better understand factors related to hearing in VS patients.

Desired Result: Improved treatments for VS patients.

Level of Evidence - Level V

Indicate IRB or IACUC: Approval was obtained from the Institutional Review Board (IRB #22 001587).

Histopathologic Diversity in Idiopathic Sudden Sensorineural Hearing Loss: A Multi-Institutional Temporal Bone Study

Diana M. Correa, MD; Michael S. Castle, MD; Rafael da Costa Monsanto, MD, PhD
Abbie K. Hall, BS; Ivan A. López, PhD; William H. Slattery, MD; Sebahattin Cureoglu, MD
Meredith E. Adams, MD, MS; Akira Ishiyama, MD; Alicia M. Quesnel, MD

Hypothesis: Idiopathic sudden sensorineural hearing loss (iSSNHL) represents a heterogeneous disorder characterized by multiple patterns of cochlear degeneration.

Background: iSSNHL is a medical emergency with over 66,000 new cases annually in the United States. Its etiology remains poorly understood, limiting the development of targeted therapies. Human temporal bone (hTB) studies are essential for clarifying pathological consequences, generating mechanistic hypotheses, and guiding candidacy for emerging treatments.

Methods: Postmortem hTBs from donors diagnosed with iSSNHL during life were identified through a systematic review of clinical records across three institutional collections. Inner and outer hair cell survival was evaluated using 100× DIC microscopy of every hair cell on H&E sections in a subset of cases. Supporting cell survival, tectorial membrane abnormalities, and endolymphatic hydrops were assessed using semi-quantitative digital scoring. Spiral ganglion neuron (SGN) quantification and spatial distribution were analyzed with a machine-learning algorithm.

Results: hTBs from 43 donors with iSSNHL were examined histopathologically. Preliminary analysis showed 26% of cases exhibited an encapsulated tectorial membrane (vs. 0% in age-matched controls) and 22.2% demonstrated endolymphatic hydrops. Among hydrops cases, 66.7% also showed tectorial membrane encapsulation, suggesting a potential association. Fractional hair cell survival correlated with focal audiometric threshold elevations in cases with deafness >7 months. Supporting cell survival negatively correlated with duration of deafness, suggesting progressive degeneration. SGN counts did not correlate with the duration of deafness (preliminary 13% of cases counted).

Conclusions: This study represents the largest hTB series of iSSNHL to date. iSSNHL demonstrates diverse cochlear pathologies, supporting a heterogeneous etiology. A subset showed concurrent hydrops and tectorial membrane encapsulation. Progressive supporting cell loss over time suggests that early intervention may be critical for successful regenerative therapies.

Learning Objective: Describe the key cellular and structural patterns of cochlear degeneration identified in the largest temporal bone study of iSSNHL cases.

Desired Result: We aim to characterize the spectrum of cochlear pathology in iSSNHL. We expect to identify correlations between these cellular and structural changes and clinical features such as duration of deafness, providing insights into disease heterogeneity and potential windows for future regenerative interventions.

Level of Evidence – Level III.

Indicate IRB or IACUC: IRB #2021P001358, IRB #2019P00375, IRB # 22-001587

Peri-Insertional Cochlear Implant Electrode Forces for Manual Versus Rigidly-Fixed and Handheld Robotic Insertion

Maxwell Bergman, MD; Nathan Kemper, MD; Constantinos Nikou; Zachary Urdang, MD, PhD
Alexander Claussen, MD; Bruce J. Gantz, MD; Marlan R. Hansen, MD

Objective: To compare cochlear implant (CI) electrode insertion forces across manual, rigidly fixed robotic, and handheld robotic methods and to evaluate whether handheld robotic insertion maintains the low forces achieved with rigid fixation.

Study Design: Controlled laboratory experiment using 3D-printed human temporal bone models.

Setting: Temporal bone laboratory, University of Iowa.

Patients: Not applicable (benchtop experimental model)

Interventions: Six surgeons performed 43 interpretable CI insertions into 3-D-printed temporal-bone models using three techniques—manual, rigidly fixed-robotic, and handheld-robotic using the iotaMotion iotaSOFT system

Main Outcome Measures: Axial insertion forces were captured with a millinewton-resolution load cell. Mean peak, variability, and release forces were then compared

Results: Both robotic methods generated smaller and more consistent forces than manual insertion. Rigid and handheld robotic CI electrode insertion generated smaller peak insertion forces (57 mN and 58 mN, respectively) versus manual (226 mN, $p<0.0001$). Rigid (34 mN) and handheld (44 mN) robotic electrode array insertion demonstrated less force variation compared to manual (265 ±167 mN, $p<0.001$). Finally, release forces were smaller with the robotic systems—about 67 mN for rigid and 87 mN for handheld—while manual insertions reached roughly 160 mN ($p = 0.18$)

Conclusions: Handheld robotic insertion achieved force profiles nearly identical to rigid fixation. Handheld robotic use could help the device feel more intuitive for some surgeons and while dampening insertion forces seen with manual placement. These results support handheld robotic insertion as a practical, less-traumatic bridge between traditional manual and fully fixed robotic CI techniques.

Learning Objective: To understand how handheld robotic cochlear implant insertion can provide force profiles comparable to rigid fixation

Desired Result: To encourage the adoption of robotic-assisted insertion strategies that reduce mechanical trauma and improve cochlear implant surgical consistency

Level of Evidence - Level V (experimental bench study)

Indicate IRB or IACUC: Exempt – benchtop experimental model (no human or animal subjects).

Real-time Intracochlear Distance Sensing and Navigation using Optical Coherence Tomography

Pawina Jiramongkolchai, MD; Senyue Hao, BS; Ratul Paul, PhD; AJ Adkins, MS
Jacques Herzog, MD; Craig Buchman, MD; Chao Zhou, PhD

Hypothesis: Optical coherence tomography (OCT) can be used for real-time intracochlear navigation and distance sensing.

Background: OCT is a contrast- and radiation-free imaging modality that provides real-time 2- and 3-dimensional imaging of tissue microanatomy at higher resolutions than that of conventional MRI or CT. Because the fundamental working principle of OCT is to measure the time delay of backscattered near-infrared light using low-coherence interferometry, OCT functions as an intrinsic light-based distance sensor.

Methods: A single-mode fiber (SMF)-28 attached to a custom-built 1310 nm swept source (SS) OCT system (axial resolution=10 µm) was mounted onto a translation stage to allow finely controlled movement of the fiber. The system was validated in cochlear phantoms and tested in human cadaveric cochlea. In the cadaveric cochlea, bone overlying the scala vestibuli was removed to enable direct visualization of the fiber within the scala tympani. Measurement profiles to the lateral and medial walls of the scala tympani were obtained during insertion and pull-back of the fiber as accessed through the round window membrane.

Results: Our fiber-based SS-OCT system can detect a maximum distance of 6.9 mm with an acquisition speed of 8 µs. By sensing the distances of the fiber from the medial and lateral walls of the scala tympani in real-time, our SS-OCT system allowed us to make micro-adjustments of fiber trajectory to avoid damage to both the fiber tip and intracochlear lumen.

Conclusion: Fiber-based OCT can be used to provide real-time spatial navigation and distance sensing to critical structures within the cochlea.

Learning Objective: Understand application of optical coherence tomography for intracochlear use.

Desired Result: OCT can be used to provide navigation and spatial sensing within the cochlea.

Level of Evidence – V

Indicate IRB or IACUC: IRB #202410102

Randomized Double-Blinded Placebo-Controlled Clinical Trial of In-Office Regeneration of Chronic Tympanic Membrane Perforations: Preliminary Results

David R. Friedmann, MD, MSc; Ashley Feng, BS; Emmanuel Garcia-Morales, PhD
Victoria Lancaster, RN, Daniel Jethanamest, MD; J. Thomas Roland Jr., MD

Objective: To evaluate the efficacy of regenerating chronic tympanic membrane perforations in the office setting using a growth factor (FGF-2) compared to placebo.

Study Design: This Phase 2 double-blinded randomized clinical trial involved block randomization of enrolled subjects (1:1) with a chronic tympanic membrane perforation to undergo myringoplasty with fibroblast growth factor (FGF-2 NPC-18 *Nobelpharma*) vs. control.

Setting: Ambulatory academic otology neurotology practice.

Patients: Adults with chronic dry tympanic membrane perforations for at least six months without evidence of cholesteatoma. Patients who underwent prior tympanoplasty were excluded.

Interventions: Topical anesthetic was applied and the edges of the perforation were freshened. Myringoplasty with gelatin foam sponge impregnated with FGF-2 (intervention) or normal saline (placebo) was performed at three-week intervals until the perforation was closed for up to a maximum of three treatments. Subjects who were randomized to placebo and failed to close after three treatments were offered cross-over to receive FGF-2 for up to three additional treatments.

Main Outcome Measures: Primary outcome was rate of complete closure of tympanic membrane perforation confirmed with photographic documentation at each visit. Secondary outcomes included hearing improvement and post-treatment tympanometry.

Results: Fifty-one subjects were enrolled in this trial. Twenty-six subjects were randomized to the experimental arm. Of those, 16/26 (61.5%) experienced complete closure of the tympanic membrane. Among placebo, 10/25 (40.0%) achieved complete closure. Of the fifteen subjects randomized to placebo who failed to close, 10 crossed over with only 2/10 (20.0%) achieving salvage closure of the perforation.

Conclusions: In office closure of tympanic membrane regeneration is possible using this technique though overall success rates were lower than typically achieved with surgical tympanoplasty. When successful, normal tympanograms and minimal air bone gaps were observed unlike surgical tympanoplasty. Our preliminary results suggest higher success when FGF-2 growth factor is applied compared to an identical procedure using placebo.

Level of Evidence - Choose one value between Level II

Indicate IRB or IACUC: NYU Langone Health i21-00672

Efficacy of Tympanic Membrane Regeneration Therapy for Secondary Cholesteatoma with Tympanic Membrane Perforation

Shin-ichi Kanemaru, MD, PhD; Tomoya Yamaguchi, MD; Rie Kanai, MD
Eriko Otonari, MD; Maki Yamasoba, MD; Yuki Fujii, MD; Toshiki Maetani, MD, PhD

Objective: To investigate the effectiveness of tympanic membrane regeneration therapy (TMRT) for secondary cholesteatoma (SC) with tympanic membrane perforation (TMP)

Study Design: Intervention study

Setting: Research institute hospital

Patients: The study included 38 patients with SC (41 ears in 38 cases, M/F: 21/17, 12-86 y.o.) who underwent TMRT, and 33 patients with 33 ears (M/F: 15/18, 20-75 y.o.) who underwent conventional tympanoplasty (CTP) as a historical control.

Interventions: In TMRT, an endoscope is used to remove all of the remaining TM, leaving the tympanic ring intact, to secure the surgical field, and then the cholesteatoma is completely removed. For the TM repair procedure, the edge of the TMP was disrupted mechanically, and gelatin sponge immersed in basic fibroblast growth factor were placed inside and outside the tympanic cavity and covered with fibrin glue. The protocol was repeated up to four times until closure was complete.

Main Outcome Measures: Operative time, closure of the TMP, and hearing improvement were evaluated. Adverse events, including cholesteatoma recurrence, were monitored for a period of three years or more.

Results: The operative time, TM closure rate, and cholesteatoma recurrence rate were 65minutes, 100% (41/41), and 2.4% (1/41) in the TMRT group, respectively, and 125minutes, 93.9% (31/33), and 9.1% (3/33) in the CTP group, respectively. Average hearing improvement was 12.2dB in the TMRT group and 7.5dB in the CTP group.

Conclusions: As a treatment for SC arising from the edge of TMP, TMRT showed no difference in TM closure rate or cholesteatoma recurrence rate compared to CTP. However, TMRT was superior to CTP in terms of operative time and hearing improvement.

Learning Objective: TMRT is a new treatment method that became covered by health insurance in Japan in November 2019. This treatment method is based on a tissue engineering concept that is fundamentally different from traditional TM reconstruction. Therefore, it is important to fully understand this idea in order to regenerate the TM reliably. Appropriate treatment can regenerate a near-normal TM and provide good hearing with a very small AB gap. TMRT is gradually replacing most myringoplasty and some tympanoplasty in Japan.
Because the bFGF used in TMRT has the effect of growing cholesteatoma, it has been thought that TMRT is inappropriate for cholesteatoma; however, it has been shown that TMRT can be fully applied to cases of SC where the cholesteatoma is localized within the tympanic cavity. At the conclusion of this presentation, the participants should be able to know how to manage SC without conventional surgical therapy. This new regenerative treatment will change the former concept of the otologic surgery.

Desired Result: TMRT has completed Phase II clinical trials in the United States, and Phase III trials are planned to obtain FDA approval. This treatment is expected to spread around the world because it is short, minimally invasive, low cost, and requires easy training for the surgeon. I hope that this announcement will be of some help.

Level of Evidence - Level III

Indicate IRB or IACUC : TMRT is a new treatment that became covered by health insurance in Japan. The study was approved by the ethical committee of Kitano Hospital (P210600600) and Kanai Hospital (ECNo.2001).

Single-Cell RNA Sequencing Reveals Heterogeneity and Cell-Cell Interactions of Cholesteatoma Keratinocytes

Daniel R. Romano, MD; Song-Zhe Li, MD, PhD; Richard A. Chole, MD, PhD
Michael Hoa, MD; Sidharth V. Puram, MD, PhD; Keiko Hirose, MD

Hypothesis: Tympanic membrane and cholesteatoma keratinocytes will demonstrate significant transcriptional differences at the single cell level.

Background: Cholesteatoma is a disease defined by the abnormal presence of keratinizing stratified squamous epithelium in the middle ear and/or mastoid. As compared to epidermis, the matrix (keratinizing stratified squamous epithelial) layer of cholesteatomas demonstrates dysregulated differentiation and uncontrolled proliferation. However, the molecular processes that drive pathogenesis are poorly characterized.

Methods: Cholesteatoma specimens were prospectively collected from patients undergoing surgery and immediately dissociated into single cell suspensions. Cell suspensions were subjected to single-cell RNA-sequencing (scRNA-seq), and scRNA-seq analysis was performed in R (version 4.4.2). scRNA-seq datasets including a publicly available tympanic membrane scRNA-seq dataset were integrated using Harmony.

Results: After quality control steps, single cell transcriptional profiles for > 2,000 cholesteatoma keratinocytes from n = 13 patients were available for scRNA-seq analysis. Tympanic membrane and cholesteatoma keratinocytes were overall transcriptionally similar, clustering together into distinct populations of undifferentiated (KRT15+), wounded/healing (KRT6B+/KRT16+/ KRT6C+), cycling (MKI67+/CDK1+/PCNA+), and terminally differentiated keratinocytes (LOR+/FLG+). However, closer examination clearly demonstrated a cluster of $LAMC2^{hi}/ITGA6^{hi}/LAMA3^{hi}$ basal keratinocytes which exclusively derived from cholesteatoma samples. Gene ontology and cell-cell interaction analyses identified these $LAMA3^{hi}/ITGA6^{hi}/LAMC2^{hi}$ cells as upregulating genes associated with cellular adhesion and epithelial migration and as a major target of keratinocyte-keratinocyte epidermal growth factor signaling.

Conclusions: These results hint at a possible cholesteatoma specific transcriptional program. Further study is currently underway to validate this and determine how these transcriptional differences may drive cholesteatoma pathogenesis and/or clinical variability.

Learning Objective: Attendees will be able to describe the molecular heterogeneity and transcriptional differences of tympanic membrane and cholesteatoma keratinocytes.

Desired Result: We are hoping to improve on our current understanding of the cellular mechanisms underlying cholesteatoma formation, which could allow for improved treatment strategies.

Level of Evidence - V

Indicate IRB or IACUC: IRB #202302061, Washington University in St. Louis, originally approved on 02/15/23.

Cost of Facial Nerve Monitoring

Sammy Y. Gao, BS; Warren B. Chun, MD; Tyler M. Rist, MD
Robert F. Labadie MD, PhD

Objective: Evaluate the cost-effectiveness of intraoperative facial nerve monitoring (FNM) during otologic/neurotologic surgery.

Study Design: Decision-tree cost-effectiveness analysis with probabilistic sensitivity analysis (PSA) via 1,000-iteration Monte Carlo simulation.

Setting: Tertiary academic center

Patients: Hypothetical adult cohort undergoing otologic surgery

Interventions: Simulated FNM for all otologic surgery was compared to no FNM

Main Outcome Measures: Expected quality-adjusted life years (QALYs), expected cost per patient, incremental cost-effectiveness ratio (ICER; difference in cost / difference in QALY), and probability of cost-effectiveness at willingness-to-pay (WTP) thresholds. Model probabilities were derived from published literature and expert consensus, and costs were estimated from institutional price-transparency data and adjusted hospital cost-to-charge ratio. Cost-effectiveness was stratified by three common FNM vendors.

Results: FNM for all otologic surgeries (both primary and revision) was associated with an increase in QALY of 0.34 years compared to no monitoring. Average cost increased by $47.2 per patient for equipment purchased from Vendor 1 (ICER=$136.82/QALY), but decreased by $63.8 with Vendor 2 (ICER=–$184.9/QALY) and decreased by $115.8 with Vendor 3 (ICER=–$335.7/QALY). The breakeven threshold for utility of FNM versus rehabilitation of FN paresis was 44 cases/year for Vendor 2 and 27 cases/year for Vendor 3. PSA showed monitoring all otologic surgery was cost-effective in >95% of simulations at a $100,000/QALY WTP threshold with an increase in QALY of 0.34 years at average costs per patient of +$61.50 (Vendor 1), –$49.14 (Vendor 2), and –$105.48 (Vendor 3).

Conclusions: FNM for otologic surgery is cost-effective across vendors. Although use of higher-cost electrodes leads to increases in per-patient cost, the incremental cost per QALY gained remains minimal and well below accepted thresholds. These findings suggest routine FNM use is cost-effective, particularly in institutions with surgical volume to exceed breakeven thresholds.

Learning Objective: To understand how cost-effectiveness modeling can quantify the economic impact of different facial nerve monitoring electrode systems and their influence on per-patient cost in otologic surgery.

Desired Result: Attendees will be able to interpret how variations in electrode cost and performance affect overall cost-effectiveness, recognize breakeven thresholds by vendor, and apply these findings to optimize resource use in clinical practice.

Level of Evidence - III

Indicate IRB or IACUC: Exempt.

Machine Learning Identification of Hearing Loss from Natural Speech

Peter R. Dixon, MD, MSc; Paul Heider PhD; Carl Ehrett PhD; Theodore R. McRackan, MD, MSc
Judy R. Dubno, PhD; Leslie A. Lenert, MD, MS

Objective: Hearing loss disrupts auditory feedback, resulting in measurable changes in voice production. This study evaluates the extent to which acoustic-phonetic features from natural connected speech can identify individuals with hearing loss as a foundation for voice-based hearing screening.

Study Design: Cross-sectional

Setting: Bridge2AI-Voice, a multi-institutional NIH-funded initiative collecting standardized voice and health data.

Patients: 435 participants (median age 65 years, IQR 49-73; 59% female): 85 with hearing loss (self-reported 'serious difficulty hearing' or clinical diagnosis) and 350 without.

Interventions: Participants provided three brief connected speech samples. Acoustic-phonetic voice features were extracted using OpenSMILE and Parselmouth/Praat. Models were adjusted for age, sex, depression, Parkinson's disease, and cognitive impairment and evaluated using stratified 5-fold cross-validation.

Main Outcome Measures: Area under the receiver operating characteristic curve (AUROC)

Results: Gradient Boosted Decision Trees (XGBoost) achieved mean AUROC = 0.71 +/- 0.04, exceeding logistic regression with L2 regularization (0.65 +/- 0.08, p = 0.14). Calibration was strong (Brier = 0.17 ± 0.02). Feature-family permutation analysis showed that confounders, particularly age, explained most model performance (delta-AUROC = 0.15 +/- 0.09), while mel frequency cepstral coefficient-, prosodic-, and voice-quality features contributed modest, consistent signal (delta-AUROC = 0.02-0.01), supporting physiologic links between altered auditory feedback and vocal control.

Conclusions: This study provides the first multi-institutional evidence that machine-extracted voice features can detect hearing loss from short, unconstrained speech samples. The approach demonstrates technical rigor, interpretable model behavior, and cross-validated accuracy comparable to early-stage voice biomarkers in other domains. Because hearing status was based on self-report rather than audiometric confirmation, future work with confirmed hearing loss severity will be essential to establish clinical utility for hearing screening.

Learning Objective: Participants will understand the relationship between acoustic voice features and hearing loss and recognize key methodological requirements for translating voice biomarkers to clinical practice.

Desired Result: To demonstrate the feasibility of voice biomarkers for hearing loss detection and motivate prospective studies of individuals with audiometrically confirmed hearing loss that establish voice analysis as a passive, scalable tool for hearing screening in clinical practice.

Level of Evidence - III

Indicate IRB or IACUC: Exempt

Electron Microscopy of Otoconia in a Hypercalcemic Mouse Model

Andriy O. Grynyk, BS; Callie S. Burke, BS; Richard Pellegrino, MS; Jessia Costa, DMD, PhD
Andrew Arnold, MD; Kourosh Parham, MD, PhD

Hypothesis: Mice with chronic hypercalcemia have smaller otoconia and altered surface morphology when compared to controls.

Background: Serum calcium dysregulation may contribute to otoconial degeneration and has been linked to benign paroxysmal positional vertigo (BPPV).

Methods: Four female cyclin D1 transgenic mice modeling primary hyperparathyroidism (PHPT) and four female wild-type mice of similar age were studied. Utricular otoconia were extracted under sodium cacodylate solution, gold-coated, and imaged using a Zeiss Sigma scanning electron microscope (SEM). Individual otoconia were hand measured using ImageJ to quantify major axis, minor axis, and area. Statistical analysis included linear mixed-effects modelling and Mann-Whitney testing across three otoconia size categories (small, medium, large), as there is a natural variation in otoconia size within the utricle. The frequency of fractured otoconia was assessed for structural stability.

Results: Control mice exhibited larger otoconia than experimental mice across major axis (9.09 ± 0.16 µm vs. 5.15 ± 0.048 µm), minor axis (4.55 ± 0.066 µm vs. 2.79 ± 0.022 µm), and area (39.98 ± 1.55 µm^2 vs. 13.24 ± 0.28 µm^2). The linear mixed-effects model showed a significant interaction between group and size category for all three metrics. Subgroup analysis showed the largest difference in the large otoconia category, indicating significance when evaluated for major axis ($p = 0.039$), minor axis ($p = 0.038$), and area ($p = 0.032$). Otoconia fracture frequency was low. There was a 4.4-fold increase in cracks within the hypercalcemic mice.

Conclusions: Mice with chronic hypercalcemia have fewer large otoconia when compared to normal mice, with increased frequency of fractured otoconia.

Learning Objective: Understand the impact of calcium dysregulation on otoconia structure.

Desired Result: Help clinicians understand how calcium dysregulation alters otoconia structure, which will aid management of BPPV.

Level of Evidence – N/A (basic science)

Indicate IRB or IACUC: IRB exempt. UConn IACUC protocol AP-200856-0126.

Kinematic Methods for Identification of Moderate Vestibular Loss

Morgan A. Terry, MD; Hannah R. Smith, BS; Camellia K. Liu, BS; Daniel B. Putterman, AuD
Jae W. Lee, PhD; Timothy E. Hullar, MD; Angela C. Garinis, PhD

Objective: Detecting vestibular dysfunction is important for diagnosing and treating patients with imbalance, but quantitative vestibular testing requires a specialized laboratory and highly trained staff. Kinematic methods, which measure the motion of body parts while standing and walking, are far simpler and have been shown to distinguish normal subjects from those with dramatic vestibular losses such as following vestibular schwannoma resection. However, their efficacy in diagnosing clinically challenging patients with more subtle losses is not well understood.

Study Design: Cross-sectional.

Setting: Tertiary ambulatory referral center.

Patients: English-speaking adults with either normal function, partial unilateral vestibular loss (Meniere's), or total unilateral vestibular loss (following vestibular schwannoma resection).

Interventions: Diagnostic gait task while wearing six inertial sensors.

Main Outcome Measures: Kinematic parameters of the 2-Minute Walk Test

Results: 24 subjects participated **(**control: n=10; partial unilateral: n=7; total unilateral: n=7). Stride length (p=0.019) was able to distinguish both control and partial loss from total unilateral loss but not from each other. Gait speed varied among the three groups significantly (p=0.006) but did not distinguish control or total loss from partial loss.

Conclusions: Kinematic analysis shows early promise in distinguishing intermediate vestibular losses. This offers the possibility of low-cost, convenient vestibular testing that may be useful for screening and triaging patients in lieu of conventional in-lab vestibular testing. Further exploration into kinematic metrics during walking tasks with continued enrollment may elucidate sensitive parameters of interest.

Learning Objective: Understand how kinematics may be utilized to detect subtle vestibular losses and its potential advantages in both detection and monitoring of therapies.

Desired Result: If kinematics is a sensitive detector of vestibular loss, there are many potential advantages for its use in both detection and guided therapies including ease of access, administration (remote option), and tolerability.

Level of Evidence - III

Indicate IRB or IACUC: OHSU IRB# STUDY00027062 approved 4/1/2024 (began collecting data 3/2025)

Cognitive Performance Differs Among Adults with Unilateral Audiovestibular Disorders: A Pilot Study

Maura K. Cosetti, MD; Carly Feist BA; Liraz Aire, PhD
Jen Kelly, DPT, Anat Lubetzky PT, PhD

Objective: Adults with bilateral hearing loss are at risk of cognitive decline. However, less is known about cognition in unilateral audiovestibular disorders, specifically unilateral hearing loss (UHL), unilateral vestibular hypofunction (UVH), and unilateral Meniere's Disease (MD.) Common complaints among these patients include brain fog, difficulty concentrating, forgetfulness, among others. We aimed to identify how cognitive performance differs across these 3 groups, and which domains require clinical attention.

Study Design: cross-sectional

Setting: outpatient academic center

Patients: 28 controls (mean age 59 years, range 41-78) and 30 patients (10 UHL [4F PTA <25 dB in unaffected ear; > 40 affected ear] mean age 55, 25-76; 10 unilateral definitive MD, mean age 53, 32-78; 10 UVH, mean age 59, 24-82)

Interventions: Proportion of participants per group that performed below average and any significant differences between a clinical group and controls.

Main Outcome Measures: Age-adjusted standardized scores of 8-domain computerized cognitive test battery: compositive, verbal, visual and working memory; sustained attention, reaction time, cognitive flexibility and executive function.

Results: Across most domains, controls outperformed patients with unilateral disease. Comparisons between groups and controls were significant in the domains of composite memory (proportion performing below average: 18% controls, 50% UHL ($Z=1.98$, $P=0.047$), 30% MD, 20% UVH), verbal memory (14% controls, 50% UHL and MD ($Z=2.28$, $P=0.022$), 30% UVH); executive function (7% controls, 30% UHL, 40% MD ($Z=2.39$, $P=0.017$), 10% UVH) and sustained attention (0% controls, 30% UHL ($Z=2.97$, $P=0.003$), 10% MD, 40% UVH ($Z=3.48$, $P<0.001$).

Conclusions: Unilateral audio-vestibular disorders demonstrate differences in cognitive performance compared to controls along specific domains that may reflect challenges unique to hearing loss, vestibular loss or a combination.

Learning Objective: Participants will explain the differences in domain-based cognitive performance between controls and groups of patients with unilateral hearing loss, vestibular dysfunction and definitive Meniere's disease.

Desired Result: Participants will appreciate the nuances of neurocognitive testing, and the potential relationship between disorders affecting unilateral hearing and balance

Level of Evidence – III

Indicate IRB or IACUC: STUDY-21-01026, Mount Sinai

Surgical Treatments Decrease the Association Between CHL Pathologies and Depression in the All of Us Research Program

Hannah N. W. Weinstein, BA; S. Dillon Powell, ME (Presenter); Ramzi K. Elased, BA
Lauren H. Tucker, MD, MS; Justin S. Golub, MD, MS

Objective: Previously, we found patients with specific conductive hearing loss (CHL) pathologies had higher odds of depression. This study investigates the effect of surgical treatments on this association.

Study Design: Cross-sectional epidemiologic study.

Setting: The NIH All of Us Research Program, which includes aggregated data from the electronic health records of voluntary participants.

Patients: Adult participants from the All of Us Research Program.

Main Outcome Measures: Exposures and outcomes were defined by ICD-10 codes. Exposures included otosclerosis (H80.X), cholesteatoma (H71.X), and tympanic membrane (TM) perforation (H72.X). Outcomes included major depressive disorder (MDD; F32-33) and dysthymia (F34.1). Treatments were identified with CPT codes and included tympanoplasty (69631-69633 69635-69637, 69641-69646, 69610), mastoidectomy (69502, 69505, 69511, 69601-69604), myringoplasty (69620), and stapedectomy/stapedotomy (69660-69662). Multivariable regression controlling for age, sex, education, race, ethnicity, education, smoking history and relevant surgical treatment was used to calculate absolute change in odds of depression for participants with/without a CHL pathology.

Results: 363,297 adults were included. Controlling for covariates, the odds of MDD and dysthymia among those with TM perforation decreased by **0.05** (OR=2.37;2.15-2.62; p<0.001 to OR=2.32;2.10-2.56; p<0.001) and **0.09** (OR=2.90;2.29-3.60; p<0.001 to OR=2.81;2.20-3.52; p<0.001), respectively, after the addition of tympanoplasty and/or myringoplasty. Among those with cholesteatoma, the odds of MDD and dysthymia decreased by **0.27** (OR=1.85;1.49-2.28; p<0.001 to OR=1.58;1.26-1.97; p<0.001) and **0.41** (OR=2.18;1.22-3.57; p=0.004 to OR=1.77;0.936-3.09; p=0.060), respectively, after the addition of tympanoplasty and/or mastoidectomy. Among those with otosclerosis the odds of MDD decreased by **0.06** (OR=1.48; 95% CI 1.16-1.88; p<0.001 to OR=1.42;1.09-1.83; p=0.008) following the addition of stapedectomy/stapedotomy. Otosclerosis was not associated with dysthymia.

Conclusions: Surgical treatments reduce the association of CHL pathologies with MDD and dysthymia in the All of Us Research Program. The largest decrease was seen for cholesteatoma.

Learning Objective: After this presentation, attendees will understand how surgical treatment history for conductive hearing loss pathologies impacts the association between hearing loss and depressive disorders.

Desired Result: Increase in physician knowledge regarding the relationship between hearing loss and depressive disorders, and the potential for interventions to improve patient outcomes.

Level of Evidence: IV

Indicate IRB or IACUC: All study procedures were confirmed as meeting criteria for non-human subjects research by the All of Us Research Program IRB.

Timing of Cochlear Implantation Influences Neuropsychiatric Outcomes in Sensorineural Hearing Loss

Atri Bhattacharyya, BA; Judith S. Kempfle, MD

Objective: To investigate whether the timing of cochlear implantation (CI) in adults with sensorineural hearing loss (SNHL) is associated with long-term neuropsychiatric outcomes.

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

Setting: Academic and community healthcare systems contributing to the TriNetX network.

Patients: Adults (≥18 years) with a diagnosis of SNHL who underwent CI were categorized into two groups: early CI (within 1 year of SNHL diagnosis) and late CI (1–5 years after SNHL diagnosis). Follow-up extended up to 10 years post-implantation.

Interventions: Cochlear Implantation

Main Outcome Measures: Incidence of first-time diagnoses of dementia, depression, and mild cognitive impairment (MCI) within 1–10 years after implantation. Odds ratios (ORs) were calculated after propensity score matching for age, sex, race, English language, and medical comorbidities.

Results: After matching, 3,282 patients were included in each cohort. Late CI was associated with significantly higher odds of depression and dementia compared with early CI. Patients in the late CI group had increased odds of first-time depression (ICD-10 F32.A; OR 1.464, 95% CI 1.131–1.896) and dementia (ICD-10 F01, F02, F03, G30, G31; OR 1.348, 95% CI 1.042–1.745). No significant difference was observed in the incidence of MCI between cohorts.

Conclusions: Delayed cochlear implantation in adults with SNHL was associated with an increased risk of subsequent depression and dementia during long-term follow-up. These findings suggest that earlier implantation may mitigate neuropsychiatric sequelae associated with prolonged auditory deprivation.

Learning Objective: To assess how timing of cochlear implantation affects the development of neuropsychiatric disorders in adults with SNHL.

Desired Result: To demonstrate that earlier cochlear implantation is associated with a lower risk of depression and dementia compared with delayed implantation.

Level of Evidence – Level III

Indicate IRB or IACUC: Exempt

Tinnitus Improvement Predicts Domain-Specific Quality of Life Gains after Cochlear Implantation

Sophia Chehade, BS; Tamara Mijovic, MD; Emily Kay-Rivest, MD

Objective: To determine the relationship between tinnitus improvement and domain-specific quality of life outcomes following cochlear implantation in adult recipients.

Study Design: Retrospective chart review

Setting: Single institution academic hospital

Patients: 181 adult CI recipients (aged 19–91 years; mean = 61.4 ± 17.5)

Interventions: Quality of life questionnaires

Main Outcome Measures: Tinnitus Handicap Inventory (THI) and Cochlear Implant Quality of Life instruments (CIQOL-10 Global and CIQOL-35 Profile) assessed preoperatively and at 6 and 12 months postoperatively.

Results: Linear mixed-effects models demonstrated a strong relationship between tinnitus burden and quality of life. Higher tinnitus burden was independently associated with lower CIQOL-10 and CIQOL-35 item scores, particularly in the Emotional ($\beta = -0.18$ to -0.31, FDR $p < 0.05$) and Listening Effort domains ($\beta = -0.12$ to -0.26, FDR $p < 0.05$). Patients with greater chronic tinnitus burden had persistently lower Global and Emotional scores ($\beta \approx -0.25$, FDR $p < 0.05$). A 30-point reduction in THI corresponded to 0.5–0.9-point improvements in Emotional and 0.4–0.6-point improvements in Listening Effort scores (0–4 CIQOL scale), equivalent to 10–20 points on the normalized 0–100 scale and reflecting clinically meaningful improvements. Independent of tinnitus changes, scores across most domains also improved over time, with Communication, Entertainment, and Social domains showing marked gains by 6 months ($\beta = +0.30$ to $+0.50$, FDR $p < 0.05$) that were sustained at 12 months.

Conclusions: Cochlear implantation produces broad and lasting quality of life gains, but emotional and cognitive benefits are closely tied to tinnitus trajectory. Patients with persistent tinnitus experience diminished improvements, whereas those achieving substantial tinnitus relief show the greatest gains in emotional well-being, listening effort, and overall quality of life.

Learning Objective: Participants will be able to describe how changes in tinnitus severity after cochlear implantation influence domain-specific quality of life outcomes and interpret CIQOL-10 and CIQOL-35 results in relation to tinnitus burden and improvement.

Desired Result: To enhance clinician understanding of how tinnitus relief impacts patient-reported outcomes after cochlear implantation, thereby improving patient counseling, outcome tracking, and integration of tinnitus assessment into routine post-implant care.

Level of Evidence: Level IV

Indicate IRB or IACUC: IRB 2025-11122, McGill University, approved on 8/2/2025

Temporal and Spectral Contributions to Music Perception Among Hearing-Assistive Device Users

Emmeline Y. Lin, BS; Brooke Barry, BS, BA; Patpong Jiradejvong, MS
Karen C. Barrett, PhD; Nicole T. Jiam, MD

Objective: To investigate timbre and pitch perception abilities between cochlear implant and hearing aid users.

Study Design: Cross-sectional observational study.

Setting: Tertiary care center.

Patients: 52 adults including 11 normal-hearing (NH) listeners, 17 bilateral cochlear implant users (CICI), 16 bimodal users (CIHA), and 8 bilateral hearing aid users (HAHA) who qualified for CI.

Interventions/Methods: Three abilities were assessed: 1) timbre identification (identify which instrument played a note, with variable temporal envelope modifications); 2) pitch discrimination (discriminate between two pitches played simultaneously by the same instrument); and 3) timbre discrimination (discriminate between two different instruments playing the same or different pitches).

Main Outcome Measures: One-way ANOVA with post-hoc comparisons and effect size calculations (Cohen's d) to determine between-group differences; Pearson's calculations to examine within-group correlations between test performances.

Results: For timbre identification, NH outperformed all hearing-impaired groups when temporal envelope cues (attack/release) were unaltered or reduced ($p<0.001$). When these cues were removed, performance differences between NH, HAHA, and CIHA disappeared, although NH performance remained superior to CICI ($p=0.0006$). All groups performed at chance levels for discriminating simultaneous, harmonic tones sharing overtone series. For timbre discrimination, NH and HAHA significantly differentiated between same-pitch and different-pitch conditions ($p= 0.007$), while CI users (CIHA and CICI) did not. Effect sizes for between-group comparisons were large (Cohen's $d > 1.6$). Performance across the three tasks was not correlated within groups.

Conclusions: Temporal envelope cues are important for timbre identification across all listening groups. HAHA, like NH, may retain access to the timbre and pitch cues needed for music perception, likely due to access to fine spectral cues and limited distortion compared to CI-processing strategies and device limitations. These findings may help guide post-operative musical-listening expectations among individuals considering cochlear implantation.

Learning Objective: To enhance understanding of differences in timbre and pitch perception challenges between hearing aid, bimodal device, and cochlear implant users.

Desired Result: To better understand the musical advantages and disadvantages of CIs among hearing aid users eligible for and/or considering initial implantation, or bimodal users considering a second implant.

Level of Evidence - III

Indicate IRB or IACUC: UCSF **-** 24-41324

Downstream Effects of Regulatory and Reimbursement Expansion on Cochlear Implantation: A 2012-2024 Medicare Analysis

Akshay Warrier, BA; Ryan Bartholomew, MD; Liliya Benchetrit, MD; Daniel J. Lee, MD

Objective: To evaluate the impact of the 2019 FDA single-sided deafness (SSD) indication and the 2022 Medicare eligibility expansion on cochlear implantation (CI) procedure volume, geographic distribution, provider participation, and inflation-adjusted reimbursement.

Study Design: Retrospective interrupted time series (ITS) with segmented regression using national Medicare claims (2012–2024).

Setting: U.S. Medicare Part B claims across hospital and ambulatory sites of service.

Patients: All Medicare beneficiaries receiving CI services (CPT-level identification) from 2012–2024; provider and state identifiers used for distributional analyses.

Intervention(s): Policy exposures: (1) 2019 FDA approval for SSD; (2) 2022 Medicare coverage expansion with relaxed speech-recognition thresholds.

Main Outcome Measure(s): Total Medicare payments, payment per allowed service (inflation-adjusted), procedure volume, provider counts and mean provider volume, state-level service density; secondary visualization via violin plots and reimbursement-ratio trends; comparator trends for hypoglossal nerve stimulation (HGNS).

Results: Inflation-adjusted reimbursement per CI service plateaued or declined after 2019 (segmented estimate −172.2; P=0.08), and reimbursement ratios remained largely static. Procedure volume rose modestly, increasing total CI payments without a corresponding per-service increase. Geographic heatmaps showed broader post-2019 distribution with more states reaching moderate volumes, but mean provider volume remained flat, yielding a broader yet shallower delivery pattern on violin plots. In contrast, HGNS displayed contemporaneous increases in both reimbursement and volume, underscoring relative financial inertia for CI.

Conclusions: Regulatory and coverage expansions broadened access and modestly increased CI volume but did not raise per-service reimbursement, revealing a gap between policy intent and financial execution. Fee schedule rigidity, adoption dynamics, and site-of-service factors likely mediate this disconnect. Policy efforts to improve CI access should align eligibility changes with reimbursement structures and provider incentives.

Learning Objectives
- Quantify how 2019/2022 policy changes affected CI volume, geography, and reimbursement.
- Interpret segmented regression (ITS) findings for payment-per-service versus total spending.
- Contrast CI trends with HGNS to contextualize device-based reimbursement dynamics.

Desired Result: Provide an empirical framework linking eligibility expansions to real-world utilization and payment patterns, informing policy design that couples access with sustainable reimbursement and provider engagement**.**

Level Of Evidence: Retrospective observational claims analysis; not classifiable within traditional clinical evidence hierarchies (e.g., RCTs/cohorts).

Indicate IRB or IACUC: IRB: Exempt

Binaural Hearing and Language Development after Cochlear Implantation in Children with Congenital Single-Sided Deafness

Piotr H. Skarzynski, MD, PhD, MSc; Dorota Pastuszak, MSc; Anita Obrycka, PhD
Artur Lorens, Prof; Anna Ratuszniak, PhD; Henryk Skarzynski, Prof

Objective: To assess the binaural hearing benefits after cochlear implantation (CI) in children with congenital single-sided deafness (SSD) in relation to their language development.

Study Design: cross-sectional

Setting: Tertiary referral center.

Patients: Twenty-seven children with congenital single-sided deafness who had undergone cochlear implantation in the ear with profound hearing loss were included in the study. The mean age at implantation was 4.6 years *(SD=2.7)*. Patients were evaluated preoperatively and at 14 months of CI use.

Interventions: Diagnostic

Main Outcome Measures: Receptive and expressive language skills were evaluated using standardized tests. Three binaural effects — redundancy, head shadow, and squelch — were assessed using speech-in-noise tests in different spatial configurations of speech and noise.

Results: The postoperative distribution of low, average, and high scores shifted toward higher values for both receptive ($\chi^2=6.75;\ p=.009$) and expressive ($\chi^2=9.09;\ p=.003$) language skills. Among the binaural effects, redundancy of 1.3 dB SNR (t(21)=2.26, p=.035) and head shadow of 4.0 dB SNR *(t(21)=5.50, p<.001)* were observed. The squelch effect was not found (*t(20)=1.01, p=.327*). Moreover, all three binaural effects were observed in children with average or high expressive language development scores, whereas in children with low scores, only the head shadow effect was present.

Conclusions: Cochlear implantation in children with SSD restores binaural hearing essential for language development. Binaural processing abilities could serve as an indicator of expressive language development.

Learning Objective: To understand how CI in children with SSD supports binaural hearing and its role in facilitating language development.

Desired Result: To enhance competence in managing SSD through CI.

Level of Evidence: III

Indicate IRB or IACUC: The Bioethics Committee of the Institute of Physiology and Pathology of Hearing (IFPS:KB/Statement 7/2022)

Spoken Language Outcomes after Early Cochlear Implantation in a Diverse, Multi-Institutional Cohort of Congenitally Deaf Children

Evan J. Patel, MD; Samantha Anne, MD; Daniela Carvalho, MD; Laura Covello, MA, CCC-A
Jason Park, MD, PhD; Patricia Yoon, MD; Dylan K. Chan, MD, PhD

Objective: To evaluate spoken language outcomes in a diverse, multi-institutional cohort of children with severe-to-profound hearing loss who have undergone early cochlear implantation.

Study Design: Retrospective cohort

Setting: Multi-institutional study at nine cochlear implant centers and schools with data from 2017-2025

Patients: Children with bilateral congenital severe-to-profound SNHL who underwent cochlear implantation prior to 24 months of age.

Interventions: Cochlear implantation

Main Outcome Measures: Standardized, age-normed language assessments (Preschool Language Scales (PLS) and Receptive-Expressive Emergent Language (REEL)). Sociodemographic status was assessed using the Social Vulnerability Index (SVI), a validated, national geocoded measure based on residential home address.

Results: 140 patients identified at nine separate institutions were included. Mean SVI was 0.48 (SD 0.28; range: 0-0.97). The majority of patients (57.9%, 81 patients) were implanted before 12 months (early CI) while 42.1% (59 patients) were implanted from 12-24 months (late CI). At age 3, the mean total language score for the early CI group was higher than that of the late CI group (94.8 vs 74.6, $p < 0.001$). This difference persisted to age 5, when the early CI group also had significantly better language than the late CI group (97.3 vs 74.1, $p < 0.001$). SVI was not associated with age at implantation ($p = 0.30$). On multivariable regression, SVI (HR 17.5, $p = 0.01$), pre-operative ABR threshold (HR -0.44, $p = 0.01$) and age at CI (HR 0.09, $p < 0.001$) were associated with total language.

Conclusions: Language outcomes in a diverse cohort of deaf babies implanted before 12 months of age are comparable to normal hearing counterparts, suggesting that cochlear implantation provides sufficient access to sound to support full development of spoken language.

Learning Objective: To understand expectations for spoken language outcomes in children with severe-to-profound hearing loss who have undergone cochlear implantation

Desired Result: Learners will appreciate that cochlear implantation before 12 months of age provides sufficient access to sound for the development of spoken language.

Level of Evidence – Level IV

Indicate IRB or IACUC: Approved by IRB #24-42150 at the University of California – San Francisco.

SELECTED ABSTRACTS

POSTER PRESENTATIONS

IN ORDER OF PRESENTATION

159th Annual Meeting
AMERICAN OTOLOGICAL SOCIETY

April 24-25, 2026
Sheraton Phoenix Hotel
Phoenix Convention Center
Phoenix, AZ

(Oral presentations are Fri/Sat April 24-25)

Preliminary Clinical Evaluation of a Digital Auditory-Cognitive Rehabilitation Program for Age-Related Hearing Loss

Kyoungho Park, MD, PhD; Sunwoo Lee, MD; Chanmi Lee, MD
Minchae Jeon, MD; Jihyung Lim, MD

Objective: To evaluate the preliminary efficacy and safety of a digital auditory-cognitive rehabilitation program (DP-DTx-002) for age-related hearing loss (ARHL).

Study Design: Prospective, randomized, controlled pilot study.

Setting: Tertiary referral center; ambulatory

Patients: Twenty-six participants aged 60–85 years with mild to moderate sensorineural hearing loss (PTA ≥25 dB, SDS ≤90%) were randomized to treatment or control groups.

Interventions: The treatment group used a mobile auditory-cognitive training app for 30 minutes, three times weekly, over four weeks; controls received no digital intervention.

Main Outcome Measures: Changes in Korean Hearing Handicap Inventory for the Elderly (KHHIE), Digit Span Test (DST), Korean Mini-Mental State Examination (K-MMSE), and speech discrimination scores (SDS).

Results: The treatment group demonstrated a statistically significant improvement in speech discrimination scores (SDS) following 4 weeks of digital auditory-cognitive training (ANCOVA $p = 0.008$, 0.023 for the right and left ears, respectively).

Conclusions: DP-DTx-002 was safe and feasible, showing trends toward auditory-cognitive benefit. Larger, longer trials are warranted to confirm clinical efficacy.

Learning Objective: To recognize the potential clinical benefits and limitations of app-based rehabilitation programs.

Desired Result: Increased implementation of digital therapeutic tools for remote and accessible auditory rehabilitation.

Level of Evidence - Level IV

Indicate IRB or IACUC: Exempt

Word Recognition and Cognitive Function in Older Adults with Hearing Loss: A Cross-Sectional Study Using a Standardized Neuropsychological Battery

Kyoungho Park, MD, PhD; Sunwoo Lee, MD

Objective: Assessment of the association between hearing loss and cognitive disorders

Study Design: Retrospective case review

Setting: Tertiary referral center; ambulatory

Patients: A total of 801 participants aged ≥60 years. The mean age was 77.1 ± 9.7 years, and the sex distribution was 313 males and 488 females.

Interventions: Speech audiometry was performed bilaterally. Cognitive function was assessed by using the Korea Mini-Mental State Examination (K–MMSE) and the Seoul Neuropsychological Screening Battery.

Main Outcome Measures: The mean speech recognition threshold was 39.6 ± 4.8 dB, and the speech discrimination score averaged 74.3 ± 29.9%. The mean K–MMSE score was 25.1 ± 4.3. Cognitive status was categorized as normal (n = 205), mild cognitive impairment (n = 438), and dementia (n = 158).

Results: Logistic regression revealed that age, sex, and hearing loss were significantly associated with cognitive impairment ($p < 0.05$).

Conclusions: The integration of audiological screening into cognitive risk assessments and raise the possibility that addressing hearing loss may help preserve cognitive function during aging.

Learning Objective: To emphasize the clinical importance of early hearing assessment and intervention to prevent cognitive decline.

Desired Result: Early intervention at the stage of mild hearing loss is crucial to prevent further deterioration of hearing and associated cognitive decline.

Level of Evidence - Level V

Indicate IRB or IACUC: Exempt

Traumatic Tympanic Membrane Perforations Treated with Tympanic Membrane Regeneration Therapy

Tomoya Yamaguchi, MD; Shin-ichi Kanemaru, MD, PhD; Rie Kanai, MD; Eriko Otonari, MD
Maki Yamasoba, MD; Yuki Fujii, MD; Hiroyuki Harada, MD; Toshiki Maetani, MD, PhD

Objective: To evaluate the characteristics and treatment outcomes of traumatic tympanic membrane perforations (TMPs) compared with non-traumatic perforations in tympanic membrane regeneration therapy (TMRT).

Study Design: Intervention study

Setting: Department of Otolaryngology, Medical Research Institute Kitano Hospital

Patients: A total of 568 ears treated with TMRT were analyzed, comprising 65 traumatic TMPs (traumatic group) and 503 non-traumatic TMPs (non-traumatic group). The mean age was 53.3 years in the traumatic group and 61.0 years in the non-traumatic group.

Interventions: All patients underwent TMRT, which involved freshening of the perforation edge, insertion of a gelatin sponge impregnated with basic fibroblast growth factor and sealing with fibrin glue. The procedure was repeated up to four times until closure was achieved.

Main Outcome Measures: Closure rate, age distribution, and presence of tympanic membrane calcification were compared between the two groups.

Results: The closure rate was 98.5% (64/65) in the traumatic group and 98.4% (495/503) in the non-traumatic group. Calcification of the tympanic membrane was observed in 61.5% (40/65) and 72.8% (366/503), respectively. The traumatic group showed a younger age distribution and a lower incidence of calcification. No major complications were observed.

Conclusions: In traumatic tympanic membrane perforations, the absence of chronic inflammation related to their etiology and background was associated with a relatively younger age and a lower incidence of tympanic membrane calcification. The closure rate was excellent in both groups, regardless of the cause of perforation.

Learning Objective: To understand the clinical characteristics of traumatic tympanic membrane perforations compared with non-traumatic perforations in the context of tympanic membrane regeneration therapy, and to recognize how the absence of chronic inflammation and tympanic membrane calcification may influence regenerative outcomes.

Desired Result: To demonstrate that traumatic perforations, typically occurring in younger patients and without chronic inflammatory background, show lower calcification and achieve equally excellent closure rates following tympanic membrane regeneration therapy.

Level of Evidence: IV

Indicate IRB or IACUC: IRB No. 2106006, Medical Research Institute Kitano Hospital (initial approval: June 14, 2021). TMRT has been covered by Japanese national health insurance since November 2019.

Robotic-Assisted Versus Conventional Cochlear Implantations - A Comparative Assessment

Kenneth R. Feehs, MD; Mia Z. Ferry, BS; Robert P. Hyatt, BS; Michele M. Gandolfi, MD, MS
Pedrom C. Sioshansi, MD; Eric M. Kraus, MD, MS

Objective: To assess differences in operative duration, postoperative complications and audiometric outcomes between conventional versus robotic-assisted cochlear implantations.

Study Design: Retrospective case control.

Setting: Single-institution, tertiary referral center.

Patients: Seventy-eight total adult patients were evaluated from December 2023 – February 2025, including 37 who underwent robotic-assisted cochlear implant insertion and 41 who underwent conventional cochlear implant insertion.

Interventions: Cochlear implantation using either conventional manual insertion or robot-assisted electrode insertion with iotaSOFT Insertion System.

Main Outcome Measures: Operative duration, post-operative complication rate, and audiometric outcomes including post-operative pure tone average (PTA), AzBio, Consonant-nucleus-consonant (CNC)-Word and CNC-phoneme scores.

Results: Patients who underwent robotic-assisted cochlear implantation had longer mean operative times (187.8 versus 172.1 min) and higher complication rates (10.8% versus 4.9%) though neither difference was statistically significant. Post-operative improvement in PTA was 50.5 dB in the robot-assisted group and 55.0 dB in the conventional group ($p > 0.05$). Average post-operative AzBio (76.1 versus 67.2), CNC-Word (47 versus 46.5) and Phoneme (64.5 versus 61.4) scores were all higher in the robot-assisted group compared to conventional implant insertion though no difference was statistically significant.

Conclusions: Robotic-assisted cochlear implant insertion demonstrates similar complication rates and operative durations compared to conventional cochlear implantation. Preliminary data suggest that patients who undergo robotic insertion may have improved audiometric outcomes compared to conventional CI insertion though this difference was not statistically significant.

Learning Objective: To better understand robotic-assisted CI insertion audiometric outcomes as compared to conventional CI insertion.

Desired Result: Attendees will have an enhanced understanding of the relationship between the use of robotic assistance during cochlear implant insertions and post-operative audiometric outcomes.

Level of Evidence - Level III

Indicate IRB or IACUC: IRB00125142 – Wake Forest University School of Medicine

Cochlear Implant Performance Prediction: Using the Stroop Test as a Marker of Top-Down Processing in Hearing and Speech-in-Noise Ability

Maaz S. Haji, BS; Irina Cheng, BS; Claus-Peter Richter, MD, PhD

Objective: To assess whether Stroop test scores, a measure of top-down cognitive processing ability, can predict speech-in-noise performance and help identify potentially poor cochlear implant performers.

Study Design: Prospective cross-sectional study

Setting: Academic research setting

Patients: 26 adult participants with normal hearing to mild hearing loss.

Interventions: Each participant completed a standard audiometric hearing test, a computerized Stroop test, and a Quick Speech-in-Noise (QuickSIN) test. The signal-to-noise ratio (SNR) loss was used as a proxy for speech-in-noise understanding.

Main Outcome Measures: Correlation between Stroop test times (s) and QuickSIN SNR loss (dB).

Results: Stroop test times naming the colors with incongruent information correlated significantly with QuickSIN SNR loss (N = 26; **$r = 0.68$; $p < 0.05$; power > 95%**). Participants with slower interference resolution consistently demonstrated poorer speech-in-noise performance, suggesting that top-down cognitive control meaningfully contributes to hearing outcomes in speech processing.

Conclusions: Even among individuals with normal hearing to mild hearing loss, slower Stroop performance predicted poorer speech-in-noise scores. Given that the Stroop test is a reliable measure of top-down processing abilities, a battery of similar tests may help identify individuals who struggle to use hearing at a cognitive level and could inform pre-implant assessment models which currently are limited to audiometric evaluation only.

Learning Objective: Recognize how the Stroop test can capture top-down cognitive processing relevant to hearing and predict speech-in-noise performance.

Desired Result: Promote inclusion of cognitive tests that measure top-down processing ability in cochlear implant assessments to better identify individuals at risk for poor listening outcomes post-surgery.

Level of Evidence - Level III

Indicate IRB or IACUC: Northwestern University – IRB#: STU00223538 – Obtained 06/26/2025

A Pilot Study of Virtual Reality-Vestibular Physical Therapy for Refractory Dizziness

Alexandra T. Bourdillon, MD; Evan J. Patel, MD; Ricky Chae, MD
Eliot J. Gann, DPT; Alexander Dien, DPT; Jeffrey D. Sharon, MD

Objective: To assess the tolerability and efficacy of Virtual Reality-Vestibular Physical Therapy (VR-VPT) in individuals with refractory symptoms after conventional vestibular rehabilitation

Study Design: Prospective Cohort Study

Setting: Tertiary referral center

Patients: Individuals with vestibular disorder offered VR-VPT if they (1) still had symptoms after conventional vestibular physical therapy or (2) were considered to have a specific problem suited to VR-VPT

Interventions: Treatment consisted of approximately eight 45-minute sessions, each directed by a physical therapist.

Main Outcome Measures: Differences in baseline and post-treatment surveys, provider-based assessments, and pre- and post-session Simulator Sickness Questionnaire (SSQ) scores were analyzed.

Results: Among our cohort of 18 participants, there were 10 individuals with vestibular loss (VL), six with vestibular migraine (VM), and four with Persistent Postural-Perceptual Dizziness (PPPD). Significant improvements were seen post-treatment in the Dizziness Handicap Inventory (n=15, mean difference: -11.7, 95% CI: [-18.2, -5.2], p=0.002) and the Functional Gait Assessment (n=17, mean difference: 2.3, 95% CI: [0.8, 3.8], p=0.005). Video head impulse testing and dynamic visual acuity improved in a subset of VL participants who underwent both baseline and post-treatment testing. VR-VPT sessions did not significantly provoke symptoms captured in SSQ responses, such as nausea (average difference: 0.32 ± 0.68) or general discomfort (average difference: 0.14 ± 0.68).

Conclusions: This pilot study suggests that VR-VPT can be tolerated and may benefit many patients with refractory symptoms, with additional benefits in vestibular function observed in individuals with vestibular loss.

Learning Objective: VR-VPT may improve patient-reported and objective measures of vestibular or balance function in difficult-to-treat patients.

Desired Result: To consider the role of VR-VPT in managing vestibular disorders.

Level of Evidence - IV

Indicate IRB or IACUC: 21-33311.

Listening Fatigue Contributes to Hearing-Related Quality of Life in Adult Cochlear Implant Candidates

Andrew L. S. Thornton, BA; Annie Shen, BS; Andrea J. DeFreese, AuD; Jessica H. Lewis, AuD
Benjamin W. Y. Hornsby, PhD; Terrin N. Tamati, PhD; Aaron C. Moberly, MD

Objective: To gain a better understanding of demographic, audiologic, and psychosocial factors associated with hearing-related quality of life (QOL) in adult cochlear implant (CI) candidates.

Study Design: Retrospective cross-sectional analysis.

Setting: Tertiary academic medical center.

Patients: A total of 198 adults evaluated for CI candidacy completed the Cochlear Implant Quality of Life-10 Global (CIQOL-10 Global) and other preoperative patient-reported outcome measures (PROMs). Among these, 72 patients had complete data for both the Vanderbilt Fatigue Scale 10-item version (VFS) and Tinnitus Handicap Inventory (THI) and were included in regression analysis.

Interventions: Preoperative audiologic, demographic, and PROM testing (VFS and THI).

Main Outcome Measures: Preoperative CIQOL-10 Global score.

Results: Preoperative CIQOL-10 Global scores were significantly negatively correlated with VFS ($r = -0.60$, $p < .001$) and THI ($r = -0.27$, $p = .005$), such that increased fatigue and tinnitus were associated with poorer quality of life. No significant correlations were observed for age, duration of deafness, or preoperative AzBio Sentences in Quiet (AzBio) scores in the ear to be implanted. In a multivariable regression analysis of preoperative CIQOL-10 Global including all five variables (VFS, THI, age, duration of deafness, AzBio), only VFS remained a significant independent and negative predictor of CIQOL-10 Global ($\beta = -0.58$, $p < .001$; $R^2 = 0.33$).

Conclusions: Worse listening fatigue was the sole independent factor explaining poorer preoperative hearing-related QOL, underscoring its distinct psychosocial role beyond traditional audiologic measures. In contrast, tinnitus perception, age, duration of deafness, and speech-recognition ability did not independently contribute to QOL. These findings suggest that assessing listening fatigue may provide insight into the broader cognitive or emotional costs of hearing not captured by standard metrics, allowing for enhanced counseling and expectation setting. However, a substantial portion of variance in QOL remains unexplained, highlighting the need for additional research.

Learning Objective: Recognize the role of listening fatigue as an independent contributor to hearing-related quality of life in adults prior to cochlear implantation.

Desired Result: Highlight listening fatigue screening as a potential valuable addition to preoperative cochlear implant evaluation.

Level of Evidence: Level III.

IRB: Approved, Vanderbilt University Medical Center #231259.

Speech Perception and Device Use After Cochlear Implantation in Children with Single-Sided Deafness

Emily S. Xu, PhD; Cara M. Donahue, AuD; Katherine Farnsworth, AuD; Alison Olivo, AuD
Denise Thomas, AuD; Elizabeth Tournis, AuD; Susan Reynolds, AuD
Maura Ryan, MD; Nancy M. Young, MD

Objective: To evaluate speech perception outcomes and device use in implanted children with single-sided deafness (SSD)

Study Design: Retrospective cohort review.

Setting: Tertiary care center.

Patients: 39 children with SSD diagnosed at mean age of 4.6 years (1 month -15.7 years). All children had normal cochlear nerves and no significant malformation of the cochlear turns as determined by MRI. Onset group and mean age at diagnosis: Referred Newborn Hearing Screening (Group 1) N=16, 12 months; Unknown (Group 2) N=17, 5.6 years; Sudden Loss (Group 3) N=6, 11.7 years. Seven children had other conditions in addition to SSD placing them at risk for delay in speech perception and language development.

Interventions: Unilateral CI.

Main Outcome Measures: Speech perception and average daily device use measured by hearing hour percentage (HHP).

Results: Mean age at CI 7.4 years (1.2-16.7). Mean length of device use 2 years (1-3). 90% (35/39) developed speech perception: 10 (26%) closed-set; 25 (64%) open-set. 4 (10%) improved detection without speech perception. Most children in each onset of loss group developed speech perception. Group 1: 14 (88%) 8 closed-set; 6 open-set. Group 2: 16 (94%) 1 closed-set; 15 open-set. Group 3: 5 (88%) 1 closed-set; 5 open-set. All 7 children with complicating conditions developed speech perception (1 closed-set; 6 open-set). Mean HHP for all 39 children was 41% (4%-93%): closed-set group 35%; open-set group 44%; children with no speech perception 36%; and with complicating conditions 48%. Higher socioeconomic status was significantly correlated with higher mean HHP ($p<.001$). Three (8%) children were non-users: two teenagers with sudden hearing loss and one 6-year-old with unknown age at onset of hearing loss. Two non-users had developed measurable open-set skills. Angular insertion depth of the 39 implanted electrode arrays will be determined from immediate post operative X-rays to determine if correlations with outcome measures are present.

Conclusions: Most implanted SSD children developed speech perception in the implanted ear, including those with complicating conditions. Daily device use measured by HHP was lower than has been recommended to optimize CI performance. However, the vast majority remain as device users. Further research is needed to understand the influences impacting daily device use by CI children with SSD. Whether use is driven by the child and/or parent's perception of benefit, the presence or risk of language delay, risk of loss in the normal hearing ear, as well as the influence of the home versus school environment are important to understand the impact of implantation and to improve counseling.

Learning Objective: Understand and describe range of speech perception outcomes and hours of daily device use in a heterogenous population of implanted children with SSD.

Desired Result: To improve clinicians' ability to counsel families of children with SSD and to encourage further research into device use and outcomes.

Level of Evidence - Level IV

Indicate IRB or IACUC: Lurie Children's Hospital IRB#2018-1650

Impact of Contralateral Hearing Status on Cochlear Implant Device Engagement

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

Objective: The expanding indications for cochlear implantation (CI) have perpetuated diverse hearing loss profiles among this patient population, including single-sided deafness (SSD), asymmetric bilateral hearing loss (AHL), and bilateral symmetric hearing loss (BSHL). This study quantifies CI utilization patterns to identify populations at high risk for non-use and inform targeted protocols.

Study Design: Retrospective cohort study.

Setting: Tertiary academic center.

Patients and Intervention: 84 adult CI recipients (2018-2024) with complete audiometric classification. Patients were classified by preoperative pure-tone averages: SSD (non-implanted ear ≤30dB, n=26), AHL (both ears ≥50dB with >15dB asymmetry, n=18), and BSHL (both ears ≥50dB with ≤15dB asymmetry, n=40). Groups were well-matched on age at implantation and duration of deafness.

Main Outcome Measures: Mean daily CI usage from device datalogging.

Results: Overall CI usage differed significantly across the three configurations (Kruskal-Wallis $p<0.001$). SSD patients demonstrated significantly lower utilization compared to both AHL and BSHL groups (7.2±4.1 vs 10.6±3.8 vs 11.4±3.4 hours/day, respectively; $p=0.008$ for SSD vs AHL, $p<0.001$ for SSD vs BSHL). Notably, the AHL and BSHL groups showed statistically equivalent mean daily usage (10.6±3.8 vs 11.4±3.4 hours/day, $p=0.297$, Cohen's $d=0.25$). Full-time usage (≥8 hours/day) was achieved by 50.0% of SSD patients versus 88.9% of AHL and 87.5% of BSHL patients, representing a highly significant difference across categories (χ^2 $p<0.001$). Compared to BSHL, SSD patients were 43% less likely to achieve full-time use (Relative Risk 0.57) and faced a 4.0-fold higher risk of device disengagement (suboptimal usage <8 hours/day: 50.0% vs 12.5%).

Conclusions: Contralateral hearing status predicts CI engagement, with SSD representing a uniquely vulnerable population. These findings underscore the need for tailored counseling, intensified monitoring, and targeted support strategies for SSD recipients to mitigate a high risk for device abandonment.

Learning Objective: To understand that preoperative hearing loss configuration is a fundamental determinant of cochlear implant utilization patterns, with single-sided deafness conferring significantly elevated risk for device non-use and abandonment.

Desired Result: The implementation of configuration-specific counseling and intensified monitoring protocols in clinical practice to identify high-risk SSD recipients and guide timely, targeted support strategies to improve device engagement.

Level of Evidence - Level III

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

Practice Makes Perfect: Relationship of Early Datalogging and Speech Scores in Veterans Affairs Cochlear Implant Users

W. Craig Kemper, MD; Kaitlyn A. Brooks, MD; Anna Henry AuD; Benjamin D. Lovin MD
Alex D. Sweeney MD; Angela S. Peng MD; Nathan R. Lindquist, MD

Objective: To investigate the relationship between cochlear implant daily usage "datalogging" and speech recognition scores in veterans.

Study Design: Retrospective cohort study

Setting: Tertiary referral veterans affairs medical center (VAMC).

Patients: Patients who underwent initial cochlear implantation at a single-institution VAMC between December 1998 and May 2024.

Interventions: Cochlear implant, speech recognition testing

Main Outcome Measures: Daily datalogging, speech recognition scores

Results: A retrospective chart review at a large VAMC cochlear implant center identified 29 patients implanted between December 1998 and May 2024 with 1-month datalogging information. Patient datalogging at 1-month was strongly positively correlated with datalogging at 3-month (r_s=0.9029, p<0.01), 6-month (r_s=0.8857, p<0.01), and 12-month (r_s=0.6832, p<0.01) visits. Datalogging at 1-month was moderately positively correlated with AzBio scores at 1-month but strongly correlated with increased AzBio and CNC scores at 12-months (AzBio: r_s=0.6410, p<0.01, CNC: r_s=0.6008, p<0.01). 12-month datalogging was moderately positively correlated with 12-month AzBio (r_s=0.5903, p<0.01) and mildly positively associated with 12-month CNC scores (r_s=0.4017, p=0.047). Linear regression models suggest that 1-month "early" datalogging is more significant than even age or pre-operative scores in predicting 12-month AzBio (β = 6.511, 95% CI 2.361 to 10.66, p=0.0046) and 12-month CNC (β = 5.214, 95% CI 1.711 to 8.717, p=0.0063) outcomes.

Conclusions: A growing interest in recording daily device usage "datalogging" has demonstrated a correlation between cochlear implant datalogging and postoperative speech scores. This data demonstrates that 1-month datalogging is a powerful predictor of long-term CI device usage and speech recognition scores in the veteran population.

Learning Objective:
1. Understand the impact of early CI device usage in the veteran population.

Desired Result:
Improve our understanding of the relationship between early device usage and speech recognition outcomes in the veteran population.

Level of Evidence: Level IV

Indicate IRB or IACUC: Michael E. DeBakey Veterans Affairs Medical Center IRB #1773722-5, BCM IRB H-54164

Antihypertensive Medications' Effects on Hearing Preservation in Vestibular Schwannoma Patients

Anika S. Walia, BA; Harshini Ravi, BS; Alina Galaria, BA
Michael Lee, BSN; Pranav Bingi, BS; Khoa Nguyen, BS; Jacob B. Hunter, MD

Objective: Most vestibular schwannoma (VS) patients experience progressive hearing loss, with prior research showing potential hearing preservation qualities with angiotensin receptor blockers (ARBs). Our objective is to examine whether specific antihypertensive medication classes differentially affect hearing decline in VS patients.

Study Design: Retrospective cohort study.

Setting: Tertiary academic medical center.

Patients: Of 290 VS patients, 218 patients with ≥2 audiograms were included in longitudinal analysis (mean follow-up 4.8 years). Overall, 138 patients were documented taking an antihypertensive medication.

Interventions: Observational exposure to hypertensive medications of varying classes.

Main Outcome Measures: The primary outcome measure is audiometric change, measured by change in pure tone average air conduction (PTA-AC) and across frequencies ranging from 0.5 - 8kHz, and secondary measures include dose response relation.

Results: Patients without hypertension medications (n =80) experienced tumor-side PTA-AC decline of 11.6±16.9 dB/year. Not considering all other medications, patients taking CCBs (n =34) demonstrated the strongest protective trend (5.5±9.6 dB/year; -6.1 dB/year difference, p=0.072, Cohen's d= -0.44), representing 53% slower decline. Effects were consistent across doses (low ≤5mg: -6.6 dB/year; high >10mg: -8.2 dB/year). ARBs (n=39) showed modest effects (6.4±25.8 dB/year; -5.3 dB/year, p=0.32, Cohen's d=-0.24), though no clear dose-response relationship emerged. Other medication classes (beta blocker, ACE inhibitors, and diuretics) showed minimal effects (all p>0.4, Cohen's d > -0.1). Among patients taking greater than one medication, those taking a CCB (n=23) had 44% slower hearing decline compared to non CCB including regimens (n=26) (- 4.8 dB/year, p =0.10, Cohen's d = -0.48). All frequencies (0.5-8 kHz) were proportionally affected without frequency-specific vulnerability.

Conclusions: Despite prior research demonstrating ARB are protective for hearing loss with VS, we found that calcium channel blockers demonstrated the strongest potential for hearing preservation (53% slower decline), despite nearly half of medicated patients being on multiple concurrent antihypertensive medications.

Learning Objective: To understand the effects of antihypertensive medications on hearing changes in vestibular schwannoma patients and specifically evaluate CCBs.

Desired Result: To establish rationale for prospective randomized controlled trials for CCBs for hearing protection in VS patients and guide clinical decision-making regarding antihypertensive medication selection in vestibular schwannoma patients when hearing preservation is a priority.

Level of Evidence - Level III – Cohort Study

Indicate IRB or IACUC: Exempt iRISID-2023-2306 Thomas Jefferson

Anatomy Based Fitting vs. Clinically Based Fitting in Cochlear Implants - Quantifying Map Parameter Differences

Anika S. Walia, BA; Pranav Bingi, BS; Lauren Lucas AuD; Janvi Shukla, BA
Thomas O. Willcox, MD; Rebecca Chiffer, MD; Jacob B. Hunter, MD

Objective: To quantify the difference in map parameters between anatomy-based fitting (ABF) and clinically based fitting (CBF) in cochlear implant (CI) patients and evaluate if certain electrode arrays or patient characteristics are associated with differences.

Study Design: Retrospective cohort study.

Setting: Tertiary academic medical center.

Patients: Twenty-three cochlear implant patients with Med-El arrays were included. Central frequency (CF) [Hz] and most comfortable level (MCL) were obtained from maps at electrodes 1-12 immediately prior to and post ABF was applied.

Interventions: Cochlear implant programming map information was collected for CI patients who underwent ABF, and volume measurements were determined using preoperative CTs in Otoplan 3.1.0.

Main Outcome Measures: Primary measures include mean changes between MCL and CF across all twelve electrodes between CBF and ABF. Secondary measures include associations of CF change to electrode array type (Flex-28 and FlexSoft) and scala tympani (ST) volume.

Results: Of 23 patients, demographics included 14 females, 9 males, with 87% identifying as Caucasian, and mean age at surgery of 65.7 yrs +/- 14.8 yrs. Basal electrodes (1-4) showed progressively increasing mean CF changes from base to apex (120.4 Hz, 224.3 Hz, 342.5 Hz, and 469.1 Hz), and middle electrodes (5-10) showed substantially greater changes following a similar pattern (638.04 Hz, 827.55 Hz, 972.35 Hz, 1093.87 Hz, 1312.41 Hz, 1148.68 Hz), though apical electrodes (11-12) demonstrated a tapering pattern (722.44 Hz, 247.55 Hz). ANOVA analysis indicated significant differences ($p < 0.0001$) in mean CF change when comparing across all electrodes. Mean MCL changes across electrodes 1-12 did not follow an overt pattern and ranged from 0.75 to 2.77, with no significant differences ($p=0.95$).
Between patients implanted with Flex28 ($n =17$) vs. FlexSoft ($n=5$), significant differences in mean CF change were observed at electrodes 2-4 ($p < 0.05$), with Flex28 having greater changes. Pearson correlation of ST volume ($n =12$) to mean change in CF across all electrodes per patient ($r = 0.188$, 95% CI [-0.596, 0.788], $p = 0.656$) and in MCL across all electrodes per patient ($r = -0.591$, 95% CI [-0.930, 0.292], $p = 0.162$) revealed no significant relationship. Average cochlear duct length for Flex28 patients was 31.4 mm and for FlexSoft 33.67mm.

Conclusions: Change in electrode CF from CBF to ABF is significantly different across different electrodes, with greater differences observed in middle electrodes (electrodes 5-10) in comparison to more basal or apical electrodes. Electrode array type may influence ABF frequency reassignment patterns in the basal-middle cochlear region, with significantly larger changes in Flex28 implants across electrodes 2-4 than in FlexSoft. Differences in electrode CF change indicate the benefit of ABF in CI patients and suggest further research in optimizing CBF CI programming with logarithmic maps if ABF is not available, or change in electrode design.

Learning Objective: To understand which electrode positions require the greatest programming adjustments in ABF and understand the role of electrode type and cochlear anatomy in predicting mapping changes.

Desired Result: To guide evidence-based expectations for programming changes when implementing ABF and guide decisions about which patients may benefit most from ABF.

Level of Evidence – Level III cohort study

Indicate IRB or IACUC: Exempt iRISID-2023-2348 Thomas Jefferson

Cochlear Implantation in Nonagenarians: Are the Benefits Worth the Risks?

Cameron B. Fattahi, MD; Nicholas S. Andresen, MD; Desi P. Schoo, MD; Edward E. Dodson, MD
Yin Ren, MD, PhD; Oliver F. Adunka, MD, MBA; Robert J. Macielak, MD

Objective: To assess if cochlear implant (CI) insertion is safe and effective in the ≥90-year-old population and how long these patients derive meaningful benefit from implantation.

Study Design: Retrospective case series

Setting: Academic tertiary referral center

Patients: Patients who underwent cochlear implantation with an age at surgery of ≥90-years.

Interventions: Cochlear implantation

Main Outcome Measures: Duration of CI use, average daily CI use, and audiometric outcomes including Consonant-Nucleus-Consonant (CNC) word and AzBio sentence testing in quiet.

Results: Total of 12 patients were identified, with a mean age at surgery of 91.4 years (SD ± 1.1 years). These patients had preoperative mean CNC and AzBio scores in quiet of 10 and 12.9, respectively (SD ± 13.0, 12.2). There were no intraoperative complications, and few perioperative anesthetic complications (one patient [8%] with urinary retention requiring repeated straight catheterizations and one patient with delayed oxygen wean despite lack of contributing comorbidities). After surgery, 3 patients were admitted with 1 patient having a conservatively managed hematoma, 1 patient experiencing difficulty weaning supplemental oxygen, and 1 patient (8%) undergoing planned admission due to preexisting comorbidities. Two patients (17%) experienced late complications with one experiencing device failure occurring 10 months after implantation and one patient having new-onset disequilibrium. The mean time to latest postoperative audiogram was 17.2 months (SD ± 19.5 months). Mean postoperative CNC and AzBio scores in quiet increased to 32 and 42.2, respectively (SD ± 18.3, 27.1). On average, patients used their CIs for 9.1 hours per day (SD ± 5.3 hours) and derived 2.6 years of meaningful CI use (range 0.25 to 6, SD ± 2.0 years).

Conclusions: Overall, CI surgery was generally well-tolerated in a very elderly patient population despite some anticipated perioperative challenges. Moreover, these patients had improvement in hearing outcomes postoperatively and experienced multiple years of meaningful use after implantation, highlighting the quality-of-life benefits despite their advanced age.

Professional Practice Gap & Educational Need: The length of benefit and complications associated with cochlear implantation in nonagenarians is sparsely studied in the literature.

Learning Objective: To identify the safety and efficacy of cochlear implantation in nonagenarians.

Desired Result: To assist clinicians and patients with outcomes in nonagenarians.

Level of Evidence: Level IV

Indicate IRB or IACUC: The Ohio State University IRB Protocol #2023H0410

Quantitative Temporal Bone Analysis Reveals Inflammation-Dependent Matrix Proliferation in Cholesteatoma

Nathan M. Jacob, BS; Abigail R. Montalmant, BS; Yassine Balhi, MD
Amanda M. Lauer, PhD; Zahra N. Sayyid, MD, PhD

Hypothesis: Localized inflammation promotes cholesteatoma proliferation and increased keratinization is associated with ossicular erosion.

Background: Cholesteatoma is a destructive middle ear lesion whose growth may be driven by local inflammation. Defining this relationship can clarify mechanisms of progression and inform treatment strategies.

Methods: Hematoxylin and eosin–stained slides from fourteen post-mortem temporal bones from ten affected patients were analyzed on QuPath software. Extent of keratinization (0–2), ossicular erosion (malleus, incus, stapes; 0–2), and other histologic features were qualitatively assessed. Contralateral ears were examined for pathology. Quantitative analysis measured cholesteatoma matrix length and cell layers across graded inflammatory environments using Image J software (0–2; mild, moderate, severe).

Results: The cohort's mean age was 46.9 ± 14.4 years. Of the participants, 43% were male and 57% were Caucasian. The extent of keratinization was significantly associated with erosion of the malleus and incus but not the stapes (malleus $\rho = 0.047$, incus $\rho = 0.002$, stapes $\rho = 0.112$). Contralateral cholesteatoma was present in three of four ears but did not correlate with ipsilateral severity. Quantitative analysis showed that cholesteatoma matrix length increased with severity of inflammation (67.7 ± 46.0 µm for mild, 141.3 ± 60.7 µm for moderate, and 226.2 ± 55.3 µm for severe; $F(2,42) = 26.03$, $p < 0.00001$). Mean cell layers also increased with severity of inflammation from 10.0 ± 4.4 to 21.8 ± 9.6 and 28.7 ± 6.2 ($F = 24.74$, $p < 0.00001$), with all pairwise differences being significant (Tukey $p < 0.01$).

Conclusions: Localized inflammation is associated with cholesteatoma proliferation, while keratinization is associated with ossicular erosion. Contralateral pathology is common but independent of ipsilateral severity.

Learning Objective: Understand the role of localized inflammation in cholesteatoma proliferation and the utility of quantitative histology.

Desired Result: Highlight links between inflammation and cholesteatoma growth for clinical and research contexts.

Level of Evidence: Level V

Indicate IRB or IACUC: IRB00203441, Johns Hopkins University Department of Otolaryngology – Head and Neck Surgery

Impact of Hormone Replacement Therapy on Hearing Loss, Tinnitus, and Vestibular Dysfunction in Menopause: A Multi-National Database Study

Neeti Gandra, BA; Warren Chun, MD; Shaun A. Nguyen, MD
Robert F. Labadie, MD, PhD; Ted A. Meyer, MD, PhD

Objective: To evaluate whether hormone replacement therapy (HRT) mitigates the incidence of hearing loss, tinnitus, and vestibular dysfunction in patients with menopause.

Study Design: Retrospective Cohort Database Study

Setting: TriNetX Global Collaborative Network provides real-time, de-identified, HIPAA compliant data from 156 healthcare organizations worldwide (178 million patients, September 2025).

Patients: Females aged 40-60 with and without HRT were evaluated for new diagnoses of tinnitus, hearing loss, or vestibular dysfunction following menopause. Propensity matching controlled for age, race, and ethnicity.

Interventions: Hormone Replacement Therapy

Main Outcome Measures: Means, odds ratios (OR), and risk differences (RD) with 95% confidence interval (CI) for tinnitus (H93.1), hearing loss (H90), or vestibular dysfunction (H81).

Results: The study included 41,118 HRT users and 229,648 non-users (mean ages 51.4 vs. 50.1 years). After propensity matching, HRT use was linked to higher odds of tinnitus (OR 1.22, 1.11–1.33; $p<0.0001$) and hearing loss (OR 1.28, 1.17–1.41; $p<0.0001$), but not vestibular dysfunction. Sub-analyses showed increased odds of sensorineural hearing loss specifically (OR 1.39, $p<0.0001$). To account for potential confounding effects, further sensitivity analyses were performed; associations with tinnitus and hearing loss persisted after excluding ototoxin exposure (OR 1.13, $p=0.03$; OR 1.24, $p=0.001$) and anatomical abnormalities (OR 1.24, $p=0.001$; OR 1.22, $p<0.0001$). Among patients with BMI ≥ 30, HRT showed higher odds of tinnitus (OR 1.30), hearing loss (OR 1.35), and vestibular dysfunction (OR 1.23; all $p\leq 0.008$).

Conclusions: In this large, real-world analysis, HRT use was associated with higher odds of tinnitus and hearing loss, while effects on vestibular dysfunction were inconclusive. These findings highlight the need to consider auditory and vestibular risks in HRT management.

Learning Objective: To identify the impact of HRT therapy on auditory and vestibular health for patients with menopause including hearing loss, tinnitus, and vestibular dysfunction outcomes.

Desired Result: To advocate for future prospective studies and encourage consideration of these effects when promoting HRT for patients with menopause.

Level of Evidence – Level III

Indicate IRB or IACUC: Exempt

Early Comparative Audiometric Results of a Total Ossicular Replacement Prosthesis With and Without a Stapes Footplate Shoe

Benjamin R. Johnson, MD, Kayla B. Hicks, MD, Nicholas J. Thompson, MD
Matthew M. Dedmon, MD, PhD; A. Morgan Selleck, MD
Margaret T. Dillon, AuD, PhD, Kevin D. Brown, MD, PhD

Objective: To compare postoperative audiologic outcomes for ossicular chain reconstruction (OCR) with a total ossicular replacement prosthesis (TORP) with and without a footplate shoe (FPS)

Study Design: Retrospective chart review

Setting: Tertiary Referral Center

Patients: Data were reviewed for adult and pediatric patients who underwent OCR with TORP from January 1, 2015-January 1, 2025. Patients with a history of stapedectomy or immobile footplate were excluded. Audiometric data within 1 year of surgery were available for 57 patients with TORP only and 26 with TORP + FPS.

Interventions: Ossicular chain reconstruction using TORP ± FPS

Main Outcome Measures: Air conduction pure tone average (AC PTA4), Bone Conduction pure tone average (BC PTA4), Air Bone Gap (ABG), change in ABG, % of patients with ABG ≤ 30 dB HL

Results: Using ANOVA, there was a significant effect of group (TORP + FPS vs TORP only) on postoperative ABG ($p=0.047$), change in ABG ($p=0.050$), and percentage of ABG closure ($p=0.025$) ≤1 year after surgery. Mean postoperative ABG ≤1 year after surgery for the TORP + FPS group was 23.5 dB HL (SD: 10.1) and 32.0 dB HL (SD: 13.4) for the TORP only group. Mean change in ABG for the TORP + FPS group was -10.7 dB HL (SD: 16.4) and -7.5 dB HL (SD: 15.6) for TORP only. Postoperative ABG ≤ 30dB HL <1 year after surgery was achieved in 84.6% (22/26) of TORP + FPS patients vs. 49.1% (28/57) TORP only patients.

Conclusions: OCR using a TORP + FPS showed statistically significant improvement in postoperative ABG, change in ABG, and rate of ABG closure to ≤30 dB HL for patients ≤1 year after surgery when compared to OCR using a TORP alone.

Learning Objective: To understand the FPS, the indications for its use and when it would be helpful. To describe the implications of OCR on sound mechanics and expected changes in audiogram after this procedure.

Desired Result: Better post-operative audiologic outcomes when using a FPS with an OCR, particularly in patients with a CWD cavity.

Level of Evidence - III

Indicate IRB or IACUC: UNC IRB 24-038

Role of Surgery for Tissue Culture Directed Antimicrobials in Skull Base Osteomyelitis Treatment

Hetal Lad, BS; Emma Thompson, BA; Lucy Revercomb, BS; Joseph Chong, BS
Devanshi Patel, MD; Michael Ray Moentmann, MD; Yu-lan Mary Ying, MD

Objective: Skull base osteomyelitis (SBO) is a rare but life-threatening complication of malignant otitis externa. Mainstay treatment is intravenous antimicrobials. The role of surgical intervention, namely mastoidectomy with ear tube placement, for intraoperative tissue culture remains unclear. We aim to characterize the role of surgery in facilitating culture-directed antimicrobial therapy and associated outcomes in SBO management.

Study Design: 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 Measures: Antibiotic regimen modification following culture results and subsequent disease recurrence.

Results: A total of 48 patients with a mean age of 67.2 years (79.5% male) met inclusion criteria. Surgery was performed in 60.4% (29/48) of patients, with surgical cultures obtained from the external auditory canal (EAC) (60.7%), middle ear (21.4%), and mastoid (46.4%). EAC cultures were obtained for 87.5% of patients who did not undergo surgery. Positive cultures were identified in 69.3% of surgical specimens, most commonly Candida species (20%), Pseudomonas aeruginosa (15%), and Staphylococcus epidermidis (15%). Initial antimicrobial regimens were modified based on surgical culture results in 65% of cases ($p=0.011$). Among patients receiving antimicrobials modified after surgical culture, the recurrence rate was 23.6% (5/19), compared to 40.0% (4/10) in those receiving antibiotics that did not change ($p = 0.37$). The mean time to recurrence differed by 36.5 days between those with modification of antimicrobials compared to maintenance (89 vs 52.5 days, respectively) ($p=0.34$).

Conclusions: Mastoid surgery for tissue analysis provided high therapeutic yield, prompting antibiotic modification in patients with SBO. Surgery may provide diagnostic benefit through tissue sampling to guide early targeted antimicrobial selection.

Learning Objective: To understand the diagnostic and therapeutic role of surgery in guiding antimicrobial therapy and improving clinical outcomes in skull base osteomyelitis.

Desired Result: Clinicians will recognize the value of surgical tissue culture collection in enabling targeted antimicrobial modification and reducing disease recurrence in patients with skull base osteomyelitis.

Level of Evidence: III

Indicate IRB or IACUC: Rutgers University Pro2024002225

Evaluation of the Effects of Monitored Anesthesia Care on Intraoperative Electrically-Evoked Stapedial Reflex Thresholds with Cochlear Implantation

Janice J. Chung, MD; Jacob Iveland, AuD; Akira Ishiyama, MD

Objective: Electrically-evoked stapedial reflex thresholds (eSRTs) direct upper stimulation levels of cochlear implant (CI) recipients. However, eSRTs can be difficult to achieve clinically. Intraoperative eSRTs offer an alternative. eSRT registration is depressed by general anesthesia (GA). Thus, the potential role of eSRT during CI under monitored anesthesia care (MAC) was studied.

Study Design: Retrospective cohort study.

Setting: Cochlear implant program at a tertiary medical center.

Patients: CI recipients with intraoperative eSRT between January 2023 and October 2025.

Interventions: eSRTs, CIs performed under MAC and GA.

Main Outcome Measures: Intraoperative and postoperative eSRTs compared across patients who underwent CI under MAC and GA.

Results: 50 CI632 CIs had eSRTs under general anesthesia and 4 had eSRTs under MAC. Electrodes 22, 17, 12, 6, and 1 were utilized. All 4 CIs under MAC utilized pulse width (PW) 25. 52% of the CIs under GA utilized PW 25, 10% PW 37, 16% PW 50, and 22% PW 100. There was an expected, but statistically significant, inverse relation between PW and eSRTs in electrodes 22 ($F=4.0$, $df=3$, $p<0.05$), 17 ($F=7.3$, $df=3$, $p<0.001$), and 12 ($F=3.2$, $df=3$, $p<0.05$). Notably eSRTs for electrode 17 ($U=10$, $p<0.01$) at PW 25 were significantly decreased under MAC compared to GA. The average discrepancies of eSRTs between GA and clinic were 25.6 (E22), 25 (E17), 28.3 (E12), and 35.7 (E6). Electrode 1 was clinically challenging to ascertain. Clinical discrepancies for CI under MAC were 17 (E22), 3 (E17), and 0 (E12).

Conclusions: Previous studies have suggested eSRTs remain stable within subjects over time. However, eSRTs can be challenging to establish clinically. Intraoperative eSRTs offer an alternative, and this preliminary study suggests CI under MAC may enable greater fidelity.

Learning Objective: Attendees will be able to describe the utility of intraoperative eSRTs and consider the potential benefits of MAC when performing CI.

Desired Result: Optimizing CI outcomes for patients through augmentation of the quality of intraoperative CI assessment.

Level of Evidence - IV

Indicate IRB or IACUC: Exempt.

Exploring Delays in Pediatric Hearing Loss Treatment: Timing, Access, and Outcomes

Joshua M. Cohen, BS; Shaynie Segal, BA; Kasmira Gupta, BS
Hailey D. Reisert, BS; Howard S. Moskowitz, MD, PhD

Objective: This study aims to characterize delays in intervention among pediatric patients with sensorineural hearing loss and to identify contributing factors, with the goals of reducing treatment delays, improving adherence, and enhancing patient outcomes.

Study Design: Retrospective cohort review and caregiver phone survey.

Setting: Tertiary otologic referral center.

Patients: Patients aged 0-18 years who underwent ABR screening, were diagnosed with sensorineural hearing loss, and were recommended an intervention such as hearing aids or cochlear implants.

Interventions: Patients with a documented delay of more than six months in receiving hearing loss treatment were contacted for a brief phone survey to identify barriers to care, reasons for delays, and potential additional resources.

Main Outcome Measures: The primary outcomes were the rate of treatment delay (≥6 months) and factors associated with delay and adherence.

Results: 188 patients were identified in an 11-year period, with 30% (n=56) experiencing treatment delays exceeding six months. Among delayed cases, 39% (n=22) never received intervention, and overall, only 53% (n=77) of patients were fully adherent to treatment. Race was not significantly associated with treatment delays ($p=0.098$), while neurological comorbidities were significantly associated ($p<0.05$). The degree of hearing loss was not significantly related to delay, however, both adherence and age demonstrated significant associations. Adherence and treatment delay were significantly correlated ($p<0.001$), with patients experiencing longer delays less likely to remain adherent. Preliminary phone surveys identified provider communication (50%) and scheduling difficulties (40%) as the most reported contributors to delays.

Conclusions: Timely intervention for pediatric hearing loss remains a persistent challenge, affecting 30% of patients. Efforts to improve communication, coordination, and access to hearing loss services are essential for reducing delays and optimizing developmental outcomes.

Learning Objective: To identify key factors contributing to delays in receiving care and suboptimal adherence in pediatric hearing loss care.

Desired Result: Clinicians will enhance their understanding of these factors, explore treatment strategies to promote timely follow-up and adherence, and mitigate developmental delays.

Level of Evidence - III

Indicate IRB or IACUC: Albert Einstein College of Medicine, RB Number: 2024-16523

Association Between Mastoid Aeration and Temporal Bone Fracture Patterns and Complications

Karen K. Hoi, MD; Gregory D. Disse, MD, PhD
Osama Raslan, MD; Doron Sagiv, MD

Objective: This study investigates the relationship between mastoid air cell volume and temporal bone fracture (TBF) patterns and complications.

Study Design: Retrospective cohort study.

Setting: Single tertiary level 1 trauma center.

Patients: Adult patients with TBF who underwent temporal bone computed tomography (CT) between 2018-2024.

Interventions: Quantitative 3-dimensional (3D) volumetric analysis of the mastoid air cell system and mastoid bone using CT imaging and 3D segmentation software (Mimics InPrint).

Main Outcome Measures: Percent mastoid aeration (mastoid air cell system volume divided by total mastoid volume) was compared between TBF patients and matched healthy controls, and among subgroups defined by otic capsule (OC) involvement, facial nerve status, and CSF leak presence.

Results: Forty-two TBF patients (50 fractures) and 42 matched controls were included. Mean mastoid aeration was 23.6% in TBF patients and 26.2% in controls (p=0.07). Patients with CSF leak had significantly less mastoid aeration than those without (14.2% vs. 24.9%; p=0.002). Aeration did not differ by fracture pattern (OC-violating 20.9% vs. OC-sparing 23.9%, p=0.19), or by presence of complete facial paralysis – which included patients presenting with House-Brackmann VI paralysis or those intubated without corneal reflexes or pain grimace – compared with those without complete paralysis (22.5% vs. 23.5%; p=0.30). Among patients able to undergo a voluntary facial nerve examination at presentation, greater mastoid aeration correlated with better facial function, reflected by lower House-Brackmann scores (p=0.04).

Conclusions: To our knowledge, this is the first study that investigates mastoid aeration in TBF using whole-mastoid volumetric analysis. Greater mastoid aeration was associated with a lower rate of CSF leak, supporting a potential role of the mastoid air cell system in modulating injury severity and fracture-related complications.

Learning Objective:

1. Evaluate the relationship between mastoid aeration and temporal bone fracture severity and complications.

Desired Result: Attendees will recognize that reduced mastoid aeration may be associated with worse facial nerve outcomes and CSF leak following temporal bone trauma, suggesting that mastoid aeration could influence fracture-related complications and patient outcomes.

Level of Evidence - III

Indicate IRB or IACUC: Exempt

Referral Patterns for Dizziness and Vertigo Patients at a Tertiary Otolaryngology Clinic

Kunal A. Koka, BS; Pallavi Kulkarni, MD; Marc D. Polanik, MD
Veenadhari Kollipara, BA; Mark E. Whitaker, MD

Objective: This study aimed to characterize referral trends for patients presenting with dizziness to a tertiary Otolaryngology clinic, with a specific focus on the incidence of vestibular migraine (VM), to identify opportunities for optimizing care pathways.

Study Design: Retrospective Chart Review

Setting: Tertiary Referral Center

Patients: Adult patients referred over a one-year period to a tertiary Otolaryngology clinic with the diagnosis of dizziness/vertigo, imbalance, postural instability, or abnormal gait.

Interventions: Diagnostic and Therapeutic

Main Outcome Measures: Outcomes measured included: specialty of referring provider, initial referral diagnosis, prior diagnostic work-up and treatments, the Otolaryngologist's diagnosis, and additional testing or treatments initiated as a result of the evaluation.

Results: Of the 119 patients seen, most patients (60%) were referred without a definitive diagnosis. Of the patients who received a diagnosis following Otolaryngology evaluation, the most common pathologies were VM (25.8%), benign paroxysmal positional vertigo (13.7%), and Meniere's (8.9%). VM was the most underdiagnosed and incorrectly diagnosed condition with only 1/32 patients having that diagnosis at referral and 11/32 patients being incorrectly diagnosed prior to Otolaryngology evaluation. Most patients with VM were referred to neurology (53%) following Otolaryngology evaluation. Prior to Otolaryngology referral, 82% of Meniere's and 81% of VM patients were not trialed on appropriate first-line therapy.

Conclusions: Most patients referred for dizziness had an absent or incorrect diagnosis at referral, often delaying initiation of appropriate first-line therapy, especially patients with VM. This underscores a need for enhanced recognition of common vestibular pathologies and refinement of initial management and referral practices for patients presenting with dizziness.

Learning Objective:

- Identify the frequency and implications of inaccurate diagnosis and initial management of dizzy patients by referring providers.
- Emphasize the high prevalence of vestibular migraine among patients referred for dizziness and the need to improve recognition and referral practices for this population.

Desired Result: Emphasize the need for outreach and education of referring providers to improve recognition of common dizziness pathologies, especially vestibular migraine, to reduce unnecessary referrals, diagnostic delays, and inappropriate treatments.

Level of Evidence – Level IV

Indicate IRB or IACUC: The Pennsylvania State University IRB STUDY #00023970, approved on 1/11/2024.

Risk of Developing Otosclerosis in Female Patients Using Exogenous Estrogen

Kunal A. Koka, BS; Veenadhari Kollipara, BA; Caitlin Papalia, BS; Varun Patel MD

Objective: Otosclerosis is more prevalent in female patients, and symptom severity worsens during pregnancy. One proposed mechanism for this finding is fluctuating estrogen levels and its impact on bone remodeling through regulation of inflammatory pathways and osteoclast activity. However, the impact of exogenous estrogen use in females on risk of developing otosclerosis remains unclear. The aim of this study is to determine the association between exogenous estrogen use and development of otosclerosis in female patients.

Study Design: Retrospective Cohort

Setting: TriNetX is a global health research network containing de-identified patient electronic health record data from over 105 health care organizations around the world.

Patients: The TriNetX Research Database was queried for adult female patients using exogenous estrogens between 2009-2018 with at least 5 years of follow up and a control cohort, without exogenous estrogen use, propensity score matched for age, pregnancy status, and race. Female patients with a diagnosis of otosclerosis, stapedectomy, or stapedotomy prior to exogenous estrogen use were excluded.

Interventions: Exogenous estrogen use

Main Outcome Measures: Risk ratio with 95% confidence intervals for otosclerosis (ICD-10: H80) development between 1 day and 5 years following the initiation of exogenous estrogen was measured.

Results: We identified 1,892,623 female patients using exogenous estrogen and 16,215,831 patients in the control cohort. After propensity score matching, the exogenous estrogen cohort had a 0.041% risk of developing otosclerosis compared to a 0.023% risk amongst the control cohort (risk ratio: 1.77, 95% confidence interval: 1.57-1.99, $p < 0.0001$).

Conclusions: Our study found an increased relative risk of developing otosclerosis in female patients using exogenous estrogen compared to the control cohort. This finding suggests that an increased estrogen level due to exogenous estrogen supplementation is positively correlated to the development of otosclerosis.

Learning Objective:

- Describe the association between exogen estrogen exposure and the development of otosclerosis.
- Explain proposed mechanisms through which estrogen levels contribute to higher risk of otosclerosis in females.

Desired Result:

- Understand the impact of exogenous estrogen on development of otosclerosis.
- Early detection of otosclerosis through increased clinical suspicion in patients using exogenous estrogen.

Level of Evidence – Level IV: Retrospective cohort study

Indicate IRB or IACUC: Exempt

Association Between Socioeconomic Status, Hearing Level, and Adaptive Functioning in Deaf or Hard-of-Hearing Preschoolers

Lourdes Kaufman, BA; Arielle Spellun, MD; Dylan K. Chan, MD, PhD

Objective: Hearing loss is a well-established risk factor for developmental delays due to reduced language access during critical developmental periods. Adaptive behavior—a core developmental measure of a child's ability to function in their environment—is an important patient-centered outcome in deaf or hard-of-hearing (D/HH) preschoolers but remains poorly characterized. This study evaluates predictors of adaptive behavior in D/HH preschoolers.

Study Design: Prospective cohort study

Setting: Multi-institutional

Patients: D/HH children aged 1-5 years

Interventions: This is a secondary analysis of a randomized clinical trial (NCT04928209). High- and low-income cohorts were defined as +/- 266% Federal Poverty Level. Pure tone average in the better ear (PTA) and amplification device use were obtained from medical records and evaluated as covariates.

Main Outcome Measures: Adaptive Behavior Assessment System – Third Edition (ABAS-3) Parent Form Conceptual Standard Score, encompassing Communication, Functional Pre-Academics, and Self-Direction skills.

Results: Among 84 participants, 66.7% were low-income (n=56) and 92.5% used amplification devices. Mean PTA was 43.2 dB (SD = 29.4, range: 7.5–110 dB). The overall cohort scored below population average on conceptual skills (Mean = 93.0, 95% CI [88.7, 97.3], 32nd percentile). Children from lower-income families scored significantly lower (Mean = 88.1, 95% CI [82.9, 93.3]) than higher-income peers (Mean = 103.0, 95% CI [96.1, 110.0]), $p = 0.0008$. In multiple linear regression controlling for PTA and amplification use, income remained a significant predictor ($\beta = -17.46$, SE = 4.66, $p < 0.001$), with lower-income children scoring 17.5 points lower. PTA ($\beta = -0.01$, $p = 0.93$) and amplification use ($\beta = 2.04$, $p = 0.82$) were not significantly associated with adaptive behavior.

Conclusions: Socioeconomic status is independently associated with adaptive behavior in D/HH children, while hearing level and amplification device use were not.

Learning Objective: To identify factors associated with higher adaptive behavior development in a diverse population of D/HH children.

Desired Result: Clinicians will appreciate that social factors have a significant influence on a D/HH child's adaptive behavior, while hearing level and use of devices do not. Understanding this can help clinicians advocate for socioeconomic support services and shift focus from purely audiological interventions to addressing broader social factors to improve functional outcomes for D/HH children.

Level of Evidence - Level III

Indicate IRB or IACUC: IRB #24-41251 University of California, San Francisco, Approval: 7/3/2025

Watchful Waiting Versus Immediate Treatment and the Risk of Acute Otitis Media Complications

Nicole E. Smolinski, PharmD, PhD; Patrick J. Antonelli, MD, MS; Jingchuan Guo, MD, PhD
Yu-Jung Jenny Wei, PhD; Almut G. Winterstein, RPh, PhD

Objective: To compare acute otitis media (AOM) outcomes among children managed with watchful waiting (WW) versus immediate antibiotics for uncomplicated, non-recurrent AOM.

Study Design: Retrospective cohort study

Setting: National Medicaid and MarketScan® Commercial Claims databases from 2005-2019

Patients: Children 6 months-12 years old with AOM without otitis-related complications within 6 months prior, and no other infections in the 2 weeks before to one week after index diagnosis of AOM.

Interventions: WW was defined as no pharmacy dispensing of oral antibiotics within 2 days of diagnosis compared to immediate antibiotic treatment within 2 days of diagnosis.

Main Outcome Measures: Non-serious outcomes included recurrent AOM, AOM recurrence, tympanic membrane perforations (TMP), hearing loss, chronic suppurative otitis media (CSOM), and myringotomy. Serious complications in the month after diagnosis included mastoiditis and meningitis.

Results: Among over 1 million AOM episodes in children with continuous enrollment since birth, WW (17.2% of episodes) was associated with a significant decrease in the risk for recurrent AOM (RR 0.86, 95% CI 0.83-0.89) and any following AOM recurrence (0.88, 0.84-0.94) compared to immediate antibiotics. In both populations, there was no significant difference in the risk of myringotomy, hearing loss and severe complications. Conversely, in the publicly insured population, we found that WW leads to a slight increase in the risk of CSOM (1.10, 1.04-1.18) and acute TMPs (1.29, 1.14-1.47). Of note, less than 5% of episodes managed with WW were treated within a week of diagnosis. In children with incomplete follow up since birth, we found comparable results indicating no significant difference in serious complications of AOM between WW and immediate antibiotics.

Conclusions: Evidence suggests no benefit of antibiotics in preventing most AOM complications, indicating many children may be unnecessarily exposed to antibiotics.

Learning Objective: To assess the risk of complications following management of AOM.

Desired Result: Clinicians will more closely adhere to clinical guidelines with watchful waiting for uncomplicated, non-recurrent AOM.

Level of Evidence - III

Indicate IRB or IACUC: University of Florida, IRB202302138, Jan 2024

Trends & Determinants of Watchful Waiting for Acute Otitis Media in Publicly Insured Children

Nicole E. Smolinski, PharmD, PhD; Patrick J. Antonelli, MD, MS; Jingchuan Guo, MD, PhD
Yu-Jung Jenny Wei, PhD; Almut G. Winterstein, RPh, PhD

Objective: To assess the trends and determinants of watchful waiting (WW) for the management of acute otitis media (AOM) in publicly insured children

Study Design: Retrospective cohort study

Setting: National Medicaid claims data from 2005 to 2018

Patients: Children 6 months to 12 years old with AOM, without otitis-related complications in prior 6 months were included.

Interventions: WW was defined as no pharmacy dispensing of oral antibiotics within 3 days of diagnosis.

Main Outcome Measures: We assessed monthly WW prevalence and determinants of WW using multivariable logistic regression models.

Results: Our cohort included 1,650,326 uncomplicated, non-recurrent AOM episodes with 17% managed by WW, decreasing from 20% to 12% over the study. Black children were more likely than White to be managed by WW (1.12, 95% CI 1.17-1.20). Other patient factors had minimal impact on WW use. Otolaryngologists were more likely to use WW compared to pediatricians (OR 14.1, 95% CI 13.58-16.64) as were low-proclivity antibiotic prescribers (antibiotics dispensed for ≤20% of AOM episodes) when compared to high-proclivity prescribers (antibiotics dispensed for ≥80%, OR 58.05, 95% CI 53.77-62.67).

Conclusions: WW for the management of uncomplicated, non-severe AOM is used in a minority of cases. Clinician factors are stronger determinants of WW than patient factors. Further research is needed to understand the drivers of AOM antibiotic management and reduce unnecessary antibiotic prescribing.

Learning Objective: To describe the determinants and trends of watchful waiting for pediatric AOM.

Desired Result: Clinicians will increase use of WW for the management of AOM with targeted quality improvement in areas with lower likelihood of WW.

Level of Evidence - III

Indicate IRB or IACUC: University of Florida, IRB202302138, Jan 2024

Preoperative Imaging Studies for Primary Otosclerosis Surgery

Omer J. Ungar, MD; Daniel Zik, MD; Rani Abu-Eta, MD; Oren Cavel, MD
Ophir Handzel, MD; Nidal Muhanna, MD, PhD; Shiri L. Maymon, MD

Objective: To quantify the cumulative number needed to scan (NNS) with preoperative high-resolution temporal bone computed tomography (HR-TBCT) to yield a single management change in patients undergoing primary stapes surgery for otosclerosis-related hearing loss.

Design: Retrospective case review.

Setting: Tertiary referral center.

Patients: All patients referred for primary stapes surgery between the years 2010-2025.

Intervention: Preoperative HR-TBCT findings were compared to intraoperative findings. All findings that altered informed consent, surgical candidacy, or surgical approach were recorded.

Main Outcome and Measure: To calculate the cumulative and temporal bone (TB)-specific condition NNS.

Results: A total of 892 patients were identified (male-to-female ratio 305:587) with an average age of 49.3. HR-TBCT revealed concomitant TB pathology resulting in management change in 14% (124 ears). Prevalence of TB conditions that alter management of stapes surgery included third window lesions (5.8%), lateral ossicular chain fixation (4.1%), overhanging facial nerve (1.3%), obliterative otosclerosis (1.0%), far-advanced otosclerosis (1.0%), and persistent stapedial artery (0.6%). The cumulative NNS for at least one management change, confirmed intraoperatively, was 38 (95% confidence interval 77-22).

Conclusion: Routine preoperative HR-TBCT identifies clinically significant TB pathology that alters management in approximately 14% of stapes surgery candidates. HR-TBCT facilitates more accurate patient selection, improves informed consent, and reduces intraoperative complications.

Professional Practice Gap & Educational Need: The clinical value of routine preoperative HR-TBCT for primary stapes surgery is uncertain. Establishing a NNS could improve informed decision making for both surgeon and patient.

Learning Objective: To become aquatinted with the beneficial clinical value of preoperative HR-TBCT.

Desired Result: To improve comprehensive presurgical counselling and planning by incorporating HR-TBCT into the preoperative assessment.

Level of Evidence: III

Indicate IRB: 056323TLV

Longitudinal Investigation of Shared-Care Networks and Their Impact on Cochlear Implant Practice

Shawn M. Stevens, MD; Michael A. Roarke, BS; Frances Nowlen, BS; Samuel Barber, MD
Marine Prevost, AuD; Ashley Randall, AuD; Nancy Flores, AuD

Objective: Investigate the impact of a provider-network/shared-care (PN/SC) model on a high-volume adult cochlear implant (CI) practice.

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 (age ≥18yr) CI candidates/recipients. Inclusion criteria: initial consultation with the lead surgeons and ≥ 1 subsequent clinical and/or post-surgical visit. Patients were divided into PN and non-PN (fully managed internally) groups based on referral pathway. PN patients were subdivided into PN-map (returned to PN for mapping) and PN-def groups (PN deferred mapping).

Interventions: Candidacy workup, surgery, auditory rehab, bimodal hearing aid fitting.

Main Outcome Measures: Demographics, surgical conversions, time to surgery, AZBIO-Q outcomes, percentage of patients returning for PN-mapping, bi-modal hearing aid fitting rates.

Results: 519 patients/543 ears were included. Of these, 406 patients/421 ears were non-PN. 113 patients/122 ears were PN referred (22% of total n=). Of these, 79% underwent PN-delivered CI evaluations. 67 patients/74 ears (59%) returned for PN-mapping. PN patients required fewer preop clinic visits than non-PN patients (1.6vs.2.8; $p < 0.001$), had significantly higher surgical conversion rates (87.7vs.66.5%; $p < 0.0001$), and experienced quicker time to surgery (126vs.150 days; $p = 0.0009$). Non-PN, and PN-map patients did not significantly differ in either preop presentations or postop AZBIO-Q scores (65.1vs.67.5%; $p = 0.54$). A new bimodal hearing aid was fit in 42-60% of CI recipients as reported by PN practices.

Conclusions: Implementation of a PNSC model had significant impacts on surgical conversion rates, time to surgery, and postoperative outcomes. Patients returning to their PN group for mapping had good outcomes.

Learning Objective: Describe the potential impact of PNSC on CI practice.

Desired Result: Educate providers on potential benefits of PNSC models.

Level of Evidence - III

Indicate IRB or IACUC: PHXU-24-500-074-73-12. St. Joseph's Dignity Health

Air–Bone Gap Closure After Stapedotomy: Impact of Patient Sex and Otosclerosis Pattern

Sudhir Manickavel, MD; Samantha Cerasiello, MD; Michael Castle, MD
Hossein Mahboubi, MD; William H. Slattery, MD; Kevin A. Peng, MD

Objective: To evaluate whether prosthesis length independently predicts postoperative air–bone gap (ABG) closure ≤10 dB after stapedotomy and to quantify the contributions of otosclerosis pattern and patient sex to outcomes.

Study Design: Retrospective cohort.

Setting: Private practice tertiary otology center.

Patients: Adults undergoing primary stapedotomy for otosclerosis (2020–2024).

Intervention: Transcanal laser-assisted stapedotomy with Eclipse piston prosthesis.

Main Outcome Measures: ABG closure ≤10 dB at the first postoperative audiogram; covariates included age, sex, preoperative ABG, prosthesis length, and intraoperative otosclerosis pattern (Anterior, Bipolar, Diffuse, Obliterative).

Results: Of 120 cases, meeting inclusion criteria with pre-operative and 3-month post-operative audiograms,77.5% achieved ABG closure ≤10 dB. Mean prosthesis length was 4.39 mm (SD 0.26) in men and 4.27 mm (SD 0.22) in women. In multivariable models, male sex was associated with higher odds of closure (adjusted OR 7.35, 95% CI 1.76–30.62, p=0.006). Compared with Bipolar, Anterior (aOR 0.13, 95% CI 0.03–0.55, p=0.006) and Obliterative (aOR 0.02, 95% CI 0.0006–0.58, p=0.023) sites had lower odds. Prosthesis length was not independently associated with closure after adjustment; higher preoperative ABG showed a nonsignificant inverse trend (aOR 0.95, 95% CI 0.89–1.00, p=0.07).

Conclusions: In our study, patient sex and disease site—particularly anterior and obliterative foci—are key determinants of ABG closure, whereas prosthesis length within standard ranges is not. These data can focus preoperative counseling on disease pattern and patient factors.

Professional Practice Gap & Educational Need: Variation in prosthesis length selection and underreporting of site- and sex-adjusted outcomes may limit optimized counseling and expectations.

Learning Objective: Recognize that, after adjustment, sex and otosclerosis site more strongly predict ABG closure than prosthesis length within standard ranges.

Desired Result: Improve preoperative counseling by emphasizing disease pattern and patient factors over incremental length adjustments.

Level of Evidence: Level IV.

Indicate IRB or IACUC: IRB-approved

Device-specific and Modality-level Effects of Neuromodulation for Subjective Tinnitus: A Systematic Review and Meta-Analysis

Anusha A. Gogulapati, BS; Katherine Guo, BS; Lane D. Squires, MD

Objective: Compare clinical efficacy, safety, population characteristics, and protocol parameters of Lenire, a bimodal neuromodulation device delivering synchronized sound and tongue stimulation, to other tinnitus neuromodulation modalities.

Data sources: Databases searched included PubMed, ScienceDirect, Web of Science, and Embase, covering studies published through 2025. Indexing keywords related to *tinnitus*, *bimodal neuromodulation*, *Lenire*, *Tonguetip*, *neurostimulation*, and *hearing device* were combined to maximize retrieval. Editorials, case reports, and conference abstracts were excluded.

Study selection: Eligible studies included adults ≥18 years with subjective tinnitus treated with Lenire or comparable neuromodulation interventions, reporting pre- and post-treatment Tinnitus Handicap Inventory (THI) or Tinnitus Functional Index (TFI) scores. Studies lacking quantitative outcomes, duplicate populations, or follow-up <8 weeks were excluded.

Data extraction: Two independent reviewers extracted study characteristics, mean or change ± SD in THI/TFI, responder rates, and adverse events following PRISMA guidelines. Risk of bias was assessed with RoB 2 for RCTs and ROBINS-I for nonrandomized studies. Certainty of evidence was appraised using GRADE methodology.

Data synthesis: Two randomized controlled trials (n = 517) and one real-world chart review (n = 212) met inclusion criteria. Both RCTs demonstrated significant within-subject THI improvement (mean change ≈ –14 to –18 points, $p < 0.001$). Random-effects meta-analysis revealed a pooled standardized mean difference = –0.88 [95% CI –0.99, –0.77]; $p < 0.001$; $I^2 = 0\%$, indicating a large, statistically significant treatment effect with low heterogeneity. Sensitivity analysis yielded similar results. Retrospective study showed 91.5% responder rate (95% CI 86.9–94.5%) and mean THI change –27.8 ± 1.3 points, supporting real-world effectiveness.

Conclusions: Bimodal neuromodulation via Lenire demonstrates large, consistent reductions in tinnitus handicap. While findings are robust in magnitude, current literature is limited by few independent trials and industry sponsorship bias. Further non-industry, head-to-head studies comparing Lenire with other neuromodulation devices are warranted.

Professional Practice Gap & Educational Need: Despite commercial availability, clinicians lack consolidated evidence on Lenire's comparative efficacy, durability, and generalizability beyond trial populations. This review synthesizes existing data to guide counseling and treatment selection for tinnitus patients.

Learning Objective: Understand current evidence on the efficacy and limitations of bimodal (tongue + sound) neuromodulation in tinnitus management.

Desired Result: Enable clinicians to make evidence-based recommendations regarding neuromodulation devices and identify priority areas for future independent research.

Level of Evidence - Level II

Indicate IRB or IACUC: Exempt

Estimating Middle Ear Implant Lengths Using Photon-Counting CT Imaging and Deep Learning Ossicular Segmentations

Aunika Zheng, BS; Andy S. Ding, MD, MSE; John P. Carey, MD
Charles C. Della Santina, MD, PhD; Francis X. Creighton, MD; George S. Liu, MD

Objective: To assess the reliability of automated ossicular segmentations in estimating ossicular chain reconstruction (OCR) prosthesis lengths using photon-counting CT scans of temporal bones.

Study Design: Retrospective review.

Setting: Tertiary academic center.

Patients: Eight subjects with unoperated temporal bones and intact ossicles.

Interventions: Photon-counting CT scans of 13 temporal bones were obtained and de-identified. Manual ground truth segmentations of ossicles were completed in 3D using 3D Slicer software. Automated segmentations were generated using a validated nnU-Net deep learning model.

Main Outcome Measures: Three distances were manually measured from both segmentation methods to estimate prosthesis lengths: (1) stapes footplate to umbo of tympanic membrane (TORP), (2) stapes capitulum to umbo (PORP), and (3) footplate-incus distance (stapes prosthesis). Statistical analysis used repeated measures ANOVA with post-hoc Sidak t-tests.

Results: Automated and manual segmentations showed high agreement for the malleus (Dice coefficient 0.97 ± 0.02, mean $\pm$ SD), incus (0.98 ± 0.02), and stapes (0.78 ± 0.12). There were no differences for TORP (4.8 ± 0.4 mm vs. 4.8 ± 0.4 mm, $p > 0.05$) and stapes prosthesis length estimates (4.0 ± 0.2 mm vs. 4.0 ± 0.2 mm, $p > 0.05$). Automated PORP estimates were greater than manual estimates (3.2 ± 0.4 mm vs. 3.0 ± 0.4 mm, $p < 0.01$). Qualitative review of CT scans revealed variable visualization of the stapes suprastructure.

Conclusions: Deep learning-driven ossicular segmentations in photon-counting CT scans is a reliable and automated approach for estimating multiple common OCR prosthesis lengths. Further research is needed to improve visualization of the stapes superstructure and validate these measurements against intraoperative data.

Learning Objective: To understand limitations and potential enhancements for assessing OCR prosthesis lengths via preoperative temporal bone CT scans.

Desired Result: To demonstrate reliability of an innovative automated method for preoperative OCR prosthesis lengths assessments using photon-counting CT.

Level of Evidence - IV

Indicate IRB or IACUC: IRB00322104, Johns Hopkins Medicine, approved 5/29/2022.

Prevalence of Asymmetric Hearing Loss and Retrocochlear Pathology in Cochlear Implant Candidates

Ina A. Lee, MS; Michael W. Canfarotta, MD; Laiken Griffith, BA; Annie Shen, BS
Nadine I. Ibrahim, MD; David S. Haynes, MD; Kareem O. Tawfik, MD

Objective: 1) To estimate the prevalence of asymmetric sensorineural hearing loss (AHL) in adult cochlear implant (CI) candidates, and 2) to characterize the sensitivity and specificity of AHL in identifying retrocochlear pathology in this population.

Study Design: Retrospective cohort.

Setting: Tertiary referral center.

Patients: Two thousand thirty-eight adult patients who underwent a CI evaluation between 2002 and 2024.

Interventions: Cochlear implant candidacy evaluation and magnetic resonance imaging (MRI) of the temporal bone.

Main Outcome Measures: Three different criteria were used to define AHL: 1) interaural asymmetry ≥10 dB at 3 consecutive frequencies (10 dB AHL), 2) interaural asymmetry ≥15 dB at 2 consecutive frequencies (15 dB AHL), and 3) interaural asymmetry ≥20 dB or ≥30 dB at 2 consecutive frequencies if <65 or ≥65 years old, respectively (American Neurotology/Otological Society [ANS/AOS] AHL guidelines). Presence or absence of retrocochlear pathology was determined on MRI.

Results: The prevalence of AHL was 67.0%, 60.4%, and 34.5% when using 10 dB AHL, 15 dB AHL, and ANS/AOS AHL guidelines, respectively. Retrocochlear pathology was identified in 3.5% of patients that underwent MRI. The ANS/AOS AHL guidelines offered higher specificity in identifying retrocochlear pathology when compared to the 15 dB AHL and 10 dB AHL guidelines (64.8%, 38.9%, 32.3%, respectively) yet came at the tradeoff of reduced sensitivity (54.4%, 78.9%, 82.5%, respectively).

Conclusions: The prevalence of AHL in CI candidates varies widely based on definition, ranging from 34.5% to 67.0% in the present cohort. The new ANS/AOS guidelines for AHL demonstrated the highest specificity yet lowest sensitivity in the identification of retrocochlear pathology in this population. These findings may aid clinicians in the preoperative selection of imaging modality for CI candidates.

Learning Objective: Many patients referred for evaluation of cochlear implant candidacy present with a "better-hearing ear." The objectives of this presentation are 1) to understand the prevalence of asymmetric sensorineural hearing loss in cochlear implant candidates and 2) to describe the sensitivity and specificity of various definitions of asymmetric hearing loss in identifying retrocochlear pathology in this population.

Desired Result: At the conclusion of this presentation, providers should be able better counsel patients on the utility of preoperative magnetic resonance imaging in detecting retrocochlear pathology in cochlear implant candidates with asymmetric sensorineural hearing loss.

Level of Evidence – Level IV

Indicate IRB or IACUC: IRB #240876, Vanderbilt University

Cochlear Implant Outcomes in Far Advanced Otosclerosis

Karl R. Khandalavala, MD; Katherine G. Bragg; Brian A. Neff, MD; Colin L.W. Driscoll, MD
Matthew L. Carlson, MD, MBA; James R. Dornhoffer, MD

Objective: To describe the outcomes of cochlear implantation (CI) in patients with far advanced otosclerosis (FAO).

Study Design: Retrospective matched cohort.

Setting: Tertiary academic medical center.

Patients: Patients with FAO who underwent CI, and age/sex-matched control patients without prior diagnosis of FAO who underwent CI.

Interventions: Cochlear implantation.

Main Outcome Measures: Speech perception outcomes quantified by Az Bio sentence and CNC word scoring. Postoperative incidence of facial nerve stimulation and new-onset vestibular complaints.

Results: In total, 96 ears amongst 81 total patients who had a history of otosclerosis and underwent ipsilateral CI, with 96 control ears. A large proportion of the ears (78/96) had undergone some form of prior treatment for otosclerosis, with the most common being stapedotomy (72 patients [92%]). Speech perception improved significantly following CI, with median ipsilateral CNC word score increasing from 2% (IQR 0-20) to 70% (IQR 52-82) and median bilateral Az Bio sentence score in quiet increasing from 0% (IQR 0-23) to 82% (IQR 72-92). Median postoperative speech testing was slightly but significantly greater in the FAO group compared to controls for both CNC word scores (70% FAO, 60% Control; p=0.002) and Az Bio sentence scores (82% FAO, 73% control; p=0.015) Postoperatively, 11 of 96 implanted ears (11%) experienced some form of facial stimulation, which resolved in 10 cases with implant reprogramming. New postoperative vestibular complaints were reported in 18 cases (19%), with 12 patients requiring vestibular therapy.

Conclusions: CI in patients with FAO is a safe and effective intervention that can result in excellent improvements in speech recognition despite the complex anatomy and prior surgical history associated with this population.

Learning Objective: To describe the outcomes of CI in the FAO population.

Desired Result: The audience will understand the speech outcomes, and potential for facial nerve stimulation as well as vestibular symptomatology following CI in patients with FAO.

Level of Evidence – Leve IV

Indicate IRB or IACUC: IRB approved 8/18/2025 (ID: 22-000183)

Newborn Hearing Outcomes and Delayed Hearing Loss in Neonatal Intensive Care Unit Graduates

Myeongsin Kang, MD; Myung-Whan Suh, MD, PhD (presenter);Sang-Yeon Lee, MD, PhD
Moo-Kyun Park, MD, PhD; Seung Han Shin, MD, PhD
Ee-Kyung Kim, MD, PhD; Hye Jeong Jin, RN

Objective: To evaluate the practicality and role of the hearing screening system in the neonatal intensive care unit (NICU) setting, and to elucidate the incidence of newborn hearing loss and delayed hearing loss in NICU neonates.

Study Design: Retrospective review of 11 years of NICU hearing test outcomes.

Setting: Tertiary referral center

Patients: 1,070 neonates born at a gestational age of less than 32 weeks or weighing less than 1,500 g at birth.

Interventions: Universal newborn hearing screening (UNHS), confirmatory auditory brainstem response (ABR) testing, and hearing threshold evaluation at a corrected age of 7 months.

Main Outcome Measures: Referral rate, hearing loss confirmation rate, incidence of delayed hearing loss, causes of hearing loss, and types of hearing intervention.

Results: Screening rates consistently met or exceeded 95%, ensuring timely hearing assessment. The referral rate was 25.7%. Hearing loss was confirmed in 4% (43/1,070) of NICU neonates. Cochlear implantation was performed in 5 cases, and hearing aids were prescribed in 5 cases. The referral rate was 6–7 times higher, and the incidence of hearing loss was 10 times higher than that of well-babies. Delayed hearing loss was observed in 1.2% (13/1,070). Most cases of delayed hearing loss were due to otitis media, and one patient developed cholesteatoma requiring surgery.

Conclusions: Continuous quality assurance of hearing screening and confirmation in the NICU setting are crucial, as the incidence of hearing loss was 10 times higher than that of well-babies. Although hearing was normal at birth, 1.2% of NICU graduates developed delayed hearing loss, emphasizing the need for regular hearing evaluations.

Learning Objective: To understand the effectiveness and challenges of UNHS in high-risk populations.

Desired Result: To provide a realistic picture of hearing loss in high-risk populations and motivate continuous improvement of hearing screening protocols in every NICU.

Level of Evidence - Level IV

Indicate IRB or IACUC: This study was approved by the Institutional Review Board of Seoul National University Hospital (project number 1303-092-476).

Revisiting the Role of Pressure Dressing After Otologic Surgery: A Systematic Review and Meta-Analysis

Pey-Yu Chen, MD; Che-Yi Lin, MD, MMS; Harrison W. Lin, MD
Mehdi Abouzari, MD, PhD

Objective: To evaluate the effectiveness of pressure dressing after otologic surgery for evidence-based postoperative care.

Data sources: We searched PubMed, Embase, Cochrane Library and Airiti Library using Boolean operators for literature written in English or Mandarin from inception to October 10, 2025.

Study selection: Abstracts compared patients with and without pressure dressing after otologic surgery and evaluated postoperative surgical site outcomes were included.

Data extraction: The total number of patients, number of patients with complications in each group (pressure dressing (PD) *vs.* control), and the mean and standard deviation of the visual analogue scale (VAS) scores were extracted.

Data synthesis: The selected effect measure for complications was the Peto odds ratio (OR), whereas the mean difference (MD) was used for VAS scores. Effect estimates from individual studies were pooled using the DerSimonian and Laird random-effects model.

Results: Forty-nine articles were identified; twelve relevant articles were reviewed in detail, and seven studies reported data on 11 types of complications. Of these, 10 complications had sufficient data for meta-analysis. The PD group experienced significantly higher incidences of three complications: auricular bruising (6/397 *vs.* 0/358; odds ratio [OR] 7.90, 95% confidence interval [CI] 1.59–39.54; $I^2 = 0\%$), dress-related headache (4/44 *vs.* 0/48; OR 8.69, 95% CI 1.18–63.89; $I^2 = 0\%$), and skin erythema (103/414 *vs.* 4/378; OR 11.20, 95% CI 7.35–17.07; $I^2 = 0\%$). Two studies that reported VAS pain scores showed significantly higher pain scores in the PD group (pooled MD 2.20, 95% CI 0.31–4.10; $I^2 = 95.1\%$).

Conclusions: Pressure dressing increased minor complications (skin erythema, auricular bruising, and pain) without reducing hematoma/seroma, suggesting it may be unnecessary with adequate hemostasis.

Learning Objective: Summarize current evidence regarding the role of pressure dressing after otologic surgery.

Desired Result: To improve patient comfort and reduced unnecessary interventions.

Level of Evidence: I

Indicate IRB or IACUC: Exempt.

Analysis of Cochlear Duct Length Based on Computed Tomography Images of Temporal Bones in Patients of the Institute of Physiology and Pathology of Hearing

Piotr H. Skarzynski, MD, PhD, MSc; Emilia Czaplicka, MSc; Anita Obrycka, PhD
Artur Lorens, Prof; Henryk Skarżyński, Prof

Objective: To analyse cochlear length in the Polish population and establish normative reference values, including sex-specific differences, USING computed tomography (CT) imaging of the temporal bone.

Study Design: Retrospective cohort study.

Setting: Tertiary referral center.

Patients: A total of 1056 cochleae were examined, derived from 528 individuals. Of these, 517 (49%) belonged to females and 539 (51%) to males. Inclusion criteria were normal cochlear morphology and high-quality imaging data.

Interventions: High-resolution temporal bone CT images were analysed using OTOPLAN software. All cochlear duct measurements were performed by an experienced radiologist.

Main Outcome Measures: Mean cochlear duct length and its distribution within the Polish population, with analysis of sex-related differences and categorisation into terciles for both sexes.

Results: The mean cochlear length in the total population was 35.51 mm (SD = 1.75; range 27.1–41.2 mm). Although the distribution was approximately normal, statistical testing revealed significant deviations ($p < 0.001$). Female cochleae were significantly shorter than male cochleae (M = 34.96 mm; SD = 1.61 vs. M = 36.00 mm; SD = 1.73; $p < 0.001$). The sex-specific tercile boundaries were as follows: for females, ≤34.4 mm (short), 34.5–35.4 mm (average) and ≥35.5 mm (long); and for males, ≤35.4 mm, 35.5–36.7 mm and ≥36.8 mm.

Conclusions: This study provides the first normative data on cochlear length in the Polish population. These results can serve as a reference for comparative international comparisons and support clinical decision-making in cochlear implant electrode selection and surgical planning.

Professional Practice Gap & Educational Need: Prior to this research, no such data existed for the Polish population. Such data are crucial for optimizing cochlear implant procedures and ensuring that electrodes fit patient anatomy accurately.

Learning Objective: To understand cochlear length variability in the Polish population and recognize its clinical implications for cochlear implant surgery planning.

Desired Result: Improving precision in cochlear implant planning and enhancing postoperative auditory outcomes through population-specific normative measurements.

Level of Evidence - Level III.

Indicate IRB or IACUC: KB.IFPS/12/2024

Cochlear Implant Minimum Speech Test Battery - Version 3 Will Result in Additional Audiometric Candidates: Who Should Receive Priority in the Context of a Constrained Healthcare System?

Samer Salameh, MD; Jacob Sulkers, M.Cl.Sc.; Jordan Hochman, MD

Objective: The revised Minimum Speech Test Battery-Version 3 (MSTB-3) for adult cochlear implant (CI) candidacy prioritizes the Consonant-Nucleus-Consonant (CNC) test. This study aims to evaluate the impact of this change on CI candidacy rates and projected surgical wait-times.

Study Design: Cross-sectional study.

Setting: A Tertiary Cochlear Implant Program in Canada.

Patients: Patients assessed for CI candidacy between January 2019 and December 2023.

Interventions: CI candidacy was re-evaluated employing the MSTB-3 as the criterion for candidacy.

Main Outcome Measures: Revised CI candidacy rates at different applied CNC cutoff scores (30% - 50%) and the projected resultant change in surgical wait-times.

Results: A total of 284 patients were assessed for CI candidacy, of whom 192 patients proceeded with surgery. Of the remaining 92 individuals assessed; 11 (12%) were audiometric candidates who declined implantation, 21 (22.8%) were excluded due to medical ineligibility, and 60 (65.2%) were not audiological candidates based on MSTB-Version 2 criteria. When re-evaluated using MSTB-3, an additional 8, 17, and 24 patients met audiological candidacy criteria at CNC cutoffs of 30%, 40%, and 50%. This represents a 4% to 13% increase in candidates, and a projected 6.5 to 10.9-month increase (27% to 45% increase) in wait-times had these criteria been implemented from 2019 to 2023.

Conclusions: Transitioning criteria to the MSTB-3 could potentially yield a 13% increase in implant candidates which will further strain the health system. We subsequently generate a schema grounded in distributive justice to address patient wait-times.

Learning Objective: To understand how the implementation of the revised Minimum Speech Test Battery–Version 3 (MSTB-3) affects cochlear implant candidacy rates and surgical wait-times within a resource-constrained healthcare system.

Desired Result: Physicians will be able to describe and quantify the impact of transitioning to MSTB-3 criteria on candidate eligibility and implant program resource demands, as well as to recognize the importance of equitable strategies—grounded in distributive justice—to manage increased wait-times.

Level of Evidence – Level III

Indicate IRB or IACUC: University of Manitoba Research Ethics Board approval (HREB #H2015:209)

Updated Incidence of Cochlear Implantation Shows Recent Uptick Among Adult Candidates in the United States

Theresa B. Hennesy, MD; Vinaya Manchaiah, AuD, PhD; Matthew L. Carlson, MD, MBA
Bridget Mosley, MPH; Liza Creel, PhD; Ashley M. Nassiri, MD, MBA

Objectives: The current study provides a 5-year update of the incidence of cochlear implantation among traditional cochlear implant (CI) candidates 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: CI.

Main Outcome Measures: Annual incidence of CI among traditional CI candidates, changes in incidence over time.

Results: The study cohort included 69,947 adults ≥20 years old who underwent CI surgery between 2015 and 2023, with a median age of 67 (IQR 56-78). Males accounted for 51% of cases, females 45%, unknown 4%. Unilateral surgery (including bilateral sequential surgery) represented 99.7% of cases. The estimated traditional candidate population (bilateral severe-to-profound hearing loss) in 2023 was 2.8 million adults. When including an estimated 15% market share for Med-EL, the annual number of CIs increased from 6,105 in 2015 to 13,260 in 2023. Overall, the incidence of CI among adult traditional CI candidates increased from 252 CIs per 100,000 person-years in 2015 to 474 in 2023. Incidence increased at a faster rate in the most recent years (27 per 100,000 person years in 2016 vs 73 in 2023).

Conclusions: Though still exhibiting severe under-penetration, the incidence of cochlear implantation among the adult candidate has nearly doubled since 2015. Continuous reporting of national metrics for cochlear implantation is a critical aspect of measuring the overall efficacy of efforts to increase access to care for this patient population.

Learning Objectives:
Describe the rates of cochlear implantation and changes over time within the adult population.
Understand the current rates of unilateral vs. bilateral cochlear implant surgery in adults.
Understand the demographic makeup of the patient population undergoing cochlear implantation.

Desired Result: Physicians, audiologists, and researchers would better understand current incidence of cochlear implantation to better inform efforts to increase access to cochlear implants nationwide.

Level of Evidence: III

Indicate IRB or IACUC: Exempt

Cochlear Implant Underutilization: A Single-Center Analysis of 106,134 Patients

William Y. Shin, BA; Andrea DeFreese, AuD; Susan Amberg, AuD; Christine Brown, AuD; Nichole Dwyer, AuD
Allyson Sisler-Dinwiddie, AuD; Tayler Sparrow, AuD; Noelle Steele, AuD; Brianna Sheckells, AuD; Sara Unrein, AuD
Stephanie Yaras, AuD; Marc Bennett, MD; David Haynes, MD; Aaron Moberly, MD; Matthew O'Malley, MD
Elizabeth Perkins, MD; Kareem Tawfik, MD; Frank Virgin, MD; Christopher Wooten, MD; Taha A. Jan, MD

Objective: 1) To evaluate prevalence of cochlear implant (CI) candidates meeting the 60/60 referral criteria in the better hearing ear versus either ear independently and 2) to assess CI utilization rates at a high-volume tertiary care center.

Study Design: Retrospective Review of Deidentified Audiology Database

Setting: Tertiary Academic Medical Center

Patients: 106,134 patients evaluated by audiologists between 2010 and 2025

Interventions: Diagnostic audiologic testing

Main Outcome Measures: Proportion of patients meeting 60/60 criteria (500, 1000, and 2000 Hz pure tone average ≥ 60 dB HL and unaided word recognition testing ≤ 60%) with their better hearing ear only versus either ear independently. CI utilization rates among patients meeting 60/60 referral criteria under each condition.

Results: Among 87,984 patients with complete audiometric data, 1,282 (1.46%) patients met the 60/60 criteria in their better hearing ear. When applied to either ear independently, 5,064 (5.76%) patients qualified - a four-fold increase in candidate identification. This expanded cohort included 2,784 (55%) patients with bilateral symmetric hearing loss, 961 (19%) with single-sided deafness, and 1,319 (26%) with asymmetric hearing loss. CI utilization rates were 23.9% (306/1,282) for the better-ear criteria and 10.4% (525/5,064) for the either-ear criteria patients.

Conclusions: Applying 60/60 criteria to each ear independently identifies a substantially larger population of potential CI candidates, particularly those with asymmetric hearing loss and single-sided deafness who may now qualify under expanded FDA recommendations. Despite above-average CI utilization rates compared to the nationwide average, underutilization of CI exists even at a large tertiary referral center.

Learning Objective: To quantify the gap between CI candidacy and utilization at a high-volume center.

Desired Result: To highlight the need for updated referral guidelines and systematic approaches to address barriers to CI access.

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

Indicate IRB or IACUC: 231252

Emotion and Symptom Content in Patient Narratives of Superior Canal Dehiscence Syndrome: A Thematic and Sentiment-Based Analysis

Akshay Warrier, BA; Liliya Benchetrit, MD; Daniel J. Lee, MD

Objective: To quantify emotional tone and thematic prevalence in patient-authored narratives of superior canal dehiscence syndrome (SCDS) and to explore emotion–topic associations using natural language processing (NLP).

Study Design: Retrospective observational content analysis of social media posts with predefined SCDS-related keywords.

Setting: Online patient forum (Reddit); ambulatory context outside traditional clinical encounters.

Patients: 326 posts authored by individuals self-reporting SCDS symptoms or experiences; eligibility required SCDS keyword match after preprocessing.

Intervention(s): None; computational pipeline only—data scraping, text cleaning, unsupervised machine learning

Main Outcome Measure(s): Distribution of emotions (National Research Council lexicon; 10 categories), topic prevalence from Latent Dirichlet Allocation (LDA), and topic–emotion associations tested by chi-square with standardized residuals.

Results: Six LDA topics emerged: (1) patient–physician interaction, (2) vestibular symptoms & diagnosis, (3) diagnosis journey & imaging, (4) pressure & sound-related symptoms, (5) hearing tests & emotional impact, and (6) SCDS diagnosis. Negative and fear-based emotions predominated, with the greatest negative counts in Topic 1 (N = 70, 26%) and Topic 2 (N = 95, 35%). Although the omnibus chi-square was not significant ($\chi^2(45)=16.19$, $p=0.99998$), standardized residuals revealed distinct patterns: trust (+2.1) and surprise (+1.8) were elevated in Topic 3 (Diagnosis Journey & Imaging), joy (+2.3) in Topic 5 (Hearing Tests & Emotional Impact), with smaller increases in fear and anticipation across topics.

Conclusions: Quantitatively mapping emotional tone and themes in patient narratives, and probing residual-based emotion–topic links despite a nonsignificant omnibus test, provides empirical insight into the lived experience of SCDS. These data can support earlier clinical recognition, more empathic counseling, and development of patient-centered outcome measures tailored to SCDS, while highlighting patient–physician interactions and vestibular symptom discussions as emotionally salient domains.

Learning Objectives

- Quantify the emotional tone and thematic prevalence within patient-authored online narratives of superior canal dehiscence syndrome (SCDS).
- Identify key emotion–topic associations to better understand patients' lived experiences.
- Illustrate how natural language processing (NLP) methods can inform patient-centered research in otology.

Desired Result: Provide an empirically grounded framework for understanding patient-reported experiences of SCDS to guide earlier recognition, improve clinician–patient communication, and inform development of patient-centered outcome measures

Level Of Evidence: Level of evidence does not apply

Indicate IRB or IACUC: Exempt

Safety and Efficacy of Middle Cranial Fossa Repair of Lateral Skull Base Cerebrospinal Fluid Leaks in Elderly Patients

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

Objective: To assess safety and efficacy of middle cranial fossa repair of lateral skull base (LSB) defects in elderly patients

Study Design: Retrospective cohort study

Setting: Tertiary referral center

Patients: Patients aged 65 or older with lateral skull base spontaneous cerebrospinal fluid (sCSF) leaks and tegmen defects undergoing middle cranial fossa repair

Interventions: Middle fossa craniotomy and repair of cerebrospinal fluid leak and tegmen defect.

Main Outcome Measures: Duration of hospital stay, complications, duration of temporal lobe retraction,

Results: 58 patients (34 [59%] female) aged 65 or older underwent 63 middle fossa craniotomies (38 [66%] right-sided) for lateral skull base sCSF leaks. The average age was 70.1 (standard deviation 4.3) years (range: 65-81 years), the average body mass index (BMI) was 36.1 (6.6) and 10 (15.9%) patients had a prior history of meningitis. 38 (66%) patients had a documented history of obstructive sleep apnea. Average hospital length of stay was 2.4 (1.2) days and 90.5% of patients had no postoperative complications. Complications included recurrent leak (2, 3.2%), postoperative intracranial hemorrhage (2, 3.2%, repeat operation in 1 instance), and transient word-finding difficulty (2, 3.2%). Video recordings were reviewed for 8 cases. Of these, two (25%) did not require any usage of a middle fossa retractor. When performed, median duration of retraction was 28 minutes and 28 seconds (range: 19:08-54:45). Pure tone averages improved from an average of 43.7 (11.5) decibels nHL to an average of 29.2 (11.0) decibels nHL ($p<0.0001$) postoperatively.

Conclusions: Middle fossa craniotomy requires relatively limited retraction of the temporal lobe and has a low rate of postoperative complications in the elderly population. MCF provides safe and robust LSB repair.

Learning Objective: Middle cranial fossa repair of the lateral skull base is effective and may be employed with a low risk of complications even in patients aged 65 and older.

Desired Result: Middle cranial fossa repair of the lateral skull base is safe and effective in elderly patients.

Level of Evidence – Level IV

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

Outcomes of Cochlear Implantation in Patients with Single-Sided Deafness: A Single-Center Retrospective Analysis

Basir S. Mansoor, BS; Emily Wong, MD; Walter Kutz, MD

Objective: To evaluate the audiologic performance and surgical outcomes of adults with single-sided deafness (SSD) who underwent cochlear implantation (CI) at a tertiary academic center.

Study Design: Single-center retrospective chart review

Setting: Tertiary academic center

Patients: Twenty-eight adults with SSD who received a CI between March 2017 and August 2024.

Interventions: Cochlear implantation for rehabilitation of single-sided deafness.

Main Outcome Measures: Pre- and postoperative audiometric measures including pure-tone average (PTA), speech reception threshold (SRT), word recognition score (WRS), AzBio sentence recognition in quiet, and Consonant–Nucleus–Consonant (CNC) word scores.

Results: The most common etiologies of hearing loss were sudden sensorineural hearing loss (39%) and Meniere's disease (28%). Mean age at implantation was 54.5 ± 11.2 years. Preoperative PTA in the implanted ear averaged 86.3 ± 21.0 dB HL, improving to 28.8 ± 7.5 dB HL at 3 months and remaining stable through ≥24 months (33.8 ± 6.8 dB HL, $p < 0.001$). Median AzBio scores increased from 0% [0–11] preoperatively to 55% [20–82] at 3 months, 74% [61–84] at 12 months, and 72% [42–88] at ≥24 months (all $p<0.01$). CNC word scores improved from 0% [0–0] to 64% [12–80] at 3 months and 60% [43–88] at 12 months. Mean daily CI wear time ranged from 6.6 to 9.3 hours at postoperative time points. While 18% of patients experienced transient postoperative vertigo, dizziness, or imbalance, surgical complications were minimal.

Conclusions: Cochlear implantation in adults with SSD produces significant and durable improvements in hearing thresholds and speech perception, with low complication rates.

Learning Objective: To recognize the clinical benefits and safety of cochlear implantation for adults with single-sided deafness.

Desired Result: Understand that cochlear implantation offers effective, safe auditory rehabilitation for SSD.

Level of Evidence – Level IV

Indicate IRB or IACUC: UTSW - STU 032018-085, approved 4/18/2018

From Barriers to Solutions: Multi-Level Determinants and Optimization of Cochlear Implant Access in Georgia

Darshan Chudasama, MPH; Sneha Chauhan, MD; Rachel Grimes, BS
George Davies, MD; Jack Owen, MD; Sarah Hodge, MD

Objective: To identify statewide and institutional barriers to cochlear implant (CI) access and evaluate targeted interventions to improve care efficiency and equity in Georgia.

Study Design: Mixed-methods study including statewide retrospective analysis and institutional retrospective and prospective cohort review.

Setting: Statewide epidemiologic data and a tertiary community-based academic center.

Patients: Children <18 years with CI procedures (2018–2020, statewide) and all pediatric/adult CI recipients (2018–2024, institutional).

Interventions: Educational outreach, imaging consolidation, audiology staffing expansion, and appointment coordination.

Main Outcome Measures: Statewide CI utilization by demographics, insurance, and geography; institutional referral-to-activation time, throughput, and attrition.

Results: Utilizing the HCUP (Healthcare Cost and Utilization Project) database, we found that pediatric CI utilization in Georgia was <15% of expected incidence, with significant disparities by insurance, income, and geography. Only 9% of implants occurred before age one. Most (88.6%) were performed in metropolitan areas, reflecting rural underrepresentation and workforce shortages. At our institution specifically, referral-to-activation averaged five months and required >5 visits. Following implementation of targeted interventions, throughput modestly improved (19→22 procedures per 6 months despite losing half of surgical workforce), and surgery-to-activation time decreased from 38 to 29 days. With community outreach and educational initiatives, referral AzBio scores rose from 11.2% to 20.2%, and mean PTA thresholds decreased from 80.0 dB to 76.8 dB in one year. Despite these gains, evaluation-to-surgery interval lengthened (66→107 days) as one surgeon left the institution. However, systemic barriers and workforce limitations continued to constrain access.

Conclusions: CI underutilization in Georgia arises from intersecting systemic inequities and institutional inefficiencies. Sustainable improvement requires coordinated, multi-level solutions integrating Medicaid policy reform, rural audiology expansion, standardized referral pathways, and streamlined institutional CI processes.

Learning Objective: Describe multi-level barriers to cochlear implant access and strategies for pathway optimization.

Desired Result: Enhance clinician understanding of systemic and institutional determinants of CI underutilization to inform equitable, patient-centered access improvement.

Level of Evidence: Level III

IRB: IRB # 2107287-8

A Review of Cochlear Implant Care Delivery and Outcomes in a Native American Population

Frances Nowlen, BS; Michael A. Roarke, BS; Marine Prevost, AuD; Ashley Randall, AuD
Jaysen Moreno, AuD; Nancy Flores, AuD; Shawn M. Stevens, MD

Objective: Explore the use of cochlear implant (CI) to treat hearing loss in a Native American (NA) population in the Southwestern USA.

Study Design: Retrospective review.

Setting: Single tertiary care center.

Patients: All patients evaluated for CI from 2021-2025. The investigators teamed with audiologists from a local NA-regional medical center using a shared-care network (SCN) model. Inclusion criteria: adults >18y, one consultation visit with the lead surgeon/PI, and ≥1 subsequent clinical/postop visit.

Interventions: Candidacy workup, surgery, auditory rehab.

Main Outcome Measures: Demographics, surgical conversions, reasons for non-conversion, time to surgery (TTS), AZBIO-Q scores, post-implantation usage rate, and loss to follow up rate.

Results: 519 patients met criteria (NA+all non-NA). To date, 57 Nas have met inclusion criteria. Tribal representation included seven distinct Southwestern communities/reservations. The mean age of NA patients was 66.2 years (range 18-88). Male/female distribution was equal. Mean distance traveled by NA patients was 92miles one way. The NA cohort was more likely to experience a non-conversion due to unexplained LTF (25%) compared to non-NA patients (6.1%; p=0.01). Insurance denial rates did not differ between groups. 32 NA patients have converted to surgery. The surgical conversion rate was significantly lower for NA patients (56%) compared to other non-NA SCN-referred patients (85%; p=0.0002) and non-NA patients as a whole (70.2%; p=0.02). Median TTS for NA patients was 81.5 days (IQR55-180). Mean postop AZBIO-Q scores were lower than for non-NA patients (46 vs 67%; p=0.07). Poor device usage (≤2hours/day) was documented in 16% of NA recipients.

Conclusions: NAs represent an underserved population in the domain of CI care. Some success treating NA patients has been achieved via a SCN model. This is the first known report on CI care in NAs.

Learning Objective: Describe how NA and non-NA populations differ in the delivery of CI care.

Desired Result: Educate providers regarding the delivery of CI care in NA Populations.

Level of Evidence - IV

Indicate IRB or IACUC: PHXU-24-500-074-73-12. St. Joseph's Dignity Health

Post-COVID-19 Pandemic Growth of National Hearing Aid Utilization: A Population-Based Study

Keren Oren, MD; Itai Hazan, MD; Stav Edri Abikasis, MD; Tomer Kerman, MD
Liron Kariv, MSc; Oded Cohen, MD; Oren Ziv, MD

Objective: To investigate the impact of the COVID-19 pandemic on the national demand for hearing aids and assess post-pandemic trends across different age groups.

Study Design: Ecological time-series study.

Setting: A large health organization in Israel with approximately 5 million members.

Patients: 97,149 patients were referred for hearing aid fitting between March 2018 and February 2024. Patients were stratified into three groups: pre-pandemic (2018–2020), pandemic (2020–2022), and post-pandemic (2022–2024).

Interventions: Referrals for hearing aid fitting issued by otolaryngologists.

Main Outcome Measures: Yearly incidence rate of referrals for hearing aid fitting (per 100,000 patients), stratified by age group.

Results: The incidence of hearing aid referrals increased significantly during and after the COVID-19 pandemic compared to the pre-pandemic period. The most notable rise occurred from the second year of the pandemic onward. Younger adults (18–49 years) demonstrated the largest relative increase with an incidence rate ratio (IRR) of 3.16 (95% CI: 2.74–3.65; $p < 0.001$) in the second post-COVID year compared to the pre-pandemic period. Significant increases were also observed in the 50–75 age group (IRR: 2.10, 95% CI: 1.87–2.36; $p < 0.001$) and in patients ≥75 years (IRR: 1.53, 95% CI: 1.35–1.74; $p < 0.001$).

Conclusions: The COVID-19 pandemic was associated with a sustained rise in hearing aid demand, particularly among younger adults. Mask-related communication barriers and heightened awareness of hearing loss likely contributed. The persistence of elevated demand post-pandemic underscores the importance of prioritizing hearing rehabilitation in public health planning, especially in anticipation of future pandemics or widespread masking scenarios.

Learning Objective: To understand how the COVID-19 pandemic and associated masking policies influenced hearing aid utilization across different age groups.

Desired Result: Attendees will gain insight into the broader effects of public health measures on hearing rehabilitation needs and the importance of early intervention strategies.

Level of Evidence: Level III.

IRB: Approved by the institutional Helsinki Committee (Clalit Health Services). Consent to participate was waived due to the retrospective nature of the study.

The Effect of Climate and Meteorological Factors on Meniere's Disease: A Scoping Review of Current Evidence

Sriprachodaya Gaddam, BS; Sonaal Verma, BS; George Wanna, MD
Zachary Schwam, MD; Enrique Perez, MD; Maura Cosetti, MD

Objective: To analyze the current evidence on the influence of climate on Meniere's Disease.

Data sources: A scoping review was performed following PRISMA guidelines. Databases searched included PubMed, ScienceDirect, Web of Science, Scopus, and Embase, covering studies published in English from 1984 through 2025.

Study selection: Studies were included if they directly investigated MD in relation to any climate-based measures: atmospheric pressure, barometric pressure, air pollution, seasonality, ambient particulate matter, or other weather or meteorological variables. Of 230 abstracts screened, 9 studies met the inclusion criteria, comprising 40, 211 patients with diagnosed MD.

Data extraction: Extracted data included study location, design, climate variable assessed, patient population, and key findings. The quality, validity, and comparability of studies were evaluated based on clarity of diagnostic criteria, methods, and outcome measures.

Data synthesis: Findings were synthesized qualitatively due to heterogeneity in the study designs and outcomes reported. Descriptive comparisons were made to identify common meteorological risk factors and proposed pathophysiologic mechanisms linking climate variables to MD onset or exacerbation.

Conclusions: All studies were conducted internationally, with most in East Asia (6/9). Both short-and long-term exposures to ozone, carbon monoxide, and particulate matter were associated with increased risk of MD, likely mediated by oxidative stress, neuroinflammation, and autoimmune pathways. Low atmospheric pressure, high humidity, and elevated temperatures, particularly during summer or typhoon seasons, were correlated with worsening audiovestibular symptoms. Conversely, one study found that hypobaric exposure may modulate MD episodes. MRI-based studies suggest that atmospheric pressure may influence endolymphatic space volume via effects on fluid absorption, ion regulation, and autonomic function. Findings across studies encourage further research into the effect of climate and meteorological factors on MD.

Learning Objective: To understand how climate and meteorological factors affect the onset and progression of MD

Desired Result: Attendees will understand the importance of the investigation of meteorological factors affecting MD for prediction of onset, episodes, and management.

Level of Evidence: Level V

Indicate IRB or IACUC: Exempt.

Evaluation of the Relationship Between Microtia Severity and Jahrsdoerfer Score in Non-Syndromic Patients

Sriprachodaya Gaddam, BS; Corinne R. Stonebraker, BA; Mingyang Gray, MD
Maura Cosetti, MD; Zachary Schwam, MD

Objective: To investigate the relationship between microtia grade and Jahrsdoerfer score in non-syndromic patients with congenital aura atresia (CAA), a previously unestablished association, to assess whether external ear severity can serve as a reliable predictor of middle ear anatomy.

Study Design: Retrospective review

Setting: Tertiary referral center

Patients: Patients with unilateral microtia and non-syndromic CAA who underwent evaluation for microtia and/or atresia repair

Interventions: Non-contrast fine-cut computed tomography of the temporal bone imaging (CTTB)

Main Outcome Measures: Grade of microtia (I-VI) using the Marx classification and the Jarhsdoerfer score.

Results: Twenty patients with unilateral CAA and microtia (average age of 15.7 years, range 7 - 40 years) were evaluated (75% male). The distribution of microtia grades was as follows: Grade 1 (n = 3), Grade 2 (n = 10), Grade 3 (n= 5), Grade 4 (n = 2). Mean Jarhsdoerfer scores based on grade were 8.7 for Grade 1, 5.8 for Grade 2, 6.4 for Grade 3, 6.0 for Grade 4. Ordinal logistic regression model did not find a statistically significant relationship between Jarhsdoerfer score and microtia grade ($\beta = -0.12$, SE = 0.16, Wald = 0.57, $p = 0.449$), indicating that in this cohort, microtia severity was not a significant predictor of Jarhsdoerfer scores.

Conclusions: No significant correlation was found between Marx microtia grade and Jahrsdoerfer score. Surgeons cannot rely solely on the appearance of the ear to estimate surgical candidacy or expected anatomic complexity. Even severe microtia (Grade 3-4) may still have favorable middle ear anatomy for atresia repair. Individualized imaging assessment to guide surgical planning is thus critical. However, further research is encouraged given the small sample size of the study.

Learning Objective: To understand the correlation between external ear severity and middle ear anatomy.

Desired Result: Attendees will understand how the severity of microtia relates to the Jahrsdoerfer score and the implications of this relationship for surgical candidacy and counseling in aural atresia.

Level of Evidence: Level V

Indicate IRB or IACUC: STUDY 21-01768, Icahn School of Medicine at Mount Sinai

Influence of Hearing in the Non-implanted Ear and Age on the Long-term Speech Recognition of Adult Cochlear Implant Users with Asymmetric Hearing Loss

Sylvia Mihailescu, BSE; Samantha P. Scharf, AuD; Kevin D. Brown, MD, PhD
Matthew M. Dedmon, MD, PhD; A. Morgan Selleck, MD
Nicholas J. Thompson, MD; Margaret T. Dillon, PhD, AuD

Objective: This study analyzed the influence of hearing in the non-implanted ear and age on the long-term speech recognition in noise for adult cochlear implant (CI) users with asymmetric hearing loss (AHL).

Study Design: Prospective, repeated-measures study

Setting: Tertiary academic referral center

Patients: Adults with AHL, defined as normal or mild-to-moderate hearing loss in the better ear and moderate-to-profound hearing loss in the poorer ear.

Interventions: 40 participants were evaluated for the first year after cochlear implantation as part of a clinical trial. Of those, 35 participants (19 female) consented to a long-term outcomes study and were evaluated annually (out to 10 years post-activation).

Main Outcome Measures: Unaided thresholds measured behaviorally were used to calculate a pure-tone average (PTA: 0.5, 1, 2, 4 kHz) at each visit. Sentence recognition in noise was assessed with AzBio sentences in a 10-talker masker with the target from the front and the masker presented 90 degrees toward either ear or co-located with the target. A linear mixed effects model analyzed the effects of PTA for the non-implanted ear, age at surgery, and interval (1 year post-activation and later) on long-term speech recognition benefit.

Results: Speech recognition benefit (spatial release from masking) did not significantly change 1-year post-activation for either condition. Speech recognition benefit was significantly influenced by hearing in the non-implanted ear when the masker was toward the CI ear, and by age at surgery when the masker was toward the non-implanted ear. Six (17%) participants experienced a significant decline in PTA in the non-implanted ear. For those, performance improved with hearing aid fitting adjustments or bilateral cochlear implantation (n=2).

Conclusions: Long-term outcomes for adult CI users with AHL are significantly influenced by hearing in the non-implanted ear and age – though differentially across test configurations. This data supports the recommendation for routine assessment of the non-implanted ear to understand performance over time and when to fit/modify hearing technology (e.g., CI).

Learning Objective: This study aims to better understand how the hearing in the non-implanted ear and age influence long-term outcomes for adult CI users with AHL, which can influence clinical decisions to monitor and address worsening hearing in the non-implanted ear.

Desired Result: Attendees will understand the differential effects of age and hearing in the non-implanted ear on speech recognition benefit in different target-to-masker configurations.

Level of Evidence - Level III

Indicate IRB or IACUC: UNC 10-0473

Hearing Loss Associated with Temporal Bone Fractures

Ankur Gupta, MD; Elizabeth Cash, PhD; Jerry Lin, MD, PhD

Objective: To characterize the prevalence, type, and predictors of hearing loss following temporal bone fracture (TBF) in a modern trauma population.

Study Design: Retrospective chart review

Setting: Level I tertiary academic trauma center.

Patients: All adult patients (≥18 years) with radiographically confirmed TBF between 2014–2021 (n=535).

Interventions: No therapeutic intervention was performed. Data were derived from retrospective chart review, including clinical documentation, high-resolution temporal bone CT imaging, and audiometric testing performed during outpatient follow-up.

Main Outcome Measures: Prevalence and type of hearing loss (conductive, sensorineural, mixed) by mechanism of injury and fracture classification (longitudinal, transverse, mixed; otic capsule sparing vs. involving); association with ossicular chain disruption.

Results: Among 535 patients (599 fractures; mean age 43±17 years; 76.8% male), 22.4% (120/535) reported hearing loss at initial evaluation. Audiometric results were available for 120 patients: 45.0% had conductive hearing loss, 33.3% sensorineural, and 21.7% mixed. Gunshot wounds were significantly more likely to be associated with mixed hearing loss compared with all other mechanisms (Chi^2 9.43, p=0.024). Otic capsule–involving fractures were more likely to present with mixed hearing loss than otic capsule–sparing fractures (Chi^2 13.93, p=0.012). Hemotympanum was independently associated with higher odds of any hearing loss (OR 2.89, 95% CI 1.72–4.86, p <0.01). Radiographically identified ossicular disruption was present in 7/49 (14.3%) CHL patients.

Conclusions: Nearly one in four patients with TBF demonstrated objective hearing loss, with mixed loss predominating among otic capsule–involving and penetrating injuries. Early audiologic assessment and recognition of high-risk fracture patterns may guide timely intervention and counseling.

Learning Objective: Participants will be able to identify risk factors for conductive, sensorineural, and mixed hearing loss following temporal bone fracture and apply these predictors to optimize early diagnosis and management strategies.

Desired Result: Improve early identification and management of hearing loss in patients with temporal bone fracture through risk stratification by fracture type and mechanism of injury.

Level of Evidence: Level III.

Indicate IRB or IACUC: University of Louisville IRB 18.0401, approved March 2024

Electrolyte and Inflammatory Marker Differences in Meniere's Disease: A Multi-Institutional Comparative Analysis

Claire Larson, BS; Huseyin Isildak, MD

Objective: To investigate systemic electrolyte and inflammatory parameter differences in patients with Meniere's Disease (MD) against age- and sex-matched controls through a large multicenter clinical database.

Study Design: Retrospective analysis utilizing TriNetX data.

Setting: Academic and non-academic healthcare institutions.

Patients: The study analyzed a total of 47,285 patients with Meniere's Disease (F:65.2%, M:34.8%) and 8,792,754 patients who represented the general population (F:55.5%, M:44.5%) from 2015 – 2025 between ages 30 and 60. Patients with chronic kidney disease (CKD), acute kidney injury (AKI) were excluded to minimize renal confounding. Patients undergoing loop or thiazide diuretic treatment were also later excluded to minimize confounding.

Interventions: N/A

Main Outcome Measures: This analysis examines serum electrolyte, inflammatory, and lipid composition of both cohorts.

Results: Even after the exclusion of potential confounders, Meniere's Disease (MD) was associated with several electrolyte differences. Potassium levels were significantly lower in MD patients ($d = 0.24$), with mild alterations noted in calcium and magnesium and modest elevations in calcidiol. Sodium levels were comparable between groups overall, though differences reached statistical significance, especially among females. Consequently, the Na/K ratio was slightly elevated in both male and female MD cohorts relative to controls. Leukocyte and neutrophil counts were higher in MD patients ($d \approx 0.3$), whereas ESR and CRP were lower. Rheumatoid factor was slightly higher in female patients ($d \approx 0.1$). Mild lipid profile differences were observed, including small variations in cholesterol and triglyceride levels, though effect sizes were minimal.

Conclusions: These preliminary findings suggest subtle but consistent systemic differences in electrolyte balance and inflammatory biomarkers among patients with Meniere's Disease. The observed reduction in potassium and increased Na/K ratio may support hypotheses linking altered ionic homeostasis to Meniere's Disease pathophysiology. Further analyses are warranted to clarify the mechanistic significance of these findings.

Learning Objective: To explore significant differences in electrolyte, inflammatory, and lipid biomarkers on a population-based level to better understand the metabolic profile and underlying pathophysiology behind Meniere's Disease.

Desired Result: By identifying differences in the serum electrolyte composition of MD, healthcare providers may adjust pharmacologic treatment and prevention strategies to optimize patient outcomes.

Level of Evidence: Level IV

Indicate or IACUC: Exempt.

Comparative Analysis of Sudden Hearing Loss and Sensorineural Hearing Loss: Insights from TrinetX Data

Claire Larson, BS; Huseyin Isildak, MD

Objective: This study aims to investigate differences in demographics, biochemical markers, and comorbidities between patients with sudden hearing loss and those with sensorineural hearing loss (SNHL) within the age range of 30 to 60 years.

Study Design: Retrospective analysis utilizing TrinetX data.

Setting: Academic and non-academic healthcare institutions.

Patients: The study analyzed a total of 203,344 patients with SNHL (F: 49.97%, M: 47.54%) and 25,056 patients with sudden hearing loss (F: 50.73%, M: 47.51%).

Interventions: N/A

Main Outcome Measures: This analysis examines demographic distributions, biochemical test results, and the prevalence of comorbid conditions in both cohorts.

Results: A significant difference in ethnicity was observed, with Asian patients constituting 3.82% in the SNHL cohort compared to 8.61% in the sudden hearing loss cohort ($p < 0.001$). Biochemical markers, including Natriuretic Peptide B ($p < 0.001$), Natriuretic Peptide B Prohormone N-Terminal ($p < 0.001$), Parathyrin ($p = 0.045$), Hepatitis B virus surface antibody ($p < 0.001$), and Oxygen Saturation ($p = 0.027$), demonstrated significant differences between the groups. Conversely, no significant differences were identified for biomarkers such as Troponin I and Thyrotropin or comorbidities including musculoskeletal diseases and hypertension ($p \approx 0.24$ and $p \approx 0.10$, respectively). No significant cerebrovascular diseases in the groups was noted.

Conclusions: Significant differences in biochemical markers such as Natriuretic Peptide B and Natriuretic Peptide B Prohormone N-Terminal indicate varying cardiovascular related markers. Oxygen Saturation was also low in the sudden HL group. Hepatitis B virus surface antibody was high in sudden HL patients. Monitoring these biomarkers could enhance risk assessment and management strategies in the patients.

Learning Objective: To identify key differences in demographics and biochemical markers between sudden hearing loss and SNHL patients and explore associated comorbidities that may be clinically meaningful.

Desired Result: By recognizing the significant biochemical markers and demographic differences, healthcare providers can develop tailored monitoring and intervention strategies, potentially improving patient outcomes.

Level of Evidence: Level IV

Indicate IRB or IACUC: Exempt.

Cochlear Implantation in Elderly U.S. Military Veterans: Safety, Efficacy, and Electrode Selection

Douglas J. Totten, MD, MBA; Hunter L. Elms, MD; Karen Libich, AuD; David B. Pisoni, PhD
Evan C. Cumpston, MD; Rick F. Nelson, MD, PhD

Objective: To assess objective and subjective cochlear implant (CI) outcomes in elderly military veterans with respect to age, electrode implanted, and cognitive function

Study Design: Retrospective cohort study

Setting: Tertiary VA Medical Center

Patients: US. Military Veterans receiving cochlear implantation from 2019-2025

Interventions: Cochlear implantation, audiologic rehabilitation.

Main Outcome Measures: Pre-operative and 6-month post-operative AzBio sentence testing and consonant-nucleus-consonant (CNC) word testing, cochlear implant usage, and pre-operative self-assessed gerocognitive evaluation (SAGE) testing, 12-item Speech, Spatial and Qualities of Hearing Scale (SSQ-12).

Results: 110 CIs were implanted from 2019-2025, of which 13 patients were implanted bilaterally and 84 were implanted unilaterally. Average (standard deviation) age at time of implantation was 75.2 (8.2) years with ages ranging from 36 to 91. All patients were male and 98% were white. SAGE Scores showed mild cognitive decline in 12.7% of patients. Average duration of hearing loss was 36.0 (18.1) years with mean amplification use of 21.5 (14.9) years. CI522 was implanted in 15 (14%) ears, CI622 in 70 (65%), CI632 in 14 (13%) and CI624 in 8 (7%). All electrodes showed similar improvement, direct comparison of 600 series electrodes showed that both CI622 and CI632 cohorts demonstrated improvement in AzBio (CI622: 59.0 [26.7], $p<0.0001$; CI632: 57.1 [22.4], $p=0.0005$) and CNC testing (CI622: 54.5 [20.8], $p<0.0001$; CI632: 53.6 [16.7] $p<0.0001$) 6 months postoperatively. SSQ-12 scores improved from an average of 2.7 (1.5) to 4.9 (1.9) ($p<0.0001$). Patients averaged 12.5 (3.1) hours of CI usage daily.

Conclusions: Veterans of all ages, including elderly Veterans with prolonged durations of hearing loss, achieve substantial subjective and objective hearing improvements from CI within 6 months of implantation regardless of electrode type used.

Learning Objective: U.S. Military Veterans have similar hearing outcomes after cochlear implantation with either perimodiolar or lateral wall CI electrodes.

Desired Result: Perimodiolar or lateral wall electrodes provide superior CI outcomes to U.S. Military Veterans

Level of Evidence – Level IV

Indicate IRB or IACUC: Richard L. Roudebush VA Medical Center IRB # 13588 (Approved 11/30/2021)

Predicting Post-Operative Dizziness in Cochlear Implant Patients

Justina R. Varghese, BA; Brandon Bounds, BS; Akshay Prabhakar, BSA; Kayla Powell, MD
Sebastian Guadarrama-Sistos-Vazquez, MD; Kenny Lin, MD; Jeffrey Vrabec, MD

Objective: To determine the factors predicting post-operative dizziness in cochlear implant patients.

Study Design: Retrospective cohort study

Setting: Tertiary care center

Patients: Patients who underwent cochlear implantation with available pre-operative videonystagmography data between February 14th, 2018-March 28th, 2025.

Interventions: Diagnostic; comprehensive vestibular testing

Main Outcome Measures: The primary outcome was the presence of subjective postoperative dizziness.

Results: Among 159 cochlear implant patients, 66 (42%) reported subjective post-operative dizziness. 88 (55%) patients were determined to have vestibular asymmetry on preoperative testing, while 71 (45%) were classified as having symmetric vestibular function. Among patients with vestibular asymmetry, 50% experienced post-operative dizziness, significantly higher than the 31% post-operative dizziness rate in those with symmetric vestibular function ($p = 0.016$). There was no significant association with post-operative dizziness and implantation in better or worse ear, age, intratympanic steroid administration, or uncompensated vestibular function in asymmetric patients.

Conclusions: In our cohort, vestibular asymmetry was found to be a significant predictor of postoperative dizziness in cochlear implant patients and should be taken into consideration during surgical planning. Further studies are necessary to assess factors that may contribute to mitigating post-operative dizziness.

Learning Objective: To explore possible contributors to postoperative dizziness after cochlear implantation.

Desired Result: To increase physician awareness of vestibular asymmetry as a potential predictor of postoperative dizziness in cochlear implant patients to inform surgical decision-making and enhance patient counseling.

Level of Evidence - Level IV

Indicate IRB or IACUC: IRB #38356, Houston Methodist Research Institute

Unilateral and Bilateral Fitting of Flexible, Noninvasive Bone Conduction Hearing Aids

Raaha Kumaresan, BS; Enosh Lim, MS; Mohammad Moghimi, PhD

Hypothesis: Optimized bilateral fitting of flexible, Band-Aid®-like bone conduction hearing aids will significantly improve hearing gain, speech clarity in noisy environments and sound localization compared to unilateral fitting.

Background: Conductive hearing loss is a common cause of hearing loss among the pediatric population. While bone conduction implants require surgical intervention, existing non-surgical alternatives cause stigmatization and discomfort. Therefore, we are developing thin, flexible, Band-Aid®-like pediatric bone conduction hearing aids that generate vibrations onto the epidermis. These hearing aids can be applied unilaterally or bilaterally behind the ear. However, a key problem with unilateral treatment is poor sound localization and difficulty in speech understanding in noisy environments. This study aims to determine and improve the audiological benefit of bilateral fittings, characterized by functional gain and sound localization.

Methods: COMSOL Multiphysics software was used to model the human head and hearing aid(s) and conduct finite element analysis. Clinical studies will compare unilateral and bilateral fitting in patients with congenital conductive hearing loss and individuals with induced conductive hearing loss.

Results: Finite element analysis demonstrated that bilateral treatment increased the maximum transmission of vibrations from the hearing aid to the skull by approximately 4 dB at 1.7 kHz. Additionally, bilateral treatment decreased the diffusion of vibrations throughout skull, localizing the maximum vibrational magnitude to the temporal bone. Furthermore, changing the phase of one hearing aid from 0 to 105° attenuated the vibrations on the same side.

Conclusions: Preliminary results suggest bilateral treatment combined with phase modifications can increase functional gain and improve sound localization. Upcoming clinical studies will further investigate functional gain, directionality, and speech recognition in noisy environments.

Learning Objective: Attendees will be able to (1) assess the impact of unilateral and bilateral fitting on functional gain, speech clarity, and sound localization and (2) understand the audiological benefits of bilateral fitting.

Desired Result: Improved functional gain and sound localization with optimized bilateral fitting

Level of Evidence – Level IV

Indicate IRB or IACUC: IRB under review at Wake Forest University School of Medicine

Understanding the Relationship Between Cochlear Dimensions, Sex, and Body Size in Adults

Sammy Y. Gao, BS; Shaina W. Twardus, BA; David Kayekjian, BS; Rui Li, PhD
Benoit M. Dawant, PhD; Jack H. Noble, PhD; Robert F. Labadie, MD, PhD

Objective: This study evaluated associations between sex, body dimensions (height and weight) and cochlear morphometry to better define demographic and anatomical factors that may inform cochlear implant (CI) planning.

Study Design: Retrospective chart review

Setting: Tertiary academic medical center

Patients: Adult CI candidates who underwent preoperative computed tomography (CT) imaging of the temporal bone

Interventions: CT scans were analyzed using previously published cochlear segmentation software to obtain A-dimension, B-dimension, and cochlear duct length (CDL) as estimated using the simplified Escudé equation.

Main Outcome Measures: Associations between patient age, sex, height, weight, and cochlear dimensions were assessed using Spearman's correlation coefficients.

Results: Preliminary analysis of 150 adults, with plans to expand to 1,000 by the time of presentation, demonstrated positive correlations between height and cochlear dimensions (Spearman's ρ: A=0.25 (p=0.02), B=0.23 (p=0.04), CDL = 0.25 (p=0.02)). Sex was also correlated with cochlear size (ρ=0.26–0.28, p<0.02). In unadjusted linear regressions, height showed small but significant effects on cochlear dimensions (A: β=0.009, p=0.012; B: β=0.006, p=0.015; CDL: β=0.033, p=0.012), while female sex was associated with smaller cochlear dimensions (A: β=–0.23,p=0.003; B: β=–0.15, p=0.004; CDL: β=–0.83, p=0.003). When controlling for height, sex emerged as the strongest predictor, with females demonstrating smaller cochlear dimensions (A: β=–0.18, p=0.047; B: β=–0.12, p=0.046; CDL: β=–0.66, p=0.047). Cohen's d indicated small effect size differences between males and females (0.49–0.50). Cohen's d indicated differences in cochlear dimensions between males and females across all measures with small effect size (0.49–0.50).

Conclusions: Height showed weak positive correlations with cochlear dimensions, but these effects diminished after adjustment for covariates. Sex-related differences were more robust, with females exhibiting smaller cochlear dimensions across all measures.

Learning Objective: To evaluate how sex and body size relate to cochlear dimensions and recognize their relative contributions to cochlear anatomical variability.

Desired Result: Increase clinician awareness that sex-related differences, rather than general body size, may better explain variation in cochlear dimensions, supporting more individualized and anatomically informed surgical planning.

Level of Evidence - III

Indicate IRB or IACUC: Exempt

Cisplatin-Induced Hearing Loss Prevention with Intratympanic Therapy Systematic Review and Meta-Analysis

Zachary A. Kons, MD; Calvin J. Kersbergen, MD, PhD; Deborah Goss
Aaron K. Remenschneider, MD, MPH

Objective: Cisplatin-induced hearing loss (CIHL) is a significant consequence of cisplatin treatment for malignancy. Intratympanic (IT) injections have been trialed to prevent CIHL in humans. To provide clarity on which agents have been studied via IT injection and their efficacy, we performed a systematic review and meta-analysis.

Data Sources: OVID Medline, Embase, Web of Science, and Cochrane Library were queried.

Study Selection: Human studies between 1980-2025 evaluating prevention of CIHL with IT medication delivery which reported at least one hearing-related outcome were included. Studies not involving cisplatin or with interventions not involving IT administration were excluded.

Data Extraction: Databases were searched in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines. Prospective randomized trials were included, and a systematic review was performed for all studies. Demographic and audiometric data were collected from each study. Random-effects models were used to compare across studies, and subgroup analyses were performed for each IT agent.

Data Synthesis: The initial search yielded 1017 articles, which were screened according to criteria. Ten studies were identified, involving 284 patients. Studies included data on IT dexamethasone, N-acetylcysteine (NAC), and sodium thiosulfate (STS). Pooled analysis across all agents and frequencies did not reveal a significant difference in hearing thresholds between treatment and control ears (prediction interval [-3.77, 3.20], negative favors treatment). Subgroup analysis of IT dexamethasone [-1.74, 3.80] and IT NAC [-1.02, 4.64] also did not demonstrate significant differences. STS data were not amenable to pooled analysis; however, one study demonstrated a significant decrease in ASHA-defined ototoxicity (40% vs 85%, p=0.0027).

Conclusions: To date, no IT agent has consistently decreased CIHL, although limited data suggest that IT STS may decrease ototoxicity. More trials are necessary to fully elucidate these effects.

Learning Objective: To understand which intratympanic agents have been studied to prevent CIHL and the effectiveness of each therapy.

Desired Result: Review the available literature to understand which intratympanic agents have been effective for preventing CIHL and guide further research to focus on therapies with encouraging preliminary evidence.

Level of Evidence – Level II, pooled evidence from small randomized controlled trials

Indicate IRB or IACUC: Not applicable.

Association of Anti-resorptive Osteoporosis Medications with Temporal Bone Osteonecrosis

Anthony Thai, MD; Jennifer C. Alyono, MD, MS

Objective: Determine if anti-resorptive osteoporosis therapies are associated with temporal bone osteonecrosis

Study Design: Retrospective case-control study

Setting: Tertiary referral center

Patients: Patients aged > 18 years examined by a neurotologist since 2010 with chronic exposed external auditory canal (EAC) bone were identified. Patients with prior head and neck radiation and canal cholesteatoma (with temporary exposed bony fragments that subsequently healed over with healthy skin) were excluded. Matched controls were identified using propensity score matching with 5:1 ratio, matching on age, sex and race.

Interventions: n/a

Main Outcome Measures: Proportion of patients on anti-resorptive medication

Results: 81 patients with exposed EAC bone were identified. 43 and 33 were excluded due to osteoradionecrosis and canal cholesteatoma, respectively. Five patients with exposed bone were included and matched with 25 controls. Mean age of all patients was 69.8 years, 80.0% were female, and 60.0% were white. Compared to controls, osteonecrosis patients were more likely to have taken denosumab (5 [100%] vs 0 [0%], $p<0.001$). Additionally, 2 (40%) and 1 (20%) osteonecrosis patients were on bisphosphonates and tyrosine kinase inhibitors, respectively, compared to 1 (2.5%) and 0 (0%) for controls. Average time from denosumab initiation to osteonecrosis diagnosis was 51.6 months. All osteonecrosis patients had persistent exposed bone after mean follow up of 15.6 months.

Conclusions: Patients with chronic exposed EAC bone without prior radiation are more likely to have taken denosumab compared to controls. In unexplained, non-healing temporal bone osteonecrosis, clinicians should query whether patients are taking anti-resorptive medications.

Learning Objective: Anti-resorptive medications may be associated with higher risk of temporal bone osteonecrosis.

Desired Result: In patients with unexplained temporal bone osteonecrosis, clinicians should investigate whether patients are taking anti-resorptive therapies.

Level of Evidence - IV

Indicate IRB or IACUC: Stanford School of Medicine, protocol #77794. Approved 11/14/2024

Real-World Vestibular Schwannoma Management: Treatment Trends, Facial Weakness Outcomes, and Disparities in a Large US Network Analysis

Huseyin Isildak, MD

Objective: To characterize treatment trends, facial weakness (FW) outcomes, and demographic disparities in vestibular schwannoma (VS) management using real-world data from a large US patient cohort.

Study Design: Retrospective cohort analysis utilizing the TriNetX US Collaborative Network.

Setting: Multi-institutional US healthcare organizations across 69 Healthcare Organizations (HCOs).

Patients: A total of 72,496 patients diagnosed with VS (ICD-10: D33.3), categorized by management strategy: observation (n=63,500), stereotactic radiosurgery (SRS; n=3,073), surgical resection (n=5,910; including middle fossa [n=1,079], translabyrinthine [n=2,756], posterior fossa [n=2,438]), and combined SRS+surgery subgroups.

Interventions: N/A

Main Outcome Measures: Demographic profiles (age, sex, race), treatment modality utilization, FW incidence (ICD-10: R29.810), and historical (2022–2025) and predicted (2025–2026) treatment trends based on patient arrival rates across 44 HCOs.

Results: The cohort showed a mean age of 66 years (SD 17), slight female predominance (54.35%), and underrepresentation of Black (5.67%) and Asian (5.26%) patients relative to White patients (70.51%). Observation was predominant (87.6%), followed by surgery (65.3% of treated cases) and SRS (34.7%). FW rates were 4.7% (observation), 9.1% (SRS), and 24.4% (surgery overall; middle fossa 21.6%, translabyrinthine 24.7%, posterior fossa 26.1%). Combined SRS+surgery subgroups had higher FW (23.1–33.3%). Historical monthly volumes (2022–2025) were stable for SRS (20.1 patients) and middle fossa (5.4), with declining translabyrinthine (17.3) and increasing posterior fossa (21.4); predicted trends (2025–2026) showed slight overall decline but continued posterior fossa rise (26.0).

Conclusions: Observation remains the dominant VS strategy, with surgery carrying the highest FW risk and evolving preferences toward posterior fossa approaches. Racial disparities in treatment access persist, underscoring the need for targeted interventions to improve equity in care.

Learning Objective: To identify key treatment trends, FW risks across modalities, and demographic disparities in VS management to guide personalized clinical strategies.

Desired Result: Improved understanding of real-world VS management practices will foster equitable treatment decisions, enhance awareness of facial weakness risks across modalities, and support optimized, patient-centered care strategies.

Level of Evidence: Level IV

Indicate IRB or IACUC: Exempt.

Prospective Trial on Robotic vs Manual Insertion of Cochlear Implantation and Hearing Preservation Rates

Mikayla Huestis, MD; Ilana Yellin, MD; Nathan Jacob, BS; Michael Seidman, MD

Objective: Determine if IotaSoft Robot use improves rate of low frequency hearing preservation as compared to the standard of manual insertion for cochlear implantation.

Study Design: Prospective randomized-controlled trial comparing robotic insertion to manual insertion of electrode array.

Setting: Single tertiary center, single surgeon experience

Patients: Cochlear implant candidates with LFPTA (125 Hz, 250 Hz, 500 Hz) <80 dB

Interventions: During cochlear implantation for electrode insertion, patients were randomized to robotic or manual insertion of the electrode array.

Main Outcome Measures: ΔLFPTA and aided speech testing at 3-month postoperative visit

Results: 32 patients with available 3-month postoperative data were included in initial review.

Conclusions: Hearing preservation is equivalent with robotic and manual insertion.

Learning Objective: Evaluate if clinical use of IotaSoft Robot impacts hearing preservation outcomes.

Desired Result: Demonstrate clinical superiority of robotic insertion to standard of care with manual insertion.

Level of Evidence – Level II

Indicate IRB or IACUC: Advent Health Celebration, IRB 2269273

Design and Validation of an Augmented Reality Temporal Bone Surgical Training Tool with Virtual On-lay of Anatomic Structures onto 3D Printed Temporal Bone

Dorsa Zabihi-Pour, MD; Josee Rosset, BSc; Terry Li, PhD
Bertram Unger, MD, PhD; Jordan Hochman, MD

Objective: To develop and evaluate the effectiveness of an augmented virtual reality simulation in Temporal Bone surgical training.

Study Design: Prospective cohort study and content validation of augmented reality in education.

Setting: Canadian Teaching Hospital.

Interventions: Employ previously validated 3D printed temporal bone model with custom superimposed virtual on-lay of internal anatomy with use of augmented reality glasses (HoloLens 2, Microsoft Corp). Micro-CT data was acquired and anatomical structures segmented. The tracking code was based on open-source HoloLens 2 infrared software and employed the Research Mode sensors and OpenCV-based processing to localize reflective markers and align virtual anatomy with the physical model. Using infrared fiducial alignment, the sigmoid sinus, facial nerve, dural plates and otic capsule contents were projected onto an anatomically identical printed model.
10 otolaryngology residents evaluated relative value, workload and confidence with use of the virtual anatomical overlay. Each participant completed four temporal bone dissections, randomizing use of the virtual on lay. Ultimately end-product dissection was blindly graded by two Otologic surgeons with Welling and Canada-West scales, contrasting performance.

Results: Residents found the augmented reality to be valuable for appreciation of relative anatomy and confidence but at the cost of significant cognitive load. Issues with registration of virtual anatomy during motion of the physical model were common. Performance on validated dissection scales was equivocal with and without use of augmented reality. No difference was observed between intermediate and senior cohort scores.

Conclusions: Participants found the platform to be beneficial. Augmented reality represents an opportunity in both education and actual surgery. This is an early attempt to provide increasing information to learners to improve education.

Learning Objective:
To determine whether augmented reality can improve technical skill and spatial understanding in mastoidectomy training.

Desired Result:
Enhanced accuracy, confidence, and safety in resident temporal bone dissection.

Level of Evidence: III

Indicate IRB or IACUC: Ethics # HS26138 (B2023:089) University of Manitoba.

Prevalence of Congenital Hearing Loss and Timing of Identification in the US: A Commercially Insured Birth Cohort

Hung-Kai Chen, BPharm, MClinPharm; Yanning Wang, MS; Nicole E. Smolinski, PharmD, PhD
Judith C. Maro, PhD; Sonja A. Rasmussen, MD, MS
Almut G. Winterstein, RPh, PhD; Patrick J. Antonelli, MD, MS

Objective: To evaluate the prevalence of congenital hearing loss (cHL) and timing to cHL identification.

Study Design: Retrospective birth cohort study.

Setting: Merative™ MarketScan® commercial claims database (2005-2023)

Patients: Infants with 5 years of continuous enrollment after birth (2005-2018)

Interventions: None

Main Outcome Measures: Prevalence of cHL and time to cHL identification. We used International Classification of Diagnoses codes and audiometric codes to identify HL in insurance claims data. We assessed time to first HL diagnosis and second confirmatory diagnoses following audiometric testing. We excluded conductive hearing loss and unspecified HL diagnoses associated with otitis media or tympanostomy tubes in the year before first HL diagnosis and 6 months before confirmatory diagnosis.

Results: We included 502,274 infants. Compared to infants with an initial diagnosis in the first year of life, the prevalence of cHL more than doubled when the window for confirmatory diagnoses was expanded from 1 to 5 years (0.18% to 0.39%). When relaxing the requirement for the first diagnosis to be in the first year of life, prevalences doubled again (0.73%). After a peak in early infancy, the distribution of first diagnoses across follow-up remained constant up to age 5. The median time to initial diagnosis was 313 days (interquartile range 37-855) and to audiometry was 590 days (184-1135). The median time between initial and confirmatory diagnosis was 290 days (98-653) and median age at confirmatory diagnosis 982 days (400-1476).

Conclusions: We found a marked increase in the prevalence of cHL with longer windows for confirmatory diagnosis and significant delays between initial and confirmatory diagnosis, extending out to age 5.

Learning Objective: To describe the prevalence of cHL using a large insurance claims database.

Desired Result: Clinicians should remain vigilant in monitoring infants and young children for cHL, well beyond 1 year, potentially leading to earlier referrals for confirmatory testing and intervention.

Level of Evidence: Level III (Cohort and case-control studies)

Indicate IRB or IACUC: Exempt.

Understanding Undiagnosed Hearing Loss in Children: NHANES 2017–2020 Analysis

Kiran Ganga, BS; Nihan Z. Ercanli, BS; Valentina Fernandez-Rodriguez, BA
Sean R. Wise, MD; James Saunders, MD, MS

Objective: To evaluate the similarities between perceived hearing loss and objectively measured audiometric outcomes among U.S. children aged 6–16 years using data from the National Health and Nutrition Examination Survey (NHANES) 2017–March 2020 cycle.

Study Design: Cross-sectional analysis of national survey data.

Setting: National Health and Nutrition Examination Survey (NHANES) 2017–March 2020.

Patients: Children aged 6–16 years (n=2617) who underwent audiometric testing and for whom parent-reported perception of hearing status was available. Participants with incomplete audiometric data were excluded.

Interventions: Not applicable

Main Outcome Measures: Prevalence of objectively measured hearing loss (PTA > 20 dB in either ear), parent-reported perception of hearing loss, and concordance between perceived and measured hearing loss.

Results: Among participants with a pure tone average (PTA) > 20 dB in either ear, 71.1% of parents did *not* perceive their children having hearing loss, indicating a substantial burden of undiagnosed or unrecognized hearing loss. Spearman correlations demonstrated a very weak positive association between PTA and perceived hearing loss (Left ear: $\rho = 0.112$, Right ear: $\rho = 0.124$, both $p < 0.001$). Both the Mann–Whitney U test and Kruskal–Wallis test indicated significantly higher PTA values among parents who reported hearing loss in their children compared to those without perceived loss ($p < 0.001$). Lower income and male participants were found to have significantly worse hearing outcomes, while older age was associated with better hearing ($p<0.05$ for listed variables).

Conclusions: There is an observed difference between parent-perceived and audiometrically measured hearing loss in U.S. children, with the majority of parents unaware of deficits. Our findings highlight how parent-reported hearing loss underestimates true pediatric hearing loss and emphasizes the need for more standardized, accessible audiometric screening throughout childhood.

Learning Objective: To understand the discordance between perceived and objectively measured hearing loss in children.

Desired Result: To inform early intervention practices and inform pediatric screening policies supporting periodic audiometric testing.

Level of Evidence - Level III

Indicate IRB or IACUC: Exempt, analysis of publicly available, de-identified NHANES dataset.

Microsurgery vs Radiation in Cerebellopontine Angle Tumors: Insights from All of Us

Kristie N. Nonyelu, MS; Bijun Sai Kannadath, MBBS, MS

Objective: To compare complication rates between microsurgery and radiation therapy for cerebellopontine angle (CPA) tumors using data from the All of Us Research Program.

Study Design: Retrospective cohort study.

Setting: National database analysis using the All of Us Research Program.

Patients: Individuals diagnosed with cerebellopontine angle tumors identified through diagnostic and procedure codes.

Interventions: Microsurgery and radiation therapy (RT), including stereotactic radiosurgery (SRS) and fractionated external-beam radiotherapy.

Main Outcome Measure(s): Occurrence of treatment-related complications.

Results: A total of 705 patients were identified (microsurgery n=217; RT n=488). Complications occurred in 103/217 (47.5%) following microsurgery and 293/488 (60.0%) following RT. Chi-square analysis demonstrated a significant association between treatment type and complications (χ^2 (1) =9.649, p=0.0019). Microsurgery was associated with lower odds of complications compared with RT (OR 0.60, 95% CI 0.44\u20130.83). Further analyses will assess temporal trends and covariates influencing outcomes.

Conclusions: In this national cohort, microsurgery for CPA tumors was associated with fewer complications than radiation therapy. These findings underscore the value of nerve-preserving microsurgical approaches and highlight the utility of large-scale clinical datasets for evaluating treatment outcomes.

Learning Objectives:

1. Identify differences in complication rates between microsurgery and radiation therapy for CPA tumors.
2. Apply modality-specific complication data to improve surgical decision-making and patient counseling.

Desired Results: Enhance physician knowledge and competence regarding treatment-specific risks in CPA tumor management, promoting data-driven selection of optimal therapeutic approaches.

Level of Evidence: Level V

IRB: Exempt

Preoperative Hypoalbuminemia Predicts Adverse Outcomes in Middle Ear and Mastoid Repair Surgery

Marco A. Campioli, BA; James A. Widner, BS; Kaitlyn A. Brooks, MD; Nathan R. Lindquist, MD

Objective: To evaluate preoperative hypoalbuminemia as a predictor for postoperative complications in middle ear and mastoid surgery in a large network database.

Study Design: Retrospective cohort study

Setting: Academic and community hospitals contributing to the TriNetX network database.

Patients: Patients undergoing middle ear and/or mastoid surgery, stratified into hypoalbuminemia (n=775) and normoalbuminemia (n=7,858) cohorts. Propensity score matching yielded two balanced cohorts of 748 patients each.

Interventions: Middle ear and mastoid reconstructive surgery

Main Outcome Measures: Postoperative complications within 90 days including infectious, surgical, and hospitalization outcomes. Logistic regression within TriNetX was used to generate propensity scores for matching. Odds ratios were calculated to compare risks between cohorts, with 95% CIs derived using the logarithmic method.

Results: Following propensity score matching, patients with hypoalbuminemia faced significantly higher rates of pneumonia (OR 1.93, 95% CI 1.08–3.45), acute kidney failure (OR 1.79, 95% CI 1.19–2.69), venous thromboembolism (OR 2.04, 95% CI 1.09–3.83), sepsis (OR 2.39, 95% CI 1.40–4.07), mastoiditis (OR 2.11, 95% CI 1.44–3.07), malignant otitis externa (OR 2.39, 95% CI 1.20–4.73), hospitalization (OR 2.52, 95% CI 1.98–3.21), and critical care service utilization (OR 2.85, 95% CI 1.75–4.65). No significant differences were observed for otitis media, acute otitis externa, emergency department visit, or surgical site infections.

Conclusions: Pre-operative hypoalbuminemia within 30 days is a strong predictor of adverse postoperative outcomes in middle ear and mastoid surgery, highlighting its potential as a prognostic biomarker and possible target for medical optimization prior to surgery. Prospective studies are necessary to determine if pre-operative optimization of hypoalbuminemia improves post-operative outcomes.

Learning Objective: To understand hypoalbuminemia as a modifiable risk factor and ascertain the important negative outcomes after middle ear and mastoid surgery.

Desired Result: Surgeons and physicians will use these clinical results to increase testing of pre-operative albumin prior to middle ear and mastoid surgery and implement protocols to optimize surgical candidates' nutritional and medical status.

Level of Evidence – Level III

Indicate IRB or IACUC: Exempt

Determinants of Hearing-Related Quality of Life in Infants and Toddlers Who Are Deaf or Hard of Hearing

Nika Darvish, BA; Joy Kearns, MS, CCC-SL; Jihyun Stephans, BS; Dylan Chan, MD, PhD

Objective: Families of infants and toddlers who are deaf or hard of hearing (D/HH) face complex emotional and developmental challenges during a critical period of language and social development. This study aims to characterize factors that influence hearing-related quality of life (QOL) among families navigating congenital hearing loss.

Setting: Hospital-based tertiary and quaternary pediatric referral centers

Study Design: Prospective cohort study

Patients: 96 D/HH children, mean age 13 months [range:1-29]

Interventions: This is a secondary analysis of a randomized clinical trial (NCT04928209). Pure tone average (PTA) in the better ear, early intervention timing (Individualized Family Service Plan [IFSP] by six months of age), paternal education level (high school/GED or higher), and Social Vulnerability Index (SVI) were measured.

Main Outcome Measures: Validated Hearing-Related Infant/Toddler and Parent QOL (HIP-QL) questionnaire encompassing four domains addressing QOL for children who are D/HH, 0-42 months old (auditory/communication behavior, temperament) and their caregiver (management, parent-directed factors)

Results: Multivariable linear regression identified several significant predictors of hearing-related QOL. Higher paternal education ($\beta = 5.26$, SE = 2.35, $p = 0.027$) and earlier intervention ($\beta = 4.87$, SE = 2.10, $p = 0.023$) were associated with higher HIP-QL scores, while worse hearing predicted lower scores ($\beta = -0.085$, SE = 0.028, $p = 0.003$). The overall model explained 17% of the variance in HIP-QL scores ($R^2 = 0.17$, $F(3,92) = 7.57$, $p < 0.001$). There was no significant correlation between SVI and HIP-QL scores ($r = -0.004$, $p = 0.97$).

Conclusions: Early IFSP initiation, higher paternal education, and better unaided hearing were independently associated with higher hearing-related QOL. Multi-modal care, including timely Early Intervention services, accessible parental education, and optimal access to sound, are all needed to support D/HH children and their families.

Learning Objective: To identify clinical and socio-demographic factors associated with hearing-related quality of life among D/HH children and their families.

Desired Result: The lack of association between social vulnerability and hearing-related QOL suggests that proximal, family-level determinants may buffer against broader socioeconomic disadvantage during early development. Interventions that support timely service initiation and parental capacity-building should be emphasized in order to optimize outcomes for D/HH children and their families.

Level of Evidence - III

Indicate IRB or IACUC: [UCSF IRB#19-28356]

Determining Characteristic Latency Patterns on Auditory Brainstem Response in Autistic Individuals

Quentin C. Durfee, BS; Ziad Obideen, BS; Hänel J. Eberly, MD
Tonya S. King, PhD; Varun S. Patel, MD

Objective: Multiple retrospective studies have looked at the association between wave latencies on auditory brainstem responses (ABR) for children with autism spectrum disorder (ASD). However, there is still no definitive association with some studies showing prolonged wave latencies in children with ASD. The goal of our study was to determine how wave latencies found on ABR in children diagnosed with autism spectrum disorder (ASD) compared to those of neurotypical children.

Study Design: Retrospective cohort study.

Setting: Tertiary Academic Center.

Patients: ASD and neurotypical children who underwent ABR with numerical measured wave I, III, and V latencies between 01/2021 and 01/2023.

Interventions: Therapeutic

Main Outcome Measures: Measure whether there is a statistical difference between wave latencies between neurotypical children versus children with ASD.

Results: There was a statistically significant difference among the 2 cohorts with respect to wave I of the ABR (p=0.033), which is driven by the comparison between ASD (n = 22; mean 1.42, 95%CI 1.35-1.50) and neurotypical (n = 19; mean 1.57, 95%CI 1.49-1.65), p=0.010. There was a statistically significant difference between the 2 cohorts for wave III (p=0.002), driven by the comparison between ASD (3.94, 95%CI 3.83-4.04) and neurotypical (4.20, 95%CI 4.09-4.31), p<0.001. Similarly, a statistically significant difference was seen between the 3 cohorts for Wave V (p=0.004), driven by the comparison between ASD (6.11, 95%CI 5.96-6.27) and neurotypical (6.51, 95%CI 6.35-6.68), p=0.001. Differences between interpeak latencies I-III, III-V, and I-V were not statistically significant between cohorts.

Conclusions: Patients with ASD showed differing wave latencies compared to controls for waves I, III, and V. Differences between interpeak latencies I-III, III-V, and I-V were not statistically significant between groups. Although differences in wave latencies I, III, and V were statistically significant, the clinical significance is still unclear. Future studies should consider a larger cohort and look at wave latencies and peak amplitudes to better assess the role of ABR in evaluating differences between ASD and neurotypical children.

Learning Objective: To evaluate the utility of ABR for early detection and intervention in children with ASD.

Desired Result: Improved diagnostic protocols and reduced time to intervention for children with ASD.

Level of Evidence – Level III

Indicate IRB or IACUC: STUDY00023052, The Pennsylvania State University Institutional Review Board

Charting the Path to Competency in Stapedotomy: A Systematic Review of Learning Curves

Sophia Chehade, BS; Peter Malik, MS; Tamara Mijovic, MD
Marc A. Tewfik, MD; Lily HP Nguyen, MD

Objective: To synthesize the current evidence on learning curves in stapedotomy and stapedectomy, comparing operating room (OR) and simulation-based training studies, and to identify methodological trends, competency thresholds, and factors influencing surgical proficiency.

Data sources: Systematic searches of Ovid Medline, Ovid Embase, Web of Science, CINAHL, the Cochrane Database of Systematic Reviews, and CENTRAL were conducted. English-language studies published between 1991 and 2023 were included.

Study selection: Eligible studies analyzed the learning curve of microscopic or endoscopic stapedotomy or stapedectomy in the OR or through simulation models (animal, cadaveric, 3D-printed, or virtual). Reviews, commentaries, and purely technical reports without a learning curve assessment were excluded.

Data extraction: 1,388 studies were screened by two independent reviewers in accordance with PRISMA guidelines. Fifteen studies met inclusion criteria (11 OR, 4 simulation). Extracted data included study design, population characteristics, analytic methods, learning curve outcomes, and competency thresholds. Quality and comparability were assessed descriptively given study heterogeneity.

Data synthesis: OR studies reported wide variability in thresholds for proficiency (20–80 cases). Definitions of competency included air-bone gap (ABG) closure, operative time, and complication rates. Some described phased curves (ascending, plateau, maintenance) requiring ongoing annual case volumes (>7/year) to sustain competence. Simulation studies demonstrated earlier plateauing (7–10 trials), most often evaluated using OSATS scores or operative time. Step-specific analyses identified fenestration and prosthesis insertion as the most technically challenging substeps.

Conclusions: The stapedotomy learning curve is multifaceted and non-linear, varying by analytic method, surgical step, and training environment. Simulation enables early skill acquisition but cannot substitute for patient-based experience. Future work should standardize outcome measures, incorporate step-specific evaluation, and address maintenance of competence among low-volume surgeons.

Learning Objective: To understand how learning curves in stapedotomy and stapedectomy are measured, the number of cases or trials required to reach proficiency, and how simulation and step-based assessment can inform surgical training.

Desired Result: To enable educators and trainees to recognize phase-specific challenges in the stapedotomy learning curve and to optimize training curricula using validated metrics and simulation before transitioning to the OR.

Level of Evidence: Level III

Indicate IRB or IACUC: Exempt

Effectiveness of Intratympanic, Oral, or Combined Steroid Therapy in Adults with Sudden Sensorineural Hearing Loss: An Umbrella Review

William C. Moss, BS; Anthony M. Dapoz, MS, BS; Melisa N. Bayrak BA
Alvaro Moreira, MD, MSc

Objective: To compare the treatment efficacy and adverse effect profiles of intratympanic (IST), systemic (SST), and combined (CST) steroid therapy for sudden sensorineural hearing loss (SSNHL).

Data Sources: A medical librarian conducted a literature search using OVID, Scopus, and CINAHL, employing MeSH terms and text words related to the population, interventions, and comparators. Searches were restricted to systematic reviews and meta-analyses published in English over the past 10 years. Reference lists of included studies were screened, and searches were re-run prior to final analysis.

Study Selection: Eligible studies included systematic reviews and meta-analyses of adult patients with idiopathic SSNHL treated with IST, SST, or CST as primary therapy. Excluded were studies limited to pediatric populations, adjunct non-steroidal therapies, or alternative steroid routes. Ten studies met inclusion criteria: seven compared IST vs SST, six CST vs SST, and two IST vs CST.

Data Extraction: Extracted data included study characteristics, treatment arms, primary RCTs, effect sizes for pure-tone audiometry (PTA) gain (dB), recovery rates, adverse events, and variance estimates. Study quality was assessed using AMSTAR-2.

Data Synthesis: Meta-analysis was not performed due to overlap among primary RCTs; results were synthesized narratively. Of seven IST vs SST comparisons, five found no difference in PTA gain, two showed small advantages for IST (SMD 0.83; MD –5.93 dB), and none found significant recovery differences. Among six CST vs SST studies, results were mixed: several suggested higher odds of complete recovery with CST, though PTA effects were inconsistent. Two IST vs CST studies found no significant differences.

Conclusions: Current evidence indicates no clinically meaningful difference between IST and SST, with CST potentially offering a modest recovery benefit. Distinct adverse effect profiles support individualized therapy selection.

Learning Objective: Understand the comparative efficacy and adverse effects of intratympanic, systemic, and combined steroid therapies for SSNHL.

Desired Result: Learners can identify evidence-based differences and apply them to individualized treatment decisions

Level of Evidence – Level I

Indicate IRB or IACUC: Exempt

The Clinical Impact of Sociodemographic and Clinical Factors for Pediatric and Adult Patients with OSIA Implants

Alexis H. Kim, BA; Hannah Sturm, BS; Ivie Odie, BS; Sarah Van der Elst, MD
Stanley Pelosi, MD; Andrea Vambutas, MD; Maja Svrakic, MD

Objective: Evaluate the relationship between sociodemographic and clinical factors on follow-up rates and outcomes for OSIA implants.

Study Design: Retrospective chart review

Setting: Tertiary referral center

Patients: Pediatric (n=23) and adult (n=36) patients who received OSIA implants between 2020-2025.

Interventions: Collection of sociodemographic data (gender, insurance, median income, ethnicity, language) and clinical data (type/etiology of hearing loss, otologic surgery history, incision, implant type (OSI200/OSI300))

Main Outcome Measures: Number of attended and missed follow-ups, post-surgical complications (infection, extrusion, vertigo), processor retention/utilization, time to surgery (TTS), and time to OSIA activation (TTA).

Results: Median TTS of 5 months (mean 22.7 mo.) and median TTA of 46 days (mean 53.5 days). Average number of otology and audiology appointments were 2.6 and 2.3, respectively. Medicaid patients had longer TA (59.64 ± 39.81 days) compared to those with private/Medicare (43.8 ± 13.1 days) (p=0.032). Middle-high income groups ordered fewer replacements (p=0.024) and shorter TS (9.17± 12.38 months) than low-income groups (24.21 ± 34.1 months) (p=0.044). Patients with congenital hearing loss attended more otology follow-ups (p=0.0032). Those with conductive hearing loss missed fewer appointments (p=0.046). We recorded all post-surgical complications, of these 3 cases required device removal. All device removals were related to infection or occurred in patients with craniofacial abnormalities and devascularization from prior surgery. Horizontal post-auricular incisions had fewer complications (p=0.0078). Skin thinning, prior surgery, and device type did not significantly change post-surgical outcomes.

Conclusions: Patients with Medicaid and low-income levels had longer TTA and increased need for additional device parts, respectively. Surgical outcomes were favorable across groups, with incision type, but not device type or history of prior surgery, influencing complication rates.

Learning Objective: To inform providers of sociodemographic factors associated with follow up, time to surgery and activation as well as the clinical predictors of surgical complications.

Desired Result: Reduce disparities in OSIA care with early identification of at-risk populations and targeted interventions to optimize long-term outcomes.

Level of Evidence - Level IV

Indicate IRB or IACUC: Reviewed and exempt IRB number (24-0181)

Diverse Perspectives on Psychosocial Impact of Cochlear Implants on Pediatric Patients

Connor B. Haines, BS; Sofia Piperno, BS; Delaney ES. Clarke, BS
Brian Quinlin, MD; Brian McKinnon, MD; Dayton L. Young, MD

Objective: Child cochlear implantation (CI) rates are increasing, with significant impacts on hearing and the broader psychosocial domain of life. However, there is little that currently explores how cochlear implantation affects the psychosocial well-being of children from both the perspectives of the child CI user and their family. This review aimed to (1) describe the existing literature on the psychosocial impact of cochlear implantation on children from both viewpoints and (2) evaluate the range of reported impacts to highlight areas requiring further investigation.

Data Sources: A systematic search of Ovid, CINAHL, and Scopus databases was conducted for articles published between January 1, 2005, and January 1, 2025.

Study Selection: Eligibility was assessed independently by two reviewers, with a third consulted to resolve disagreements. Studies were included if they involved CI recipients under age 18 and explored psychosocial outcomes from the perspective of the child or their family. Studies focusing on adults or published before 2005 were excluded.

Results: Of the 310 articles identified, 22 met the inclusion criteria. The most frequently reported psychosocial improvements from the child's perspective were conversational access (100%) and everyday hearing (100%). Families reported improvements in the child's quality of life (100%), everyday hearing (100%), social activity (95%), and independence (90%). Four studies included the child's perspective, while 21 included that of the family. Some discrepancies emerged between family and child reports. Notably, children often reported more neutral psychosocial outcomes compared to their families' more positive views.

Conclusions: This review highlights a gap in research focusing on the child's direct experience. Future studies should prioritize the child's perspective to better understand the full psychosocial impact of cochlear implantation.

Learning Objective: To search the existing literature of the psychosocial impact of cochlear implantation on children and evaluate the various impacts of CI on children from both their own perspective and that of their families. We hope to suggest areas for future research including projects that focus more on the personal experiences of the child CI user and trying to find ways to improve the psychosocial impact of cochlear implantation on children so that their opinions on CI can improve.

Desired Result: Enhanced awareness of the psychosocial impact of CI on children from both their own perspective and that of their families.

Level of Evidence: Level III

Indicate IRB or IACUC: Exempt

Intergenerational Cochlear Implant: Are Parental CI Outcomes Associated with Their Children's CI Outcomes?

Idit Tessler, MD, PhD; Shibli Sleibi, MD; Nir A Gecel, MD; Ziva Yakir, MA; Yisgav Shapira, MD; Amit Wolfovitz, MD

Objective: To evaluate association between parental cochlear implant (CI) speech perception with their child's CI performance in families with hereditary hearing loss.

Study Design: Retrospective cohort study.

Setting: Tertiary academic center.

Patients: Parent-child dyads.

Interventions: Standard of care.

Main Outcome Measures: Word recognition (%) as the primary outcome evaluated ≥2 years post-implantation; Speech Reception Threshold (SRT) and daily device-use hours as secondary outcomes.

Results: Nineteen parent–child dyads were analyzed. Children demonstrated significantly higher speech perception scores compared to their parents (mean HAB: 72.8% ±18.9 vs. 44.4% ±20.8; $p = 0.05$), with a significant within-dyad difference (Wilcoxon signed-rank test, $p = 0.05$). A word recognition score >50% was achieved by 88% of children, compared to only 15.4% of parents. No significant correlation was observed between parent and child HAB scores (Spearman's $\rho = 0.037$; $p = 0.937$). Neither the sequence of implantation nor parental performance level (>50% vs. ≤50%) significantly influenced pediatric outcomes.

Conclusions: While parental CI outcomes did not predict pediatric auditory performance, these findings underscore the key role of parents as primary caregivers in the rehabilitation process. Family counseling should be tailored to the familial structure and support parental engagement and proactive involvement to optimize outcomes.

Learning Objective: Recognize that parental CI outcomes are not reliable predictors of pediatric speech perception and apply this knowledge to family counseling and expectation setting.

Desired Result: Attendees will revise counseling practices to de-emphasize parental performance and prioritize modifiable pediatric factors (age at implantation, adherence).

Level of Evidence - Level III

Indicate IRB: 5076-18-SMC

Risk Factors for Return to Care in Pediatric Patients after Cochlear Implantation in a US Integrated Healthcare System

Mackenzie J. Thurston, BS, Kathryn E. Royse, PhD, Luke Schloegel, MD, Betty Tsai Do, MD, Liz Paxton, PhD, Lenhanh Tran, MD, Sarah Connell, MD

Objective: We assessed risk factors for return to care following primary cochlear implantation (CI) in pediatric cases

Study Design: Retrospective cohort study

Setting: Integrated U.S. healthcare system between 2010 and 2021.

Patients: Pediatric (age <18) cases undergoing cochlear implantation

Interventions: Primary cochlear implantation

Main Outcome Measures: Return to care after CI placement for any cause including (7-day), emergency department (90-day), and readmission (90-day).

Results: 431 pediatric patients underwent a primary CI placement. The median age of patients undergoing implantation was 2 (Interquartile range [IQR] (1-7). Return to care was 7-day=4.6%, 90-day ED=10.4%, 90-day RA=2.6%.
In multivariable models, same-day bilateral recipients had higher 7-day odds of return to care (OR=4.27, 95% CI=1.60-11.41, P=0.0038) as did non-White patients (OR=3.34, 95% CI=1.09-10.27, P=0.039) compared to unilateral and White pediatric patients, respectively. The primary reason for returning to care was febrile illness. Non-white patients had 1.6 times the odds of a postoperative 90-day ED visit (OR=1.63, 95% CI=0.86-3.11, P=0.134). No risk factors met the threshold for significance (P<0.05) for pediatric postoperative 90-day readmission.

Conclusions: In a large integrated healthcare system, the return to care rates were low in cochlear implant recipients and those patients who returned to care primarily sought reassurance. These visits may be averted by improved health literacy surrounding a typical post-operative course to avoid undue concern. Additionally, a family-centered approach including post-operative instructions in parent's native language, prescriptions for all medications including those available over the counter, and patient education regarding varying ways to receive care are potential areas for improvement.

Learning Objective: To recognize specific issues for pediatric patients undergoing cochlear implantation.

Desired Result: Utilize evidence-based protocols to maximize patient safety and minimize healthcare costs.

Level of Evidence - III

IRB: Kaiser Permanente Southern California, Predictors of Cochlear Implant Failures and Complications, IRB#13381

Quality of Intraoperative Cochlear Implant Imaging Using Virtual vs. Standard Anti-scatter Grid Protocols

Michael S. Castle, MD; Ryan J. Patrick, MD (presenter); George Ashji
Matthew Carter, MD; Benjamin T. Crane, MD, PhD

Objective: Determine whether the utilization of a virtual anti-scatter x-ray protocol provides equivocal or better image quality compared to a physical anti-scatter x-ray grid during intraoperative cochlear implant imaging.

Study Design: Retrospective cohort study.

Setting: Operating room at both tertiary hospital and ambulatory surgery centers.

Patients: Adults aged 18 or older who underwent cochlear implantation at a single institution by a single surgeon over a 3-year period.

Interventions: Virtual anti-scatter protocol utilization in lieu of standard anti-scatter x-ray grid protocol.

Main Outcome Measures: Intraoperative image quality; secondarily examined radiation dose.

Results: 173 cochlear implantation surgeries were reviewed, performed by a single surgeon at a single institution over a 3-year period. Intraoperative x-ray imaging was utilized to verify cochlear implant positioning in all surgeries. There were no statistically significant differences between the two groups regarding race, gender, or age. 85 patients underwent the virtual ("SmartGrid") x-ray imaging protocol, whereas 88 patients underwent the standard anti-scatter grid imaging protocol. There was no significant difference in contrast-to-noise ratio or subjective image quality between protocols. The SmartGrid protocol demonstrated a lower total radiation dose (75kV/6mAs vs. 76kV/63mAs) and superior spatial resolution (52.18 vs. 51.93; $p = 0.021$) compared to the standard anti-scatter protocol.

Conclusions: Utilization of a virtual anti-scatter protocol for intraoperative cochlear implant surgery imaging demonstrates equivocal image quality with superior spatial resolution and reduced radiation dosing as compared to a standard ant-scatter grid protocol.

Learning Objectives: Understand the different anti-scatter protocols for x-ray imaging; compare image quality between virtual and standard anti-scatter protocols.

Desired Result: Virtual anti-scatter grid protocol imaging demonstrates equivocal imaging quality with reduced radiation exposure as compared to standard anti-scatter protocols.

Level of Evidence: III

IRB: Exempt.

Temporoparietal Fascia Flap as a Free-Flap-Sparing Option for Moderate-Sized Ear or Lateral Temporal Bone Defects: A Case Series

Natalie Weiss, MD, MBA; Reginald Myles, BS; Phillip Pirgousis, MD; Joseph Breen, MD

Objective: To evaluate short-term outcomes of pedicled temporoparietal fascia flap (TPFF) reconstruction as an alternative to microvascular free flaps for moderate-sized ear or lateral temporal bone defects.

Study Design: Retrospective case series.

Setting: Tertiary academic referral center.

Patients: Three (3) adults undergoing lateral temporal bone or external auditory canal (EAC) resection for cutaneous malignancy, without parotidectomy or neck dissection.

Interventions: Pedicled TPFF rotated inferiorly to resurface the mastoid or EAC defects, with split-thickness skin graft as indicated; one case included concurrent bone-anchored hearing implant placement.

Main Outcome Measures: Time to epithelialization/mucosalization; wound and donor-site complications (infection, dehiscence, CSF leak); early facial nerve status; ability to accommodate adjunct procedures.

Results: All reconstructions survived without tip necrosis or vascular compromise. Epithelialization was documented at 14 days in one case and the remaining two demonstrated uneventful early healing on follow-up. There were no documented CSF leaks, infections, or dehiscence. Donor site morbidity was entirely absent. Facial nerve function was normal where documented. The TPFF accommodated a concurrent bone-anchored hearing implant without flap compromise. One patient with prior radiation and multiple operations healed without complication.

Conclusions: In moderate ear and lateral temporal bone defects, the pedicled TPFF offers reliable, thin, vascularized coverage with low morbidity, rapid epithelialization, and compatibility with adjunct procedures, and avoids the complexity and resource demands of microvascular free flaps. TPFF should be considered a first-line option for appropriately sized defects, including in previously-treated fields.

Learning Objective:

1. Recognize the indications and anatomical considerations for using the TPFF in reconstruction of moderate ear and lateral temporal bone defects.
2. Compare the advantages and limitations of TPFF reconstruction versus microvascular free flap in terms of operative complexity, morbidity, and healing outcomes.
3. Apply principles from this case series to select appropriate candidates and optimize reconstructive planning, particularly in previously radiated or surgically altered fields.

Desired Result:

1. Improve competence in selecting TPFF for moderate ear and temporal bone defects.
2. Enhance performance in reconstructive planning that preserves hearing and minimizes morbidity.
3. Promote awareness of TPFF as a resource-efficient alternative to free flaps in otologic oncology.

Level of Evidence - Level V (Case Series)

Indicate IRB or IACUC: Exempt

AMERICAN OTOLOGICAL SOCIETY RESEARCH FOUNDATION
RESEARCH GRANT AWARDS

The American Otological Society is committed to the non-promotional advancement of knowledge and science and to a free exchange of medical education in otology and neurotology. The American Otological Society, through its Research Foundation, is offering Research Grant Awards, an Award for a Clinical Trial, full-time Research Training Fellowships, a Clinician-Scientist Award (CSA) and new in 2026, a Multi Centered Clinical Cooperative Seed grant. All of the AOS grant awards may involve research on any topic related to ear disorders. The research need not be directly on an otological disease but may explore normal functions of the cochlea, labyrinth or central auditory or vestibular systems. However, the applicant must describe how the proposed research will benefit our understanding, diagnosis or treatment of otological disorders. **Research supported by all of the grant mechanisms can relate to any aspects of the ear, hearing and balance disorders. We welcome applications that address quality and safety of care as well as to improve education and training in otology.**

AOS grant mechanisms are open to post-doctoral candidates (MDs, PhDs) from institutions in the United States and Canada. Pre-doctoral candidates are ineligible. For the new Multi Centered Clinical Cooperative Seed grant, the P.I. must be an AOS member to apply.
Additional details may be found on the AOS website.

If you would like to submit a grant for consideration of funding in the next cycle, July 1, 2027-June 30, 2028, in ONE PDF, include a LETTER OF INTENT and PI BIOSKETCH (NIH template), including details regarding other existing support, and any potential overlap with your mentor(s) by November 1st of the year prior to funding. (November 2 in 2026). The letter of intent must state the desired grant mechanism for the proposal (CSA, Fellowship grant, Clinical Investigation, Research grant, or Multi Centered Clinical Cooperative Seed grant), the Principal Investigator, and Institution(s), a working title, with an abstract and Specific Aims (2 *page limit on abstract and aims)*. Biosketches and a cover letter should accompany the 2 page proposal summary (in addition to the abstract/aims), but it is not included as part of the two page summary. The next funding cycle begins July 1, 2027. *Biosketches of all personnel are optional, but will be required if invited to submit a full application.* The LOI must be submitted via email in a single Adobe PDF, save as with the mechanism and last name of PI.

Complete applications will be invited from selected applicants based on the Research Advisory Board's review of the letters of intent. Applicants will be notified whether they are invited to submit a full application in the first week of December. Completed applications must be received by January 31st.

IMPORTANT DATES FOR THE 2027-2028 FUNDING CYCLE

November 2, 2026 - Letter of Intent due
December 4, 2026 - Email notification for request of full application
January 31, 2027 - Full application due
June 1, 2027 - Notification of award

The Research Advisory Board (RAB) is comprised of seven AOS members, each serving a 7-year term and three consultants, each serving a 5-year term. These individuals are among the most highly respected researchers in our field. The expertise and dedication of the RAB are critical to the success of the mission of the AOS Research Foundation.

A HUGE thanks to the members of the 2025-26 AOS Research Advisory Board

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Richard K. Gurgel, Executive Secretary-Elect, Research Fund of the American Otological Society
Email: Richard.Gurgel@hsc.utah.edu

Kristen Bordignon, AOS Research Fund Administrator
Email: administrator@americanotologicalsociety.org

AMERICAN OTOLOGICAL SOCIETY

Understanding Cochlear Implant Sound Quality from Listeners with Single-Sided Deafness
AOS Clinical Investigations Grant
PI: Katie Berg, AuD, PhD
AOS Sponsors: Aaron Moberly, MD (Vanderbilt) & Craig Buchman, MD (WashU)

Background and Significance

Cochlear implants (CIs) provide dramatically different sound quality experiences across users, ranging from white noise to near-natural hearing (Dorman et al., 2025). This variability makes it challenging for clinicians to predict individual CI outcomes, and incredibly frustrating for patients. Prior CI research has focused primarily on speech recognition outcomes, but few studies have investigated sound quality—the perceptual experience of *how* patients hear rather than *what* they hear. However, sound quality impacts all aspects of daily listening beyond speech recognition, from enjoying music and environmental sounds to engaging in social interactions (McRackan et al., 2019). Our recent study highlighted this knowledge gap, showing that CI sound quality is a much stronger predictor of overall quality of life than speech recognition (Berg et al., 2025). *Thus, there is a critical need to identify factors that impact CI sound quality to improve outcome prediction and counseling, and develop targeted interventions for patients who experience poor sound quality.*

This study leverages the unique perspective of single-sided deafness (SSD) patients, who have normal hearing in one ear and a CI in the other, to quantify CI sound quality features. Using an interactive matching procedure, CI users guide researchers in adjusting acoustic signals in their normal hearing ear to match what they hear through their CI. Using this approach, this project aims to 1) define the signal processing features that characterize CI sound quality for different signal types (speech vs. music) and 2) determine the impact of electrode placement on CI sound quality. We hypothesize that these differences in CI sound quality will help explain the variability in sound quality experiences reported by patients.

Progress

- Six CI632 participants (anticipated N = 30) have participated, recruitment and data collection ongoing.
- Dr. Berg moved to WashU from Vanderbilt during the award period. Based on the available patient population characteristics at WashU, we modified our recruitment to only include Cochlear precurved array recipients (CI632, CI612) rather than comparing precurved and straight arrays as originally proposed. As a result, we shifted our focus to investigate within-array variability in electrode placement metrics, such as scalar location, average modiolar distance in mm, variability in modiolar distance, and angular insertion depth in degrees (Noble et al., 2012).
- Dr. Berg has successfully set up the post-operative CT imaging analysis pipeline at WashU, with the help of Dr. Noble (consultant), to obtain the electrode placement information for each participant. Dr. Noble continues to provide ongoing support for these analyses throughout the project.
- Dr. Dennison (consultant) visited WashU in November 2025 and successfully trained Dr. Berg to obtain the CI sound quality matches using the REAPER software and continues to provide ongoing support.
- The project team meets at least monthly (virtually) to discuss project progress.

Aim 1: Define the CI Sound Quality Features of Speech and Music Signals

Music encompasses a wider frequency and dynamic range than speech and requires more independent channels for accurate perception (Limb & Roy, 2014; Shannon, 2005). Therefore, we hypothesized that music would require relatively more filtering and compression compared to speech due to its broader acoustic characteristics. To test this hypothesis, participants completed a sound quality matching task in which they adjusted up to 21 audio processing plugins applied to signals presented to their normal-hearing ear until the processed signal perceptually matched their CI ear. Similarity was rated on a 1-10 scale, where 10 indicates a perfect match to CI sound quality (note that this metric reflects perceptual accuracy of the simulation, not subjective sound quality preference). Speech matches achieved consistently high similarity ratings (mean: 9.2, range: 8.5-10.0), whereas music matches were more variable (mean: 8.5, range: 6.0-10.0; **Figure 1**). Qualitatively, participants

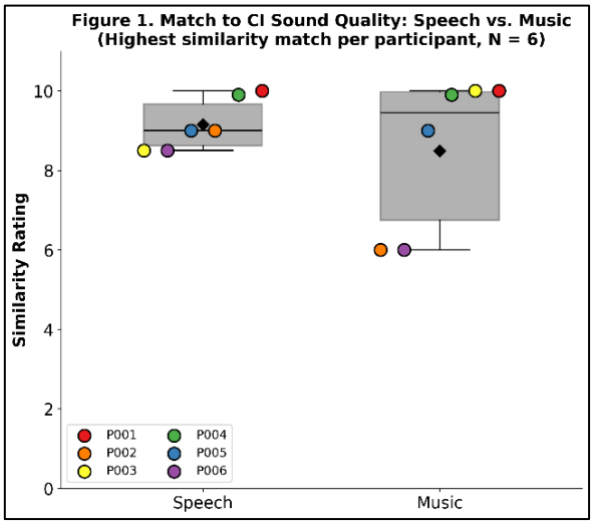
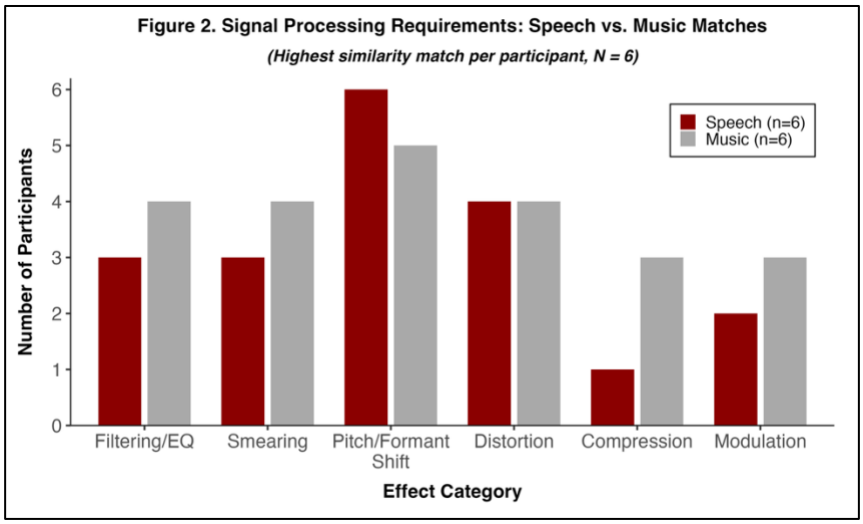


Figure 1. Match to CI Sound Quality: Speech vs. Music (Highest similarity match per participant, N = 6)

reported that music matching was difficult because uniform processing was applied to the entire signal; they indicated that vocals and instrumental accompaniment required different manipulations to accurately simulate their CI percept.

To characterize processing differences between signal types, the 21 plugins were grouped into six effect categories based on signal processing function (**Figure 2**). Pitch/formant shifting was the most commonly required category, followed by distortion. Filtering/EQ and smearing were used by half of participants for speech and slightly more for music. Consistent with our hypothesis, music matches required more compression and modulation compared to speech matches. These findings align with our expectation that music's wider dynamic range necessitates compression to simulate the limited dynamic range of electrical hearing, and music relies more heavily on temporal fine structure—rapid fluctuations conveying pitch and timbre—which is poorly transmitted through the CI (Limb & Roy, 2014). Based on these preliminary findings, future experiments will separate vocal and instrumental tracks to enable independent processing of each component. This methodological refinement is expected to improve music match similarity ratings and provide more granular insight into the differential processing requirements of complex auditory signals based on participant feedback.



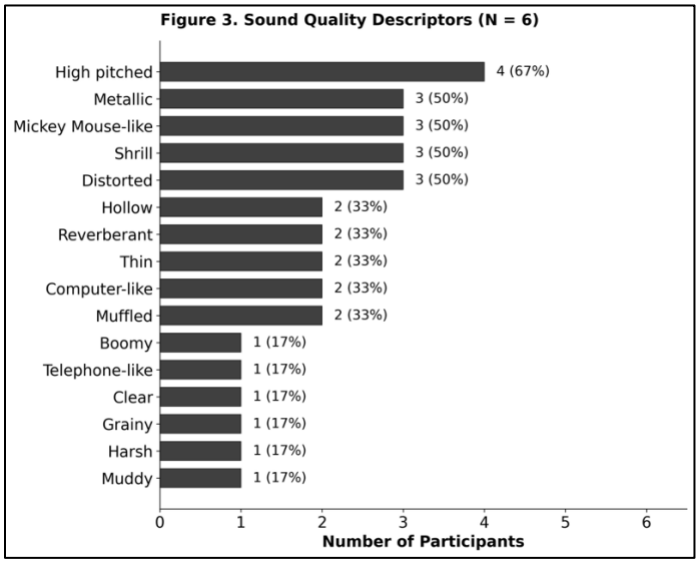
Aim 2: Determine the Impact of Electrode Placement on CI Sound Quality

For speech recognition, complete scala tympani placement and closer modiolar distance are known to predict better speech recognition scores in precurved arrays (Chakravorti et al., 2019). Therefore, we hypothesized that closer modiolar distance and complete scala tympani placement would be associated with less smearing and filtering due to less channel interaction (Berg et al., 2020). We also hypothesized that deeper insertions would be associated with less pitch upshifts (Dorman et al., 2019).

Table 1. Electrode Placement Characteristics

Participant	Average Modiolar Distance (mm)	Modiolar Distance Variability	Angular Insertion Depth (°)
P001	0.28	0.79	424
P002	0.50	0.60	442
P003	0.16	0.96	424
P004	0.62	0.51	417
P005	0.53	0.79	426
P006	0.28	0.71	425
Mean (SD)	**0.40 (0.16)**	**0.73 (0.14)**	**426 (7)**

Table 1 presents electrode placement characteristics for the current sample. All participants had complete scala tympani insertions. With limited variance in both electrode placement and plugin usage (most participants required most categories), the current sample size is insufficient to test these hypotheses.



Participants also provided subjective descriptors of their CI sound quality(Dorman et al., 2025) (**Figure 3**). The most commonly endorsed descriptor was "high pitched", followed by "metallic," "Mickey Mouse-like," "shrill," and "distorted". Free-text responses revealed additional common descriptions including "robotic", "static-y", and "tinny". Notably, the prevalence of pitch-related descriptors (high pitched, Mickey Mouse-like, shrill) aligns with our hypothesis regarding insertion depth and pitch perception, while spectral descriptors (metallic, thin, hollow) may relate to channel interaction effects from electrode positioning. Future analyses will examine whether specific descriptor patterns cluster with particular electrode placement profiles.

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American Otological Society Fellowship Grant – Progress Report

Progress Report Period: 07/01/2025 - 01/31/2026
Principal Investigator: Andrea DeFreese, AuD
Mentor: Taha Jan, MD
Project Title: Unlocking the Genetic Basis of Cochlear Implant Success: A Focus on Biomarkers of the Central Auditory Pathway

Background

Cochlear implants (CIs) are the standard of care for patients with moderate to profound hearing loss, providing an opportunity to restore functional hearing. Although over one million individuals have received CIs worldwide, approximately 80% of the variance in post-operative speech recognition outcomes remains unexplained. Prior clinical research has largely focused on peripheral auditory system factors, such as audiometric profiles and cochlear anatomy, while overlooking the central auditory pathway. Because CIs transmit signals from the spiral ganglion cells to central auditory structures, both peripheral and central pathways likely contribute to outcome variability. Converging evidence from animal models and human neuroimaging supports this dual influence, demonstrating that the structural integrity of central auditory structures and their capacity for adaptive reorganization strongly affect CI outcomes. Despite this evidence, tools to assess these central mechanisms remain largely inaccessible in routine clinical practice.

Genetic testing offers a clinically viable approach to capture individual differences in central auditory system integrity and neuroplasticity. Several genes implicated in cochlear pathology but associated with poorer CI outcomes are also expressed in central auditory structures, suggesting that genetic variation may influence CI outcomes through central mechanisms. In parallel, genes regulating neuroplasticity and synaptic remodeling have been shown to affect recovery in other rehabilitation contexts and may similarly influence adaptation to CI input. This study leverages genetics to identify biomarkers of central auditory structures (Aim 1) and their neuroplasticity (Aim 2) associated with CI-aided speech recognition. Together, these aims address a critical gap by establishing a translatable framework for predicting CI outcomes and advancing precision medicine in hearing health.

Aim 1: Determine the impact of genetic variation affecting central auditory system structures on post-operative speech recognition for adult CI users.

Hypothesis: Pathogenic variants expressed in central auditory structures integral to CI signal processing will be associated with poorer CI-aided speech recognition, whereas variants in genes expressed only in peripheral auditory structures will be associated with better CI-aided speech recognition.

Progress: We identified 330 adult CI users with available whole-genome sequencing (WGS) data in Vanderbilt's BioVU biorepository. The demographic distribution of this cohort reflects that of our clinical CI population (53% male; Figure 1). Complete WGS data were released in January 2026, representing a critical milestone that enables the next phase of analyses (see *Next Steps*).

In parallel, we have initiated extraction of CI-aided speech recognition outcomes and key covariates—including age, hearing configuration, duration of hearing loss, daily device use, and comorbidities—from our de-identified clinical database. These data are being compiled longitudinally across multiple timepoints, from pre-operative evaluation through annual post-activation follow-up, and will support analyses in Aims 1 and 2.

Concurrently, we are identifying candidate genes in central auditory structures using differential gene expression analyses. While gene expression in peripheral auditory structures is well characterized, expression patterns within the human auditory cortex remain understudied. To address this gap, we are conducting transcriptomic analyses using single-cell RNA-sequencing data from human neocortex samples provided by the Allen Human Brain Atlas. Specifically, we are identifying genes differentially expressed in primary auditory cortex relative to other primary sensory cortical regions. This approach will

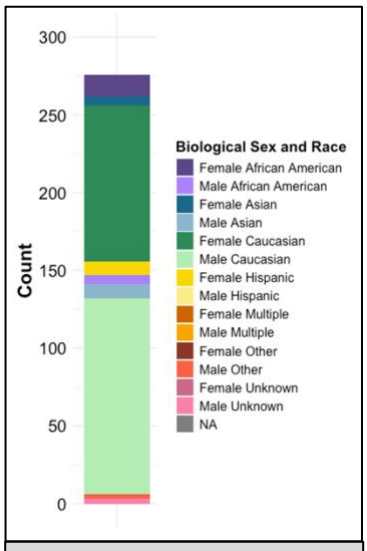

Figure 1. Demographic distribution of 330 adult CI users with WGS data in BioVU.

generate a biologically informed candidate gene set for central auditory structures, which will be used in downstream gene-set analyses (see *Next Steps*).

Aim 2: Determine the impact of genetic variation affecting neuroplasticity on post-operative speech recognition for adult CI users.

Hypothesis: Variants in genes integral to neurotrophic function broadly expressed throughout the peripheral *and* central auditory system (*BDNF, APOE*) will be associated with poorer CI-aided speech recognition.

Progress: In addition to ongoing extraction of CI-aided speech recognition outcomes and covariates (see *Aim 1 Progress*), we have begun development of the variant identification pipeline that will be used across both aims. To support this work, I completed Terra-based cloud computing training through Vanderbilt University Medical Center's Center for Quantitative Sciences, enabling independent development and execution of a WGS variant identification workflow. Using the 2025 release of Vanderbilt's BioVU biorepository, we accessed available WGS data from 13 of the 330 adult CI users (4%) to conduct pilot analyses. As a proof-of-concept, we examined variation in the *BDNF* gene and identified three individuals carrying pathogenic variants (**Figure 2**). Compared to CI users without *BDNF* variants, these individuals demonstrated lower mean CI-aided CNC word recognition scores (47% vs. 68%), although this difference did not reach statistical significance ($p > 0.05$) which is to be expected with the limited sample size.

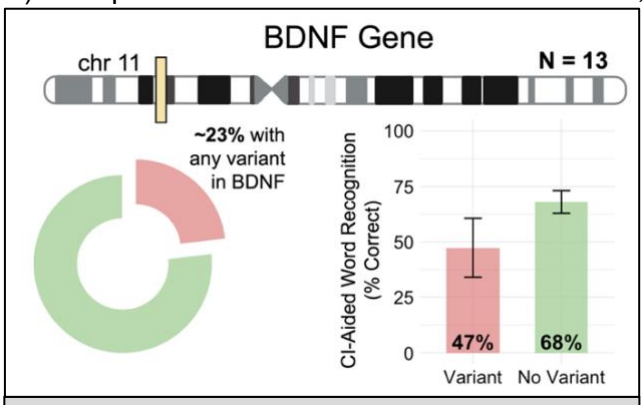

Figure 2. Distribution of variants in BDNF gene in pilot sample of 13 CI users.

Importantly, these pilot analyses demonstrate feasibility of the proposed approach by confirming that (1) WGS data are accessible within BioVU, (2) the variant identification pipeline is functional, and (3) preliminary trends are consistent with the Aim 2 hypothesis that genetic variation in plasticity-related genes, such as *BDNF*, may be associated with poorer CI-aided speech recognition outcomes. Together, these results support expansion of variant analyses to the full cohort of 330 adult CI users and to the complete set of candidate genes expressed in auditory and plasticity-related neural structures identified in Aim 1.

Next Steps

In the next phase of the fellowship award period, we will perform comprehensive variant annotation in our cohort of CI users, conducting parallel analyses for candidate genes differentially expressed in peripheral and central auditory tissues (Aim 1) and genes implicated in neuroplasticity (Aim 2). Using these distinct candidate gene sets, we will develop and execute workflows to systematically identify, filter, and annotate all variants within each gene set. Functional annotation will be performed using ANNOVAR to prioritize variants with potential functional impact on auditory system structures. Predicted deleteriousness will be evaluated using in silico pathogenicity metrics, including Combined Annotation-Dependent Depletion (CADD). Analyses will be stratified by allele frequency to evaluate rare and common variants separately. Together, these steps will establish a reproducible and scalable pipeline for identifying high-priority genetic variants for downstream association with CI outcomes.

To evaluate the hypotheses for each aim, we will conduct separate analysis of covariance (ANCOVA) models for Aim 1 and Aim 2, with CI-aided word recognition as the outcome and adjustment for relevant clinical covariates. For Aim 1, ANCOVA will test whether variants in genes expressed in central auditory structures versus peripheral-only auditory structures are differentially associated with CI performance. For Aim 2, a separate ANCOVA will assess whether variants in neuroplasticity-related genes are associated with CI-aided word recognition scores. This gene-set–based approach reduces multiple testing burden while preserving biological interpretability and statistical power.

The infrastructure developed and preliminary data generated through this fellowship have established a strong foundation for my future research program. I am deeply grateful to the American Otological Society for their support, which has enabled the development of this innovative and translatable analysis pipeline. This work will advance understanding of how genetic variation within central auditory and plasticity-related pathways influences CI outcomes and will contribute to broader precision medicine efforts in audiology by informing genetic biomarkers for outcome prediction and clinical decision-making.

American Otological Society Clinician Scientist Award – Progress Report – Funding Start: 7/1/25

AI-Driven Identification of Suspected Hearing Loss from Clinical Encounter Conversations: A Novel, Automated, and Scalable Screening Tool

PI/PD: Peter R. Dixon, MD MSc Mentors: Robert F. Labadie MD, PhD; Leslie A. Lenert MD, MS

Overview. This project aims to establish the feasibility of identifying adults with suspected hearing loss using speech and conversational features derived from recorded clinical encounters. During the current reporting period, we have made substantial progress across both Specific Aims. We have initiated participant recruitment and data collection for Aim 1, developed and validated analytic pipelines for acoustic-phonetic speech features, established and tested automated methods for detecting conversational features of hearing loss relevant to Aim 2, and built the technical infrastructure required to access and integrate clinical encounter data. Together, these activities demonstrate strong feasibility, early momentum, and readiness to advance to the next phases of data collection and modeling.

Progress Toward Specific Aim 1: Measure speech features of hearing loss in simulated clinical encounters.

Prospective Data Collection. To date, 26 participants have been recruited, and 11 participants have completed full data collection. Recruitment is now operating at steady state, with two full-time research fellows hired, trained, and dedicated to recruitment coordination and data collection, providing sustained capacity for enrollment. Based on current recruitment volume and scheduled visits, we anticipate meeting the recruitment target of 40 participants within the planned timeline.

For each completed participant, we collected a comprehensive speech corpus spanning four tasks designed to capture both naturalistic and structured speech: (1) Candid conversation (~5 minutes), (2) Diapix picture description (~7 minutes), (3) Mock medical interview (~8 minutes), (4) Rainbow Passage (~2 minutes). This multi-task protocol directly reflects the proposed study design and ensures coverage of conversational speech, semi-structured discourse, and standardized phonetic material. Towards Aim 1b, which aims to determine the effect of smartphone microphone characteristics and placement on voice characteristics and their predictive value, these recordings were made simultaneously on high-fidelity recording equipment (Rode NT1 microphone via MOTU M2 interface at 48 kHz/32-bit WAV) and with two Apple iPhones positioned to mimic clinic conditions with files compressed to match DAX Copilot specifications. Data collection has proceeded smoothly, with recordings passing all quality control checks.

In parallel, we collected a comprehensive set of participant-level measures, including demographics, speech and voice history, audiometric testing, the Revised Hearing Handicap Inventory, the Abbreviated Profile of Hearing Aid Benefit, and the Montreal Cognitive Assessment. The successful acquisition of these measures confirms the feasibility of enrolling participants with complete phenotyping and supports planned analyses that account for hearing status and relevant confounders.

Analytic Pipeline Development. We have conducted extensive analytic pipeline development for acoustic-phonetic feature analysis, directly supporting Aim 1. Using the publicly available Bridge2AI Voice dataset, we developed and validated reproducible workflows for acoustic feature preprocessing, quality control, dimensionality reduction, feature family organization, and predictive modeling. We specified, trained, and tested several dimensional reduction and modeling frameworks and obtained reasonable predictive performance (Figure 1). This work demonstrated that structured acoustic-phonetic feature families, particularly vowel space, fundamental frequency variability, glottal source measures, and speech timing, contain robust signal for detecting hearing

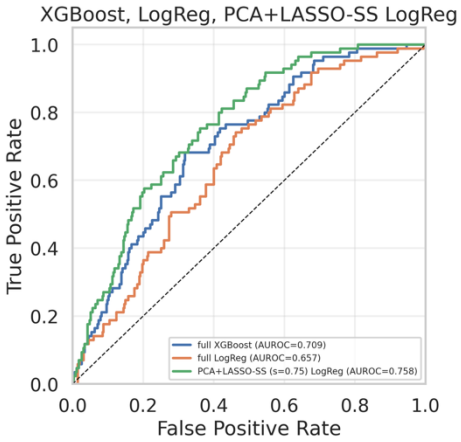

Figure 1. ROC curves for three representative models: XGBoost with full features and no feature logistic regression with full features and no feature selection, and logistic regression with PCA and LASSO stability selection.

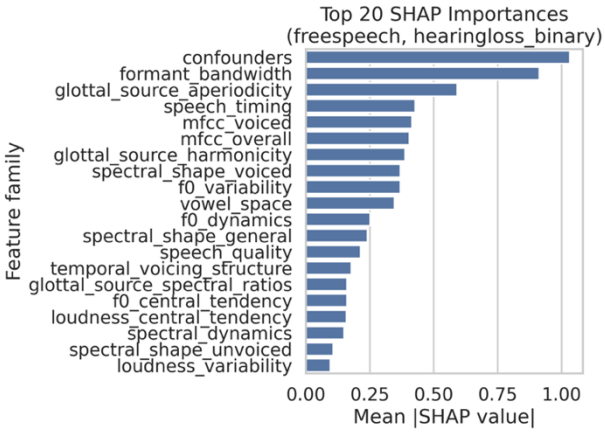

Figure 2. Relative importance of acoustic feature families in the XGBoost model for hearing loss detection in the Bridge2AI Voice dataset. Bars show normalized SHAP importance aggregated at the feature-family level, highlighting biologically motivated speech domains that contribute predictive signal.

loss from short free-speech recordings. Feature-family importance analyses showed that these domains consistently contributed to model predictions, supporting their biological relevance and motivating their application to the prospectively collected conversational speech data (Figure 2). The resulting manuscript documents these methods and provides feasibility evidence that the analytic approach can detect hearing loss–associated speech features under controlled but heterogeneous conditions. This work substantially de-risks Aim 1 by establishing validated pipelines that will be directly applied to the prospectively collected conversational speech data.

Progress Toward Specific Aim 2: Develop and validate an AI-based model for identifying adults with suspected hearing loss from clinical encounter transcripts

Conversational feature detection using large language models (LLMs). To test whether conversational features of hearing loss can be detected automatically, we developed and evaluated an LLM-based analytic pipeline aligned with Aim 2. We first created a synthetic corpus of 2,000 clinical encounter transcripts. Using this corpus, an open-weight large language model (Llama-3.3 70B) was prompted with contextual instructions, definitions, and examples of hearing loss-related conversational features (e.g., clarification requests, repetitions, delayed or unexpected responses). The model was instructed to insert one or more such features into transcripts and to return labeled text spans.

We then evaluated the same model's ability to detect these features in previously unseen transcripts. In preliminary testing, the model demonstrated high recall (mean 0.81) and accurate localization, with 66% exact span matches between predicted and reference annotations. These results demonstrate the technical feasibility of using LLMs for automated identification of conversational features relevant to hearing loss.

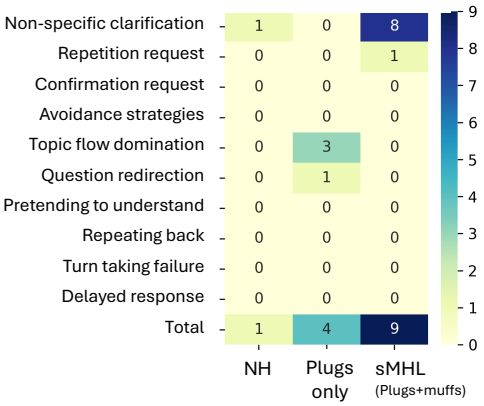

Figure 3. Frequency of LLM-identified patterns

We subsequently applied this detector to the simulated moderate hearing loss (sMHL) conversational corpus collected during preliminary studies. We had previously made pilot recordings of mock job interviews with five young adults (aged 21-26 years) with normal hearing (NH) and with simulated moderate hearing loss (sMHL) using earplugs and earmuffs in both ears (mean better ear pure tone average 0.5, 1, 2, 4 kHz [PTA] = 42 dB HL). The LLM most reliably detected clarification-related behaviors, and their frequency increased with the severity of simulated hearing loss (Figure 3). In particular, nonspecific clarification requests were markedly elevated in sMHL compared with normal hearing conditions (8 vs. 1 instances). These findings support the construct validity of clarification requests as a conversational marker of hearing loss and demonstrate that such features can be detected automatically in conversational speech using LLMs, consistent with the hypotheses underlying Aim 2.

Clinical data infrastructure and integration. In parallel, we have established the technical infrastructure required to support Aim 2 using real-world clinical data. A secure Microsoft Fabric-based data environment has been created, including a dedicated data lake with access to DAX Copilot-generated artifacts from outpatient encounters (audio recordings, transcripts, and encounter metadata). Current efforts are focused on integrating electronic health record data from Epic and audiogram results directly piped from audiometers into this environment. These steps are essential for constructing audiometrically validated cohorts and for linking conversational data to hearing outcomes as proposed. Progress to date confirms the feasibility of accessing, harmonizing, and governing these data sources at scale.

Summary and Next Steps

Overall, the project is progressing as planned and in alignment with the original aims. Recruitment and data collection for Aim 1 are underway, with successful completion of full speech and phenotyping protocols in early participants. Robust analytic pipelines for acoustic-phonetic speech features have been developed and validated, directly supporting Aim 1. For Aim 2, automated conversational feature detection using large language models has been demonstrated as technically feasible and construct-valid, and the clinical data infrastructure required for large-scale application has been established.

Next steps include completing recruitment and data collection for Aim 1, applying established acoustic pipelines to the prospectively collected conversational speech data, finalizing EHR and audiogram integration, and initiating large-scale conversational feature extraction and predictive modeling using DAX Copilot transcripts. These activities will directly advance the project toward its goal of developing scalable, AI-driven approaches for identifying adults with suspected hearing loss in real-world clinical settings.

American Otological Society Fellowship Grant – Progress Report
Progress Report Period: 07/01/2025 – 02/01/2026
Principal Investigator: Christopher Cunningham
Project Title: The critical role of Hspa5/BiP in protecting hair cells from cellular stress-induced cell death

Background:

Acquired hearing loss is a major clinical, social, and economic issue affecting millions around the world[1–3]. Hearing loss is largely irreversible, and no effective prevention mechanisms or biological therapies exist[1,4,5]. Hair cells are the sound receptor cells in the cochlea and are susceptible to multiple insults, such as loud noises, antibiotics, and infections[6–10]. These insults can generate intracellular reactive oxygen species (ROS) and other forms of cellular stress that leads to irreversible hair cell death[5,11,12]. Recently, it has been shown that ROS affects proteins and lipids, inducing endoplasmic reticulum (ER) stress and activation of the unfolded protein response (UPR)[13–17]. This response is linked to multiple acquired forms of hearing loss[13,15–18]. However, the molecular mechanisms of cellular-stress induced hair cell death are unknown. In this work, we are interested in analyzing the role of BiP (encoded by the gene Hspa5) in the cochlea. In other tissues, BiP acts as a negative regulator of ER stress. BiP prevents ER stress activation by regulating unfolded protein response (UPR) pathways[19–21]. There are three different signaling pathways gated by three receptors (IRE1, ATF6, and PERK) located in the membrane of the ER[20,22–24]. During initial periods of activation, UPR aims to mitigate ER stress and promote cell survival, but prolonged exposure to ROS and unfolded proteins leads to programmed cell death mediated by proteins including Ddit3/CHOP[25–30]. Our preliminary data show that BiP is upregulated in the cochlea in response to pathological noise exposure (NE) or inner ear administration of Tunicamycin (Tun), both of which cause profound hearing loss. To analyze the role of BiP in the cochlea, we generated conditional knockout mice (Math1-Cre; Hspa5F/F; referred to as Math1-CRE;BiP-cKO mice) in which BiP is knocked out in hair cells and support cells. Our preliminary Auditory Brainstem Response (ABR) assessment demonstrate that Math1;BiP-cKO mice are profoundly deaf across all tested frequencies caused by widespread hair cell death beginning in the first postnatal week. Investigating the molecular role of BiP in development and associated with stress associated with hearing loss insults may contribute to a better understanding of molecular and cellular mechanisms of cellular stress regulation in the cochlea and inform strategies for therapeutically addressing acquired hearing loss.

Aim 1: Investigate the mechanism by which BiP protects hair cells from cellular stress-induced death during hair cell maturation. Our previous experiments suggested that conditional knockout of BiP in the cochlea using Math1-CRE;BiP-cKO mice results in widespread hair cell death starting after postnatal day 3 (P3), during a period when BiP is upregulated during normal cochlear development. We hypothesize that BiP plays a critical role during this developmental window, and genetic loss of BiP leads to unchecked cellular stress, hair cell death and profound hearing loss in adulthood. For this aim we are investigating the pathophysiological mechanisms by which hair cells die in the absence of BiP.

Progress: In our preliminary data for the fellowship application, we showed that BiP protein is highly expressed during early cochlear hair cell development. To investigate the temporal dynamics of BiP expression, we measured cochlear BiP mRNA levels across ages in wild-type mice. We found that the BiP mRNA expression decreases with age (Figure 1A). This suggested that BiP could play a major role during a specific period of cochlear development. To further investigate the mechanism by which loss of BiP leads to hair cell death and hearing loss, we analyzed mRNA expression of UPR-linked genes in the cochlea of Math1-CRE;BiP-cKO mice. We observed that the absence of BiP leads to upregulation of UPR genes at postnatal days P2 and P7 (Figure 1B and C). Our data suggest that BiP prevents activation of the UPR response and negatively regulates ER Stress during normal cochlear development, in addition to its role under stress conditions. We are currently performing RNAscope fluorescent in situ hybridization in wild-type and mutant mice and determine cell-type specific changes expression of UPR-linked genes.

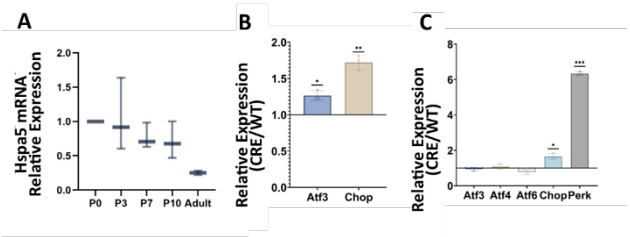

Figure 1. BiP is expressed during cochlear development and loss of BiP leads to upregulated UPR-linked gene expression. (A) qPCR of relative Hspa5 mRNA expression in prehearing P0, P3, P7, P10 and adult cochleae (P21). Data relative to P0 from the homogenized whole cochlea in wild-type mice. (B and C) qPCR of relative ER stress genes in Math1-CRE;BiP-cKOprehearing P2 and P7 mice. Data relative to control littermates. n=3. Error bars represent SD.

Math1-CRE is active in both hair cells and support cells (Figure 2B). To investigate the pathophysiological mechanisms by which BiP regulates cochlear ER stress specifically in hair cells, we generated a new conditional knockout mice line with Gfi1-Cre crossed to Hspa5F/F mice (referred to as Gfi1-CRE;BiP-cKO) specific for hair cells (Figure 2A,B). In Gfi1-CRE;BiP cKO mice, the absence of BiP in hair cells causes severe hearing loss at week 4 age across frequencies (Figure 2C). We analyzed the survival of hair cells in Math1-Cre; BiPcKO and Gfi1-CRE; BiP cKO mice. Preliminary results showed more rapid cell death in Gfi1-CRE;BiP-cKO than in Math1-CRE;BiP-cKO mice (Figure 2D). We are interested in analyzing the molecular mechanism of BiP-associated cell death in hair cells. According to reports in other tissues, upregulated CHOP (Ddit3) expression (Fig. 1B,C) leads to programmed cell death[25–27], suggesting that apoptosis may be the cause of premature death in the BiP-cKO mice. We evaluated levels of cleaved caspase-3 (CC3)+ cells, a key marker for apoptosis. Our preliminary results suggested that there are no differences in CC3+ cells in the organ of Corti of Math1;BiP-cKO or Gfi1;BiP-cKO vs wildtype in (Figure 3A). We also examined the nuclear morphology of hair cells. There were no major differences in Math1-CRE; BiP-cKO mice, but we did observe some abnormal nuclei in Gfi1-CRE; BiP cKO mice. (Figure 3C). To further evaluate apoptosis as a mechanism of cell death in BiP mutants, we plan to use TUNEL. We are also working on delivering an apoptosis inhibitor Z-VAD-FMK (MCE; HY-16658B), to test whether we can rescue cell death in the mutants. Our data suggest that BiP is a survival regulator of hair cells during development. Future plans also include collecting cochlear from P3 and P7 mutant mice for scRNA sequencing analysis.

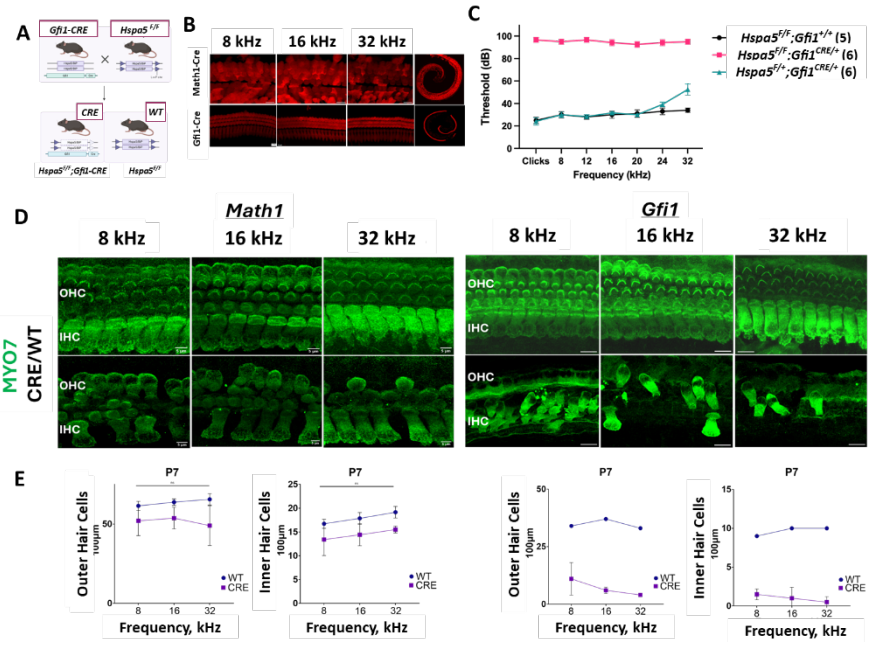

Figure 2. Hair-cell-specific KO of BiP leads to severe cell death and hearing loss. (A) We crossed BiP-cKO mice (Hspa5 F/F) with hair-cell-specific Gfi1-CRE mice. (B) A comparison of CRE (tdTomato) activity in Math1-CRE; Ai14 and Gfi1-CRE;Ai14 mice labeled in red at P1 and P8 (corresponding) in three different regions (8, 16, 32 kHz) of the Organ of Corti. Math1-CRE is expressed in hair cells and support cells. Gfi1-CRE is expressed mostly in hair cells. (C) ABR thresholds (dB) from adult homozygous Gfi1CRE-Hspa5F/F mice,, heterozygous (Gfi1-CRE; Hspa5F/+ mice), and litter-matched control (Hspa5F/F) adult mice at 4 weeks across multiple frequencies (kHz). BiP-cKO homozygous knockout mice have significantly elevated ABR thresholds, indicating profound deafness. (n~6, p<0.000001). Error bars represent SEM. (D) Immunostaining of cochlear whole mounts of P7 from Math1-Cre;BiPcKO and Gfi1-CRE;BiPcKO mice with MYO7A (green) to label hair cells. (E) Cell quantification of inner hair cells and outer hair cells from Math1-Cre;BiPCKO and Gfi1-CRE;BiPcKO mice . Scale bar = 10 µm.

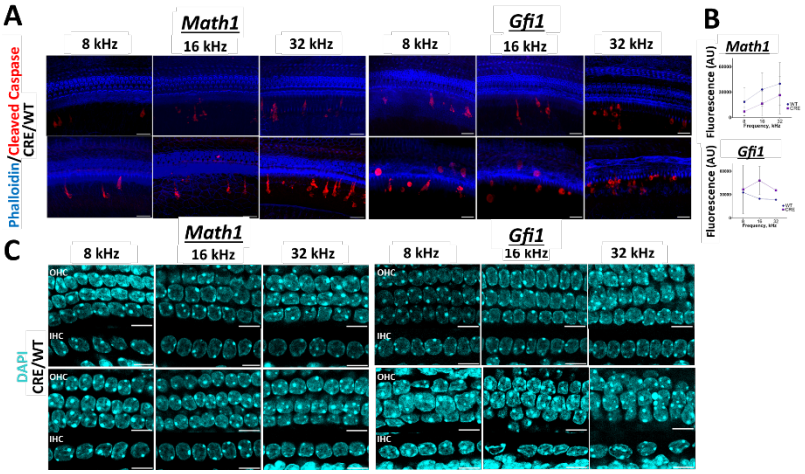

Figure 3. No evidence for apoptosis in BipCKO mice (A) Immunostaining of cochlear WM of P7 Math1-Cre;BiPcKO and Gfi1-CRE;BiPcKO mice with Cleaved Caspase 3 (red) to label apoptotic cells and Phalloidin-labeled stereocilia (blue). (B) Preliminary fluorescence quantification of Cleaved Caspase 3+ cells in Math1 and Gfi1 BiP-cKO mice at P7 in different tonotopic areas of the Organ of Corti (8,16 and 32 kHz). (C) DAPI staining to assess nuclear morphology (cyan) in Math1 and Gfi1 BiP-cKO mice at P5 in different tonotopic areas from the Organ of Corti (8,16 and 32 kHz).

Aim 2: Manipulation of BiP expression to protect against hearing loss resulting from loud noise.

In this Aim, we will deliver AAV vectors expressing BiP via the posterior semicircular canal (PSCC). We designed and generated an AAV (serotype PhP.eB) expressing BiP from a hair-cell-specific promoter to the inner ear to evaluate BiP rescue in Math1-CRE;BiP-cKO and Gfi1-CRE;BiP-cKO mice. We will perform PSCC injections of AAVs in prehearing

P1 mice to evaluate BiP expression and rescue of hair cell death. Upon confirmation of suitable AAV expression we will test whether AAV-mediated BiP expression can mitigate noise-induced hearing loss.

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Project Title
Perilymph Exosomes as Biomarkers for Inner Ear Diseases
Dates of Proposed Research
7/1/25-6/30/26
Principal Investigator
Adele Moatti
University of Pittsburgh

Progress Report

Aim 1: To identify the animal model with similar protein and miRNA expression to human perilymph. Porcine perilymph closely resembles human perilymph in protein and miRNA composition, making the pig a clinically relevant preclinical model.

Progress:
To test this hypothesis, we initiated systematic collection and molecular profiling of porcine perilymph. Perilymph samples were collected from eight pigs for bulk proteomic feasibility testing. In parallel, human perilymph samples from ten cochlear implant patients have already been collected and archived for comparative analysis. We prepared five perilymph samples for proteomics. However, initial mass spectrometry–based proteomics was compromised by blood contamination in perilymph samples. Nevertheless, these experiments provided critical insight into handling constraints and informed revised protocols.

To improve sensitivity and compatibility with ultra-low-volume samples, we are transitioning to Olink-based proteomic profiling, which is better suited for comparative cross-species analysis. Fresh porcine perilymph samples are currently being prepared for this next phase, including samples from both healthy and noise-exposed pigs.

Significance:
Establishing the pig as a molecularly relevant model for human perilymph is essential for translational biomarker discovery. These efforts lay the groundwork for direct protein and miRNA comparisons between species and support the use of porcine models for clinically meaningful inner ear studies.

Aim 2: To identify the baseline for perilymph exosome characteristics. Perilymph contains exosomes that reflect the molecular state of their parent inner ear cells.

Progress:
We evaluated three methods for EV isolation from pig perilymph: ultracentrifugation (UC), a commercial isolation kit (Kit), and a combined UC & kit approach. EVs were characterized by size distribution, Western blotting (Wb), and protein concentration as shown in **Fig 1A-I**.

Kit-only isolation resulted in substantial nonspecific protein contamination as it is evident in Wb, while UC reduced but did not eliminate off-target bands. The combined UC & kit method produced the cleanest EV profiles and was selected as the optimized protocol.

To model clinically relevant conditions, we further tested EV isolation from 10 µL versus 5 µL perilymph using UC & kit method as shown in **Fig 1J-L**. Wb analyses showed comparable EV marker profiles across volumes, demonstrating feasibility at human-relevant input volumes.

Comparing EV concentration across methods, shown in **Fig1M**, Kit method provides significantly higher EV content than UC and Kit & UC methods. Similarly, protein content was significantly higher in Kit method compared to the other two methods. However, as stated earlier, the Wb data for Kit method confirmed presence of nonspecific bands. Comparing 5 µL versus 10 µL, the EV yield did not reduce significantly. The protein content was slightly lower, but this difference was not significant.

Significance:
This aim establishes a robust and reproducible framework for EV isolation from extremely limited perilymph volumes. Defining baseline EV characteristics in healthy porcine perilymph is a prerequisite for meaningful comparison with human samples and downstream biomarker discovery.

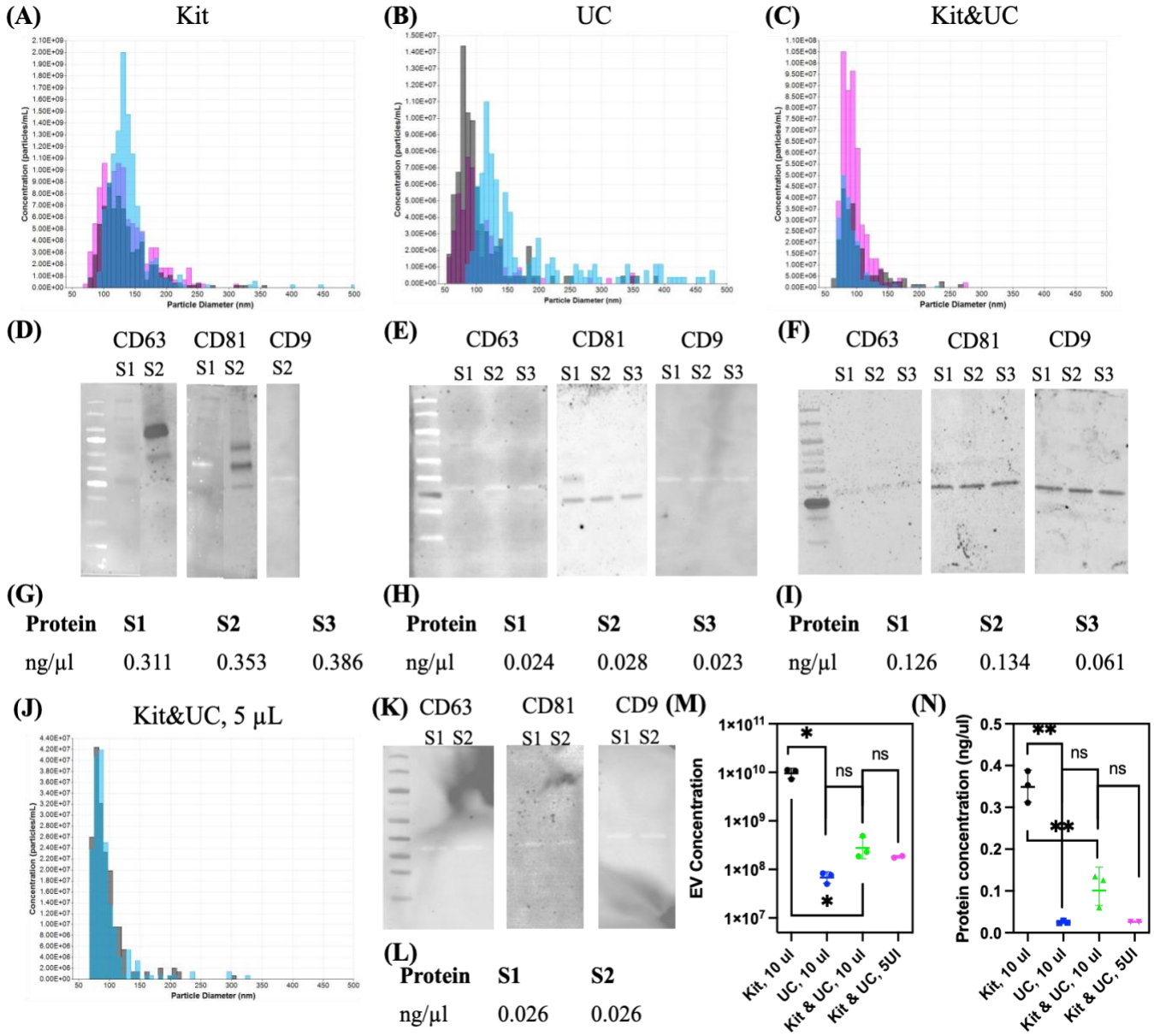

Fig 1. **EV isolation method was confirmed for low volume perilymph with high purity**. (A) EV size and concentration isolated from 10 µL of pig perilymph via Kit method from 3 pigs. (B) EV size and concentration isolated from 10 µL of pig perilymph via UC method from 3 pigs. (C) EV size and concentration isolated from 10 µL of pig perilymph via Kit & UC method from 3 pigs. (D) Wb analysis for exosomal surface markers, CD63, CD81, and CD9 for EVs isolated from 10 µL of pig perilymph via Kit method from 2 pigs. (E) Wb analysis for exosomal surface markers, CD63, CD81, and CD9 for EVs isolated from 10 µL of pig perilymph via UC method from 3 pigs. (F) Wb analysis for exosomal surface markers, CD63, CD81, and CD9 for EVs isolated from 10 µL of pig perilymph via Kit & UC method from 3 pigs. (G) Protein concentration of EVs isolated from 10 µL of pig perilymph via Kit method. (H) Protein concentration of EVs isolated from 10 µL of pig perilymph via UC method. (I) Protein concentration of EVs isolated from 10 µL of pig perilymph via Kit & UC method. (J) EV size and concentration isolated from 5 µL of pig perilymph via Kit & UC method from 2 pigs. (K) Wb analysis for exosomal surface markers, CD63, CD81, and CD9 for EVs isolated from 5 µL of pig perilymph via Kit & UC method from 2 pigs. (L) Protein concentration of EVs isolated from 5 µL of pig perilymph via Kit & UC method from 2 pigs. (M) Comparison of the EV concentration across methods shows significantly higher EV concentration isolated via Kit versus UC and Kit & UC methods (p-value: 0.0164 and 0.0168, respectively). The EVs isolated from 10 vs 5 µL of pig perilymph via Kit & UC did not show significantly different concentration. (N) Comparison of the EV protein content across methods shows significantly higher protein in samples isolated via Kit versus UC and Kit & UC methods (p-value: 0.0043 and 0.0016, respectively). The EVs isolated from 10 vs 5 µL of pig perilymph via Kit & UC did not show significantly different protein content. ***Method***. The pig perilymph (10-20 µL) was collected via capillary tube and stored in -80 C for future analysis. EVs were isolated via 3 methods of Kit (SmartSEC Mini EV), UC, and Kit & UC. EV concentration was measured via high-resolution nanoparticle characterization instrument from Izon Science (EXOID) that utilizes Tunable Resistive Pulse Sensing (TRPS). Protein content was measured via Quant IT protein assay kit. Statistical analysis was performed using Welch's t-test.

Aim 3: To identify biomarkers for different inner ear pathologic conditions. Exosomes released by inner ear cells carry molecular signatures that reflect pathological states and can be accessed through perilymph biopsy.

Progress:

We initiated comparative studies using perilymph collected from healthy pigs and pigs exposed to noise-induced injury. EVs and matched perilymph samples were prepared for proteomic analysis. Initial mass spectrometry experiments revealed keratin contamination in EV samples, likely introduced during handling, limiting interpretability. These findings prompted protocol refinements, including stricter contamination control and a shift to higher-sensitivity proteomic platforms like Olink.

With optimized EV isolation methods now established and expanded sample cohorts in hand (healthy pigs, noise-exposed pigs, and human samples), we are positioned to perform targeted, high-confidence proteomic profiling using Olink technology in the coming months.

Significance:

Identifying EV-associated biomarkers that distinguish healthy from injured inner ear states will enable molecular stratification of hearing loss. This work supports the long-term goal of developing minimally invasive diagnostic tools and guiding more precise therapeutic interventions.

Overall Impact and Future Directions

Upon completion of these aims, we expect to:
(i) establish the porcine perilymph model as a translational platform for human hearing loss biomarker discovery;
(ii) define baseline exosome characteristics in healthy perilymph; and
(iii) identify exosome signatures associated with pathological inner ear conditions.

These outcomes will provide the hearing research community with validated tools and methodologies to investigate disease mechanisms and therapeutic response. In future R01-funded work, we will extend these findings toward developing less invasive approaches for detecting inner ear–derived exosomes from peripheral biofluids such as plasma.

American Otological Society Clinical Investigations Grant
Funding Period: 07/01/25-06/30/26
PI/PD: Daniel Romano, MD
Mentors: Keiko Hirose, MD and Sid Puram, MD PhD
Title: Single-Cell RNA Sequencing Analysis of Cholesteatoma Pathogenesis

OVERVIEW:

A cholesteatoma is an otologic disease defined by the abnormal presence of keratinizing stratified squamous epithelium in the middle ear and/or mastoid bone, with complications ranging from hearing loss to facial nerve injury, and even potentially life-threatening intracranial extension and infection. Surgical removal is the exclusive available treatment for cholesteatomas, with published 5-year recurrence rates of 21-38% [1,2]. Novel therapies could decrease the morbidity and recurrence currently associated with cholesteatoma management. However, the development of new treatments will require a greater understanding of cholesteatoma biology. Here, we hope to significantly improve understanding of the molecular mechanisms underlying cholesteatoma pathogenesis and postsurgical recurrence by employing advanced genomic techniques.

ACCOMPLISHMENTS:

1. Enrolled 108 patients in a tissue collection study of surgical cholesteatoma samples
2. Generated scRNA-seq datasets for surgical cholesteatoma samples from n = 15 patients
3. Stored cholesteatoma tissues from another n = 57 patients in RNALater preservative and/or FFPE blocks for traditional RNA sequencing and VisiumHD spatial transcriptomic studies, respectively
4. Performed 10x VisiumHD spatial sequencing on a cholesteatoma sample
5. Findings presented at a podium session at AOS/COSM 2025 [3], now submitted as a publication to Otology & Neurotology (currently in revision)
6. Submitted an abstract on this project for the AOS meeting at COSM 2026 and invited to present at a podium session

AIM 1: Characterize the inter- and intracellular signaling pathways in human cholesteatoma tissue and compare this signaling to that in normal tympanic membrane tissue.

Background: Previous studies support a model in which signaling from the perimatrix (the outer subepithelial layer of a cholesteatoma) stimulates uncontrolled proliferation of cholesteatoma keratinocytes. Numerous cytokines and growth factors are overexpressed in cholesteatomas, and cholesteatomas demonstrate significant dysregulation of JAK/STAT signaling. However, the specific details remain elusive, and there is a need for research that clarifies: 1) the driver genes of uncontrolled cholesteatoma keratinocyte proliferation, 2) the upstream autocrine and/or paracrine messenger molecules, and 3) the regulatory networks and signaling pathways involved.

Progress: Here, we proposed scRNA-seq of human cholesteatoma tissue to elucidate the molecular mechanisms underlying cholesteatoma keratinocyte proliferation. As above, we have now generated scRNA-seq datasets for surgical cholesteatoma samples from n = 15 patients. scRNA-seq has revealed a rich array of cell types in human cholesteatoma tissue, including not only keratinocytes but also fibroblasts, mucosal epithelium (both ciliated and non ciliated), endothelium (both vascular and lymphatic), pericytes, many immune cell types (macrophage/monocytes, neutrophils, and B-, T-, NK-, mast, and dendritic cells), and even Schwann cells and melanocytes. Cell-cell signaling analyses with CellChat [4] have shown that perimatrix fibroblasts are a major source of intercellular signaling to cholesteatoma

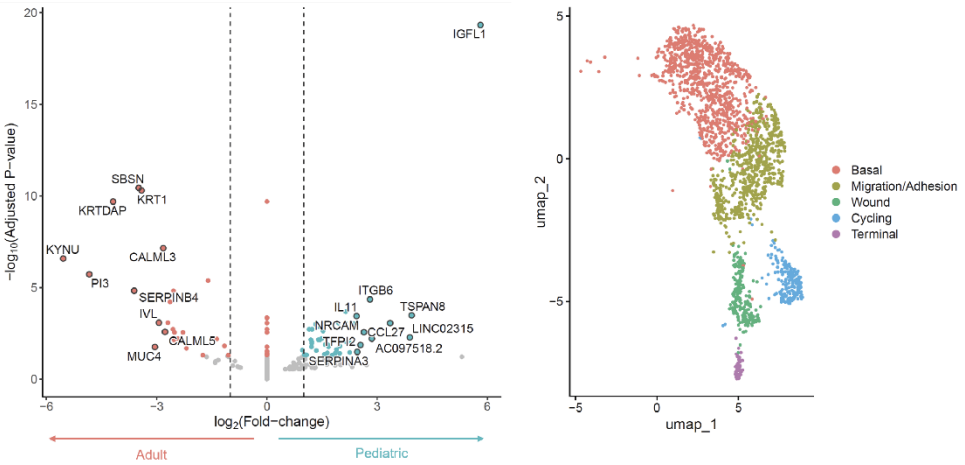

Figure 1: Volcano plot showing differential expression in cholesteatoma keratinocytes in adult vs pediatric specimens (Left). UMAP plot of keratinocytes showing populations present in cholesteatoma and tympanic membrane scRNA-seq datasets (Right). The migration/adhesion keratinocyte population was notably absent in the tympanic membrane dataset (Data not shown).

keratinocytes, with the midkine and pleiotrophin signaling axes significantly enriched in these populations across specimens [3]. scRNA-seq has also revealed apparent gene expression differences in pediatric and adult cholesteatoma tissue, with cholesteatoma keratinocytes in pediatric samples showing significantly lower expression of many epidermal maturation genes (**Fig 1**). Meanwhile, integration of datasets from cholesteatoma and tympanic membrane [5] revealed several surprising insights, including the presence of a cluster of LAMC2hi/ITGA6hi/LAMA3hi basal keratinocytes which exclusively derived from cholesteatoma samples (**Fig 1B**). Gene ontology and cell-cell interaction analyses identified these LAMA3hi/ITGA6hi/LAMC2hi cells as upregulating genes associated with cellular adhesion and epithelial migration and as a major target of keratinocyte-keratinocyte epidermal growth factor signaling, hinting at a possible cholesteatoma specific transcriptional program (**Fig 1**). Additional analyses and validation studies are currently planned.

AIM 2: Characterize the spatial transcriptional patterns in human cholesteatoma tissue and compare these patterns to those in healthy epidermal tissue.

Background: Normal epidermal maturation depends on stereotyped differentiation of keratinocytes from basal stem cells into terminally differentiated corneocytes in a basal-to-surface direction. Keratinocyte maturation is closely accompanied by changes in gene expression and morphology. Though cholesteatoma matrix resembles the epidermis histologically, previous research has revealed aberrant gene expression patterns as compared to epidermis. However, the clinical and biological significance of cholesteatomas' spatially dysregulated gene expression is not currently well understood. High-resolution spatial transcriptomics can provide insights into localized gene expression with whole-transcriptome depth and essentially single-cell resolution and would add valuable spatial context to complement the scRNA-seq data generated in Aim 1.

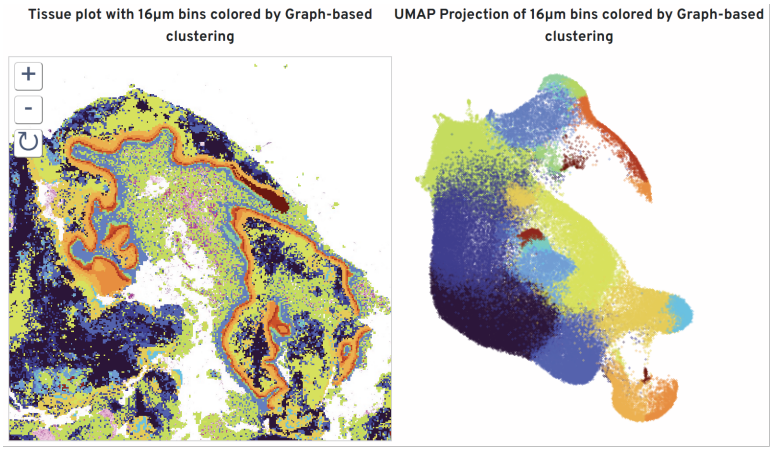

Figure 2: VisiumHD SpaceRanger output for a single cholesteatoma showing the graph-based clustering results projected onto an H&E stained section (Left) and a UMAP plot (Right).

Progress: As above, we have performed 10x VisiumHD spatial sequencing on a single cholesteatoma, with a second FFPE sample having passed quality control and awaiting VisiumHD, and an additional n = 7 specimens currently being processed for quality control checks (i.e., DV200% calculation). Data analysis of the VisiumHD data is still ongoing.

AIM 3: Determine molecular predictors of postoperative recurrence in cholesteatoma specimens.

Background: Evidence suggests that recurrent and nonrecurrent cholesteatomas demonstrate distinct transcriptional profiles. TNF-α, IL-12, and TLR-8 are upregulated in recurrent cholesteatoma specimens, and Ki-67 labeling index and KGF/KGFR double-positivity have previously been associated with recurrence. However, the molecular factors involved in recurrence are understudied, and clinically applicable molecular predictors are currently not available. Bulk RNA seq is a powerful tool allowing for relatively inexpensive and scalable comparisons of gene expression across many samples, as well as the correlation of gene expression with clinically relevant variables.

Progress: As above, we have collected a number of samples in RNALater preservative for traditional RNA sequencing. Next steps of RNA isolation, cDNA library preparation and sequencing are planned for the coming months.

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American Otological Society Progress Report, 2025-2026
Title: Molecular Heterogeneity of Vestibular Ganglion Neurons (VGNs)
PI/PD: Rahilla A. Tarfa
Mentors: Jennifer Stone, PhD
Funding period: 07/01/2025-06/30/2026
Funding Mechanism: Fellowship Grant
Date: 01/14/2026

Background: About 69 million Americans have some type of vestibulopathy, with a large proportion likely due to sensorineural causes (e.g., (Agrawal et al., 2009)). In sensorineural vestibulopathies, either hair cells (HCs) or vestibular ganglion neurons (VGNs) are damaged or lost, typically from etiologies like ototoxic medications, aging, trauma, or infections (Gleeson & Felix, 1987; Rauch et al., 2001; Rosenhall & Rubin, 1975; Sedó-Cabezón et al., 2015), resulting in clinical complaints like dizziness, vertigo and imbalance. These disorders remain difficult to treat, in part because pharmacological or genetic therapeutic agents specifically targeting elements of the vestibular system are yet to be discovered. One obstacle in developing treatments is the limited knowledge on the heterogeneity of the peripheral vestibular system and its microcircuitry, including between HCs and VGNs. More specifically, we lack an understanding of the genetic programs that drive the historical functional and anatomical heterogeneity of VGNs. This proposal focused on using single nucleus multiome sequencing (RNAseq and ATACseq) to analyze the transcriptome and epigenome of VGNs from adult mice. The overarching goal was to define molecular subtypes that correspond to some of the known aspects of their anatomical heterogeneity. Through this work, I hoped to determine the: i) different types of molecularly distinct subtypes of VGNs that exist, ii) the genes that are enriched in each subtype, iii) whether each subtype has different cell size and position in the ganglion, iv) if each subtype projects to a different zone of the utricle, and v) whether each subtype has a different constellation of terminal morphologies.

Results:

Aim I. Identify the molecular signatures that define VGN subtypes in adult mice. I am using scRNAseq to examine the transcriptional landscape of VGNs in the adult C57BL/6J mouse using SEURAT analysis pipeline to uncover transcriptionally distinct subtypes of VGNs. I am applying immunohistochemistry (IHC) and hybridization chain reaction (HCR) to validate expression of several putative biomarkers for each VGN subtype at protein and mRNA levels.

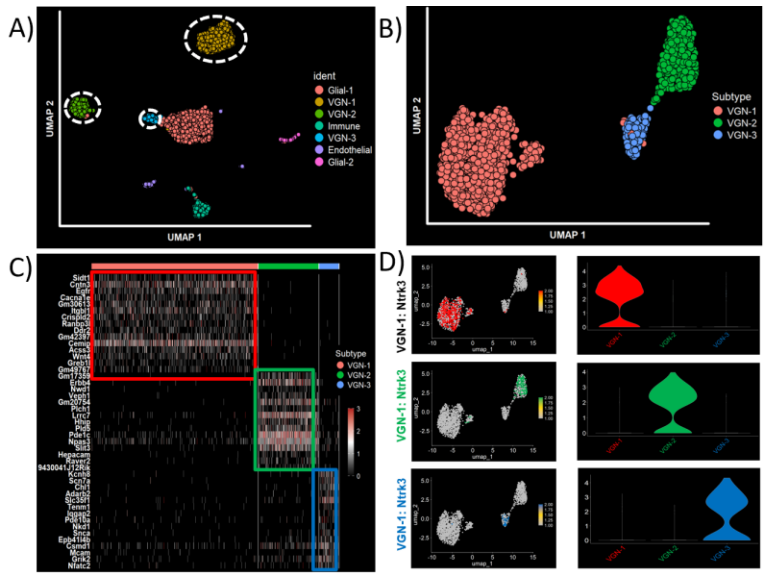

Figure 1: UMAP Plots depicting the transcriptomic landscape of the vestibular ganglion cells. A) (Top Left) UMAP plot demonstrating 7 distinct clusters each annotated following GO annotations (not shown) and identification of putative cell type markers. B) (Top Right) Re-clustering of VGN-1/2/3 from A) demonstrates the presence of 3 putative VGN clusters. C) (Bottom Left) Heatmap depicting three VGN subclusters, each with differentially expressed genes. D) (Bottom Right) Selection of candidate markers from each VGN subcluster based on log fold differences, read counts and percent expressed in the cluster, with the top candidates demonstrating the highest values in each category.

Progress:

In collaboration with Dr. Tao's laboratory at Creighton University, I interrogated single-nucleus multiome sequencing data (snRNA-seq combined with snATAC-seq) derived from 14 vestibular ganglia of mice at 6 weeks of age. Single nuclei were isolated, mRNA and DNA were tagged, and then sequenced. I analyzed multiome data using both the Seurat and Signac pipeline. Only cells with matching barcodes (present) in both ATACseq and RNAseq data were used for further analysis from the sequencing data (N = 6271 cells) (Figure 1A). I defined 3 of clusters within the vestibular ganglion. Further analysis of gene expression in the various clusters identified three putative clusters that were neuronal in nature as confirmed with a combination of GO annotations and known neural markers. I re-clustered the three putative neuronal clusters, which yielded three distinct clusters of VGNs, indicating there is considerable transcriptomic heterogeneity among VGNs (Figure 1B). Integration of RNA and chromatin accessibility profiles revealed

concordant clustering between transcriptomic and epigenomic states, supporting the presence of stable molecular subtypes rather than transient activity states. Further GO analysis identified subtype-enriched patterns of gene expression associated with neuronal excitability, axon guidance, synaptic signaling, and cell adhesion pathways—categories that align with known physiological and anatomical diversity previously described for VGNs.

Notably, several candidate marker genes showed highly enriched gene expression in one VGN cluster versus another, which I call cluster markers. So far, I confirmed differential gene expression in VGNs *in situ* for 3 cluster markers using hybridization chain reaction (HCR), double labeling with antibodies to parvalbumin (PARV), which is expressed in all VGNs. As an example, I show data for one marker, Ntrk3, in Figure 2A-C.

Analysis of ATACseq data identified sites of chromatin accessibility unique to each VGN cluster in the selected VGN-enriched genes, suggesting distinct transcriptional regulatory programs across VGN subtypes. For each cluster marker (gene), I am correlating regions of high chromatin accessibility with high expression and working to define potential regulatory units within the gene locus. Results from these analyses for Ntrk3 are shown in Figure 2D-F.

This approach is helping to establish a molecular framework for VGN classification in the adult mouse and to provide a validated set of markers for each VGN subtype for spatial and morphological correlation studies pursued in Aim II.

Aim II. Correlate the molecular subtypes of VGNs with their anatomic features in the ganglion, as well as with the morphology and position of their terminals in the utricle. I am working on completing this aim now. Using IHC or HCR in slices through the vestibular ganglion, I am exploring if there are differences between VGN subtype soma size and position in the ganglion and if these features are correlated with a specific cluster marker. I am examining afferent terminal morphology (calyx-only, bouton-only, or dimorphic) and zonal projection (to striola or extrastriola) for each VGN subtype using whole-mount preparations containing both utricles and VGNs.

Progress:

Progress toward Aim II has focused on establishing the experimental and analytical groundwork necessary to link molecular identity with anatomical features of VGNs.

Preliminary HCR experiments demonstrate that molecularly defined VGN subtypes exhibit non-uniform spatial distributions within the ganglion, suggesting potential positional organization correlated with molecular identity. Preliminary quantitative analyses further suggest differences in soma size between subtypes, consistent with long-standing observations of morphological heterogeneity in vestibular afferents.

In parallel, I have established strategies to determine if different subtypes of VGN have different afferent terminal morphology and zonal projections in the utricle. These include sparse labeling of VGNs combined with labeling for VGN subtype markers (HCR probes or proteins) and assessment of calyx, bouton, and dimorphic afferents, as well as striolar versus extrastriolar terminations of VGN afferents in the utricle. I have in-house Morf3 Cre mice (obtained from Dr. Tom Coate, Georgetown University) that have sparse fluorescently labeled VGNs (10- 50/mouse). Labeling extends from the VGN cell body to their dendrites and terminals within the end organs. I am optimizing whole-mount preparations that include end organs and vestibular ganglion and working on imaging pipelines for reliable visualization of VGN dendritic terminals and cluster markers (HCR probes and/antibodies) within the same preparation.

While comprehensive subtype-to-morphology mapping is still in progress, the foundational datasets and validation tools are now in place to complete these correlations within the funding period.

Future Directions:

Over the remainder of the funding period, efforts will focus on completing subtype validation and anatomical correlation. Specifically, I will:

1. Expand *in situ* validation of up to 3 putative subtype-specific markers/subtype in the vestibular ganglion of n = 3-5 mice.
2. Quantitatively assess soma size and ganglion position for each VGN subtype.
3. Complete mapping of VGN subtypes to terminal dendritic morphologies and zonal projections using combined genetic labeling and molecular profiling.
4. Integrate RNA and ATAC datasets to identify gene regulatory elements that may drive subtype-specific differentiation and maintenance.

Collectively, these studies will generate one of the first comprehensive molecular–anatomical framework for vestibular ganglion neurons. This work will lay essential groundwork for understanding how molecular identity shapes vestibular circuit organization and may ultimately inform targeted therapeutic strategies for sensorineural vestibular disorders.

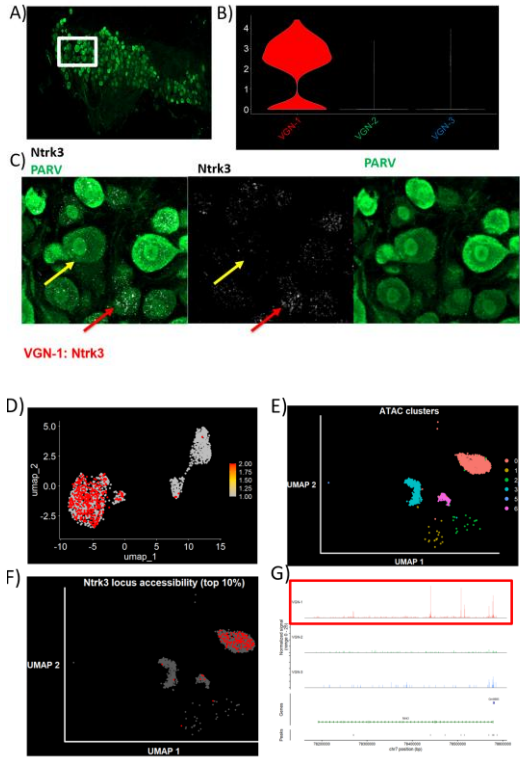

Figure 2: Validation of VGN subtype markers using RNA *in situ* hybridization.
A) Ntrk3 from VGN-1 cluster selected for validation. Vibratome section of vestibular ganglion with parvalbumin immunoreactive neurons.
B) Average expression of Ntrk3 across the 3 VGN subclusters, with distinct expression shown in VGN-1 subcluster with little to no expression in VGN-2 and VGN-3 subclusters.
C) RNA *in situ* hybridization with Hybridization chain reaction (HCR) demonstrating the presence of Ntrk3 (white) in parvalbumin +ve neurons identified through immunocytochemistry (ICC). Yellow arrow depicts an example of a neuron that is Parvalbumin+ve but Ntrk3-ve, and red arrow demonstrates a neuron that is Parvalbumin+ve and Ntrk3+ve.
D) UMAP depicting the presence of Ntrk3+ gene expression among the VGN subclusters.
E) Clustering of ATAC chromatin accessibility peaks from vestibular ganglia cells (same cells used in Figure 1) represented on a UMAP.
E) Ntrk3 locus demonstrated on a UMAP of all VG clusters, depicting unique accessibility in the VGN cluster.
F) Coverage plot demonstrating differential peak expression/chromatin accessibility of Ntrk3 across VGN subclusters. Note the peaks in Ntrk3 depicting a different regulatory state of this gene in the VGN-1 subcluster as compared to VGN-2 and VGN-3.

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2011 C. Phillip Daspit, MD

2012 Herman A. Jenkins, MD

2013 Paul R. Lambert, MD

2014 John W. House, MD

2015 D. Bradley Welling, MD, PhD

2016 Debara L. Tucci, MD, MS, MBA

2017 Samuel H. Selesnick, MD

2018 Roberto A. Cueva, MD

2019 Carol A. Bauer, MD

2020 John P. Carey, MD

2021 Patrick J. Antonelli, MD

2022 Marlan R. Hansen, MD

2023 Lawrence R. Lustig, MD

2024 Sujana S Chandrasekhar, MD

2025 William H. Slattery III, MD

PAST SECRETARY - TREASURERS OF THE AMERICAN OTOLOGICAL SOCIETY

1868 - 1870 C. E. Ryder, MD

1870 - 1879 J. O. Green, MD

1879 - 1898 J. J. B. Vermyne, MD

1898 - 1907 Frederick L. Jack, MD

1907 - 1912 James F. McKernon, MD

1912 - 1917 John B. Rae, MD

1917 - 1919 George E. Shambaugh, MD

1919 - 1925 Thomas J. Harris, MD

1925 - 1927 D. Harold Walker, MD

1927 - 1940 Thomas J. Harris, MD

1940 - 1945 Isidore S. Friesner, MD

1945 - 1950 Gordon D. Hoople, MD

1950 - 1955 John R. Lindsay, MD

1955 - 1960 Lawrence R. Boies, MD

1960 - 1965 James A. Moore, MD

1965 - 1972 Wesley H. Bradley, MD

1972 - 1977 G. Dekle Taylor, MD

1977 - 1982 Cary N. Moon, Jr., MD

1982 - 1987 D. Thane Cody, MD

1987 - 1992 Robert I. Kohut, MD

1992 - 1997 Gregory J. Matz, MD

1997 - 2002 Horst R. Konrad, MD

2002 - 2007 Clough Shelton, MD

2007 - 2012 Paul R. Lambert, MD

2012 - 2017 Steven A. Telian, MD

2017 - 2023 Sujana S. Chandrasekhar, MD

2023 - 2028 David R. Friedland, MD, PhD

AWARD OF MERIT RECIPIENTS (1949 - 2025)

1949 George M. Coates, MD
1950 Barry J. Anson, PhD
1951 Theodore H. Bast, PhD
1952 Edmund P. Fowler, Sr., MD
1953 Julius Lempert, MD
1954 Stacy Guild, PhD
1957 Georg von Bekesy, PhD
1959 Ernest Glen Wever, PhD
1960 Hallowell Davis, MD
1961 John R. Lindsay, MD
1962 William J. McNally, MD
1965 Anderson C. Hilding, MD
1966 Gordon D. Hoople, MD
1967 Merle Lawrence, PhD
1968 Lawrence R. Boles, MD
1969 Sir Terence Cawthorne
1970 Senator Joseph A. Sullivan, MB
1971 Samuel Rosen, MD
1972 Howard P. House, MD
1973 Moses H. Lurie, MD
1974 George E. Shambaugh, Jr., MD
1975 Catherine A. Smith, PhD
1976 Harry Rosenwasser, MD
1977 Frank Lathrop, MD
1978 Juergen Tonndorf, MD
1979 John Bordley, MD
1980 Ben H. Senturia, MD
1981 J. Brown Farrior, MD
1982 William F. House, MD
1983 Victor Goodhill, MD
1984 Harold F. Schuknecht, MD
1985 Wesley H. Bradley, MD
1986 John J. Shea, Jr., MD
1987 Jack V. Hough, MD
1988 George D. Nager, MD
1989 Brian F. McCabe, MD
1990 Eugene L. Derlacki, MD
1991 Richard R. Gacek, MD
1992 James L. Sheehy, MD
1993 James A. Donaldson, MD
1994 Fred H. Linthicum, Jr., MD
1995 D. Thane Cody, MD
1996 F. Blair Simmons, MD
1997 Michael E. Glasscock, III, MD
1998 Michael M. Paparella, MD
1999 Mansfield F. W. Smith, MD
2000 Robert A. Jahrsdoerfer, MD
2001 Derald E. Brackmann, MD
2002 Gregory J. Matz, MD
2003 James B. Snow, Jr., MD
2004 Robert J. Ruben, MD
2005 David J. Lim, MD
2006 Herbert Silverstein, MD
2007 Richard A. Chole, MD, PhD
2008 Malcolm D. Graham, MD
2009 William H. Lippy, MD
2010 George Gates, MD
2011 Sam E. Kinney, MD
2012 Joseph B. Nadol, Jr., MD
2013 Bruce J. Gantz, MD

2014 Richard T. Miyamoto, MD

2015 Jeffrey P. Harris, MD, PhD

2016 Charles M. Luetje, MD

2017 Clough Shelton, MD

2018 Paul R. Lambert, MD

2019 John W. House, MD

2020 Steven A. Telian, MD

2021 Miriam I. Redleaf, MD

2022 Lloyd Brooks Minor, MD

2023 Debara L. Tucci, MD, MS, MBA

2024 D. Bradley Welling, MD, PhD

2025 Robert K. Jackler, MD

In April 1948, at the 81st annual business meeting of the American Otological Society, the Council formally approved the motion of Dr. Bernard McMahon to establish an **Award of Merit**, the purpose of which was to recognize, "...outstanding accomplishment and distinguished service in the field of otology."

The proposal gave broad specification to the candidacy for the Award, noting that, "Any individual working in the field of Otology may be a candidate for the Award. One single scientific contribution of peculiar and far-reaching import; or many smaller contributions whose sum be-comes of especial significance; or outstanding leadership in surgery or teaching or research in this field-any or all of these attributes in a candidate may find him/her worthy of consideration by the Committee.

AMERICAN OTOLOGICAL SOCIETY 2026 MEMBERSHIP ROSTER

(Includes fifteen 2026 Fellows inducted at the Spring Meeting)

Kedar Adour, MD
San Francisco, CA
Emeritus

Oliver F. Adunka, MD, MBA
Columbus, OH
Fellow

Yuri Agrawal, MD
Englewood, CO
Fellow

Pedro Albernaz, MD
Sao Paulo, Brazil
Honorary

P. W. Alberti, MD
Toronto, Ontario
Emeritus

Sean R. Althaus, MD
Georgetown, TX
Emeritus

Ronald G. Amedee, MD
New Orleans, LA
Fellow

Simon I. Angeli, MD
Miami, FL
Fellow

Samantha Anne, MD, MS
Orange, OH
Fellow

Patrick J. Antonelli, MD
Gainesville, FL
Senior

Edward Applebaum, MD
Chicago, IL
Emeritus

Moises A. Arriaga, MD
Metairie, LA
Fellow

H. Alexander Arts, MD
Ann Arbor, MI
Senior

Marcus D. Atlas, MBBS
Subiaco, Australia
Corresponding

Seilesh C. Babu, MD
Farmington Hills, MI
Fellow

Douglas D. Backous, MD
Puyallup, WA
Fellow

Manohar Bance, MD
Cambridge, United Kingdom
Fellow

David M. Barrs, MD
Phoenix, AZ
Senior

Gregory J. Basura, MD, PhD
Pittsburgh, PA
Fellow

Carol A. Bauer, MD
Springfield, IL
Emeritus

Charles W. Beatty, MD
Rochester, MN
Emeritus

James E. Benecke, MD
Scottsdale, AZ
Senior

Marc L. Bennett, MD
Nashville, TN
Fellow

Ricardo F. Bento, MD, PhD
Sao Paulo, Brazil
Associate

Karen Berliner, PhD
Marina Del Rey, CA
Senior Associate

Brian Blakley, MD
Winnipeg, Manitoba
Emeritus

Nikolas H. Blevins, MD
Stanford, CA
Fellow

Charles D. Bluestone, MD
Pittsburgh, PA
Emeritus

Derald E. Brackmann, MD
Los Angeles, CA
Senior

Kevin D. Brown, MD, PhD
Chapel Hill, NC
Fellow

Craig A. Buchman, MD
St. Louis, MO
Fellow

Matthew L. Bush, MD, PhD
Lexington, KY
Fellow

Rinaldo F. Canalis, MD
Santa Monica, CA
Emeritus

Robert W. Cantrell, MD
Charlottesville, VA
Emeritus

Matthew L. Carlson, MD, MBA
Rochester, MN
Fellow

Stephen P. Cass, MD
Aurora, CO
Senior

Margaretha L. Casselbrant, MD, PhD
Pittsburgh, PA
Emeritus

Dylan K. Chan, MD, PhD
San Francisco, CA
Fellow

Sujana S. Chandrasekhar, MD
New York, NY
Fellow

Kay W. Chang, MD
Palo Alto, CA
Fellow

Douglas A. Chen, MD
Wexford, PA
Senior

Alan G. Cheng, MD
Palo Alto, CA
Fellow

Steven W. Cheung, MD
San Francisco, CA
Fellow

Wade W. Chien, MD
Potomac, MD
Fellow

Edgar L. Chiossone, MD
Miami, FL
Honorary

Richard A. Chole, MD, PhD
St. Louis, MO
Emeritus

Daniel Choo, MD
Cincinnati, OH
Fellow

Graeme M. Clark, PhD
Victoria, Australia
Honorary

Jack D. Clemis, MD
Wilmette, IL
Emeritus

Daniel H. Coelho, MD
Richmond, VA
Fellow

Newton J. Coker, MD
Santa Fe, NM
Emeritus

Maura K. Cosetti, MD
New York, NY
Fellow

Benjamin T. Crane, MD, PhD
Pittsford, NY
Fellow

Roberto A. Cueva, MD
La Mesa, CA
Senior

Sharon L. Cushing, MD, MSc
Toronto, Ontario
Fellow

M. Jennifer Derebery, MD
Los Angeles, CA
Senior

Sandra G. Desa Souza, MBMS
Mumbai, India
Emeritus

John R. Dickins, MD
Little Rock, AR
Emeritus

Christine T. Dinh, MD
Miami, FL
Fellow

Hamid R. Djalilian, MD
Orange, CA
Fellow

Joni K. Doherty, MD, PhD
Los Angeles, CA
Fellow

Katsumi Doi, MD, PhD
Mino, Japan
Corresponding

John L. Dornhoffer, MD
Little Rock, AR
Senior

Karen Jo Doyle-Enright, MD, PhD
Gregory, MI
Senior

Colin L.W. Driscoll, MD
Rochester, MN
Fellow

Judy R. Dubno, PhD
Charleston, SC
Associate

Larry G. Duckert, MD
Seattle, WA
Emeritus

Arndt J. Duvall III, MD
Minneapolis, MN
Emeritus

Thomas L. Eby, MD
Jackson, MS
Fellow

David J. Eisenman, MD
Baltimore, MD
Fellow

Hussam K. El-Kashlan, MD
Ann Arbor, MI
Fellow

Adrien A. Eshraghi, MD
Weston, FL
Fellow

Abraham Eviatar, MD
Scarsdale, NY
Emeritus

Jay B. Farrior, III, MD
Tampa, FL
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Jose N. Fayad, MD
Dhahran, Saudi Arabia
Fellow

Joseph G. Feghali, MD
Bronx, NY
Senior

Howard W. Francis, MD, MBA
Durham, NC
Fellow

Bernard Gil Fraysse, MD
Toulouse, France
Emeritus

David R. Friedland, MD, PhD
Los Angeles, CA
Fellow

Rick Friedman, MD, PhD
La Jolla, CA
Fellow

David R. Friedmann, MD, MSc
New York, NY
Fellow

Michael H. Fritsch, MD
Indianapolis, IN
Fellow

Bruce J. Gantz, MD
Iowa City, IA
Fellow

L. Gale Gardner, Jr., MD
Shreveport, LA
Emeritus

George A. Gates, MD
Boerne, TX
Emeritus

Soha N. Ghossaini, MD
Arlington Heights, IL
Fellow

Gerard J. Gianoli, MD
Covington, LA
Fellow

Paul W. Gidley, MD
Houston, TX
Fellow

Michael B. Gluth, MD
Chicago, IL
Fellow

Joel A. Goebel, MD
St. Louis, MO
Emeritus

Robert A. Goldenberg, MD
Dayton, OH
Emeritus

Justin S. Golub, MD, MS
New York, NY
Fellow

Malcolm D. Graham, MD
Atlanta, GA
Emeritus

J. Douglas Green Jr., MD
Jacksonville, FL
Fellow

John H. Greinwald Jr., MD
Cincinnati, OH
Fellow

Samuel P. Gubbels, MD
Aurora, CO
Fellow

A. Julianna Gulya, MD
Locust Grove, VA
Emeritus

Thomas J. Haberkamp, MD
Pepper Pike, OH
Emeritus

Paul E. Hammerschlag, MD
New York, NY
Emeritus

Marlan R. Hansen, MD
Iowa City, IA
Fellow

Lee A. Harker, MD
Omaha, NE
Emeritus

Jeffrey P. Harris, MD, PhD
La Jolla, CA
Senior

Michael S. Harris, MD
Milwaukee, WI
Fellow

George T. Hashisaki, MD
Charlottesville, VA
Senior

David S. Haynes, MD
Nashville, TN
Fellow

Ronna Hertzano, MD, PhD
Bethesda, MD
Fellow

Jacques Herzog, MD
St. Louis, MO
Fellow

Todd A. Hillman, MD
Wexford, PA
Fellow

Keiko Hirose, MD
St. Louis, MO
Fellow

Barry E. Hirsch, MD
Pittsburgh, PA
Emeritus

Michael Hoa, MD
Washington, DC
Fellow

Michael E. Hoffer, MD
Miami, FL
Fellow

Ronald A. Hoffman, MD
New York, NY
Senior

James J. Holt, MD, MS
Marshfield, WI
Emeritus

Robert S. Hong, MD, PhD
Farmington Hills, MI
Fellow

Karl L. Horn, MD
Santa Fe, NM
Senior

John W. House, MD
Los Angeles, CA
Senior

Tina Huang, MD
Minneapolis, MN
Fellow

Timothy E. Hullar, MD
Portland, OR
Fellow

Makoto Igarashi, MD
Tokyo, Japan
Senior Associate

S. Armagan Incesulu, MD
Eskisehir, Turkey
Corresponding

Brandon Isaacson, MD
Dallas, TX
Fellow

Huseyin Isildak, MD
Stony Brook, NY
Fellow

Juichi Ito, MD, PhD
Kyoto, Japan
Corresponding

Salvatore J. Iurato, MD
Bari, Italy
Senior Associate

Robert K. Jackler, MD
Stanford, CA
Senior

Carol A. Jackson, MD
Newport Beach, CA
Senior

Abraham Jacob, MD
Tucson, AZ
Fellow

Herman A. Jenkins, MD
Aurora, CO
Emeritus

Lars-Goran Johnsson, MD
Helsinki, Finland
Senior Associate

Raleigh O. Jones Jr., MD
Lexington, KY
Fellow

Steven K. Juhn, MD
Minneapolis, MN
Senior Associate

Timothy T.K. Jung, MD, PhD
Riverside, CA
Senior

David Jung, MD, PhD
Boston, MA
Fellow

Donald B. Kamerer, MD
Pittsburgh, PA
Emeritus

David M. Kaylie, MD
Durham, NC
Fellow

Bradley W. Kesser, MD
Charlottesville, VA
Fellow

Paul R. Kileny, PhD
Ann Arbor, MI
Senior Associate

Ana H. Kim, MD
New York, NY
Fellow

Harold H. Kim, MD
Portland, OR
Fellow

Darius Kohan, MD
New York, NY
Fellow

Gavriel D. Kohlberg, MD
Seattle, WA
Fellow

Horst R. Konrad, MD
Naples, FL
Senior

J. Walter Kutz Jr, MD
Dallas, TX
Fellow

Robert F. Labadie, MD, PhD
Charleston, SC
Fellow

Anil K. Lalwani, MD
New York, NY
Fellow

Paul R. Lambert, MD
Charleston, SC
Emeritus

K. J. Lee, MD
Guilford, CT
Emeritus

Daniel J. Lee, MD
Brookline, MA
Fellow

Kenneth H. Lee, MD, PhD
Plano, TX
Fellow

John P. Leonetti, MD
Maywood, IL
Senior

S. George Lesinski, MD
Cincinnati, OH
Emeritus

Samuel C. Levine, MD
Eden Prairie, MN
Senior

Charles J. Limb, MD
San Francisco, CA
Fellow

Vincent Y.W. Lin, MD
Toronto, Ontario
Fellow

Roger C. Lindeman, MD
Mercer Island, WA
Emeritus

Philip D. Littlefield, MD
San Diego, CA
Fellow

Ward B. Litton, MD
Bonita Springs, FL
Emeritus

Charles M. Luetje, MD
Olathe, KS
Emeritus

Larry B. Lundy, MD
Ponte Vedra Beach, FL
Senior

Lawrence R. Lustig, MD
New York, NY
Fellow

John D. Macias, MD
Phoenix, AZ
Fellow

Charles A. Mangham Jr., MD
Hailey, ID
Emeritus

Wolf J. Mann, MD
Mainz, Germany
Emeritus

Sam J. Marzo, MD
Maywood, IL
Fellow

Douglas E. Mattox, MD
Atlanta, GA
Fellow

Jennifer L. Maw, MD
San Jose, CA
Fellow

John T. McElveen Jr., MD
Raleigh, NC
Fellow

Michael J. McKenna, MD
Boston, MA
Fellow

Brian J. McKinnon, MD, MBA
Hagerstown, MD
Fellow

Sean O. McMenomey, MD
Seattle, WA
Fellow

Teddy R. McRackan, MD, MS
Charleston, SC
Fellow

Cliff A. Megerian, MD
Cleveland, OH
Fellow

Michael Merzenich, PhD
San Francisco, CA
Senior Associate

William L. Meyerhoff, MD
Dallas, TX
Emeritus

Alan G. Micco, MD
Chicago, IL
Fellow

Josef M. Miller, PhD
Ann Arbor, MI
Senior Associate

Lloyd B. Minor, MD
Stanford, CA
Fellow

Richard T. Miyamoto, MD
Indianapolis, IN
Senior

Aaron C. Moberly, MD
Brentwood, TN
Fellow

Edwin M. Monsell, MD, PhD
Issaquah, WA
Senior

Stephanie A. Moody Antonio, MD
Norfolk, VA
Fellow

Gary F. Moore, MD
Omaha, NE
Senior

William H. Moretz Jr., MD
Augusta, GA
Senior

Tetsuo Morizono, MD, DMS
Fukuoka City, Japan
Senior Associate

Terry Murphy, MD
Marietta, GA
Emeritus

Eugene N. Myers, MD
Pittsburgh, PA
Emeritus

Hideko H. Nakajima, MD, PhD
Boston, MA
Associate

Julian M. Nedzelski, MD
Toronto, Ontario
Emeritus

Brian A. Neff, MD
Rochester, MN
Fellow

Erik G. Nelson, MD
Lake Forest, IL
Senior

Rick F. Nelson, MD, PhD
Indianapolis, IN
Fellow

Ralph A. Nelson, MD
Manchester, WA
Emeritus

Quyen Nguyen, MD, PhD
La Jolla, CA
Fellow

Brian D. Nicholas, MD
Syracuse, NY
Fellow

John S. Oghalai, MD
Los Angeles, CA
Fellow

Robert C. O'Reilly, MD
Philadelphia, PA
Fellow

James J. Pappas, MD
Little Rock, AR
Emeritus

Dennis Pappas, MD
Birmingham, AL
Emeritus

Dennis G. Pappas Jr., MD
Birmingham, AL
Fellow

Simon C. Parisier, MD
New York, NY
Senior

Albert Park, MD
Salt Lake City, UT
Fellow

Steven M. Parnes, MD
Rensselaer, NY
Emeritus

Lorne S. Parnes, MD
London, Ontario
Emeritus

Kevin A. Peng, MD
Los Angeles, CA
Fellow

Myles L. Pensak, MD
Cincinnati, OH
Emeritus

Rodney Perkins, MD
Woodside, CA
Senior Associate

Brian P. Perry, MD
McAllen, TX
Fellow

Harold C. Pillsbury, MD
Banner Elk, NC
Emeritus

Dennis S. Poe, MD
Boston, MA
Fellow

Leonard R. Proctor, MD
Bel Aire, MD
Emeritus

Alicia M. Quesnel, MD
Boston, MA
Fellow

Steven D. Rauch, MD
Watertown, MA
Fellow

Miriam I. Redleaf, MD
Chicago, IL
Fellow

Aaron K. Remenschneider, MD, MPH
Boston, MA
Fellow

Celine Richard, MD, PhD
Memphis, TN
Fellow

Habib Rizk, MD
Charleston, SC
Fellow

Pamela C. Roehm, MD, PhD
Jenkintown, PA
Fellow

Peter S. Roland, MD
Eden, UT
Senior

John T. Roland Jr., MD
New York, NY
Fellow

Max L. Ronis, MD
Philadelphia, PA
Emeritus

Seth Rosenberg, MD
Sarasota, FL
Senior

John J. Rosowski, PhD
Boston, MA
Senior Associate

Edwin W. Rubel, PhD
Seattle, WA
Senior Associate

Robert J. Ruben, MD
New York, NY
Senior

Allan M. Rubin, MD, PhD
Holland, OH
Emeritus

Jay T. Rubinstein, MD, PhD
Seattle, WA
Fellow

Michael J. Ruckenstein, MD
Philadelphia, PA
Fellow

Christina L. Runge, PhD
Los Angeles, CA
Associate

Leonard P. Rybak, MD, PhD
Springfield, IL
Emeritus

Hamed Sajjadi, MD
Los Gatos, CA
Fellow

Masafumi Sakagami, MD, PhD
Hyogo, Japan
Corresponding

Peter Santa Maria, MD, PhD
Pittsburgh, PA
Fellow

Robert T. Sataloff, MD
Philadelphia, PA
Senior

James E. Saunders, MD
Lebanon, NH
Fellow

Jochen Schacht, PhD
Ann Arbor, MI
Senior Associate

Arnold G. Schuring, MD
Warren, OH
Emeritus

Mitchell K. Schwaber, MD
Nashville, TN
Senior

Michael D. Seidman, MD
Celebration, FL
Fellow

Samuel H. Selesnick, MD
New York, NY
Fellow

Clough Shelton, MD
Walla Walla, WA
Emeritus

Neil T. Shepard, PhD
Missoula, MT
Senior Associate

Jack A. Shohet, MD
Newport Beach, CA
Fellow

Herbert Silverstein, MD
Sarasota, FL
Senior

George T. Singleton, MD
Gainesville, FL
Emeritus

Piotr H. Skarzynski, MD, PhD
Warsaw, Poland
Corresponding

Henryk Skarzynski, MD, PhD
Warsaw, Poland
Corresponding

Richard J. Smith, MD
Iowa City, IA
Honorary

Eric E. Smouha, MD
New York, NY
Fellow

Samuel Spear, MD
Jupiter, FL
Fellow

Gershon J. Spector, MD
St. Louis, MO
Emeritus

Hinrich Staecker, MD, PhD
Kansas City, KS
Fellow

Konstantina M. Stankovic, MD, PhD
Palo Alto, CA
Fellow

Olivier Sterkers, MD, PhD
75016 Paris, France
Emeritus

Steven A. Telian, MD
Dexter, MI
Senior

Fred F. Telischi, MD
Miami, FL
Fellow

Norman W. Todd Jr., MD
Marietta, GA
Senior

Elizabeth H. Toh, MD, MBA
Boston, MA
Fellow

Daniel J. Tollin, PhD
Aurora, CO
Associate

Debara L. Tucci, MD, MS
Durham, NC
Senior

Aaron D. Tward, MD, PhD
San Francisco, CA
Fellow

Andrea Vambutas, MD
New Hyde Park, NY
Fellow

Esther X. Vivas, MD
Atlanta, GA
Fellow

Jeffrey T. Vrabec, MD
Houston, TX
Fellow

P. Ashley Wackym, MD
New Brunswick, NJ
Fellow

George B. Wanna, MD
New York, NY
Fellow

Bryan K. Ward, MD
Baltimore, MD
Fellow

Jack J. Wazen, MD
Sarasota, FL
Emeritus

Peter C. Weber, MD, MBA
Boston, MA
Fellow

D. Bradley Welling, MD, PhD
Boston, MA
Fellow

Stephen J. Wetmore, MD
Morgantown, WV
Emeritus

Richard J. Wiet, MD
Sawyer, MI
Emeritus

Eric P. Wilkinson, MD
Boise, ID
Fellow

Erika Woodson, MD
Poway, CA
Fellow

Sabina R. Wullstein, MD
Wurzburg, Germany
Senior Associate

Thomas P. Wustrow, MD
Munchen, Germany
Emeritus

Naoaki Yanagihara, MD
Matsyama, Japan
Honorary

Nancy M. Young, MD
Chicago, IL
Fellow

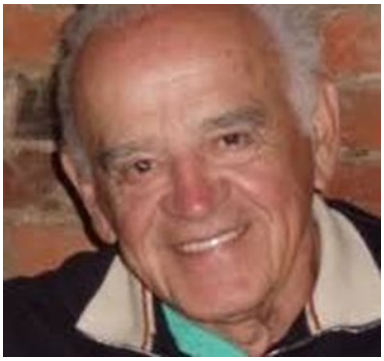
Daniel M. Zeitler, MD
Seattle, WA
Fellow

in Memoriam

The AOS Administrative office has been notified of the following members passing since the last Spring meeting.

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

Thomas J. Balkany, MD
Inducted in 1991
Passed July 29, 2025



Richard R. Gacek, MD
Inducted in 1970
AOS President 1988
ANS President 1983-84
Award of Merit 2012
Passed September 5, 2025

Joseph B. Nadol Jr., MD
Inducted in 1988
AOS President 2009
Award of Merit 2012
Passed August 2, 2025

George T. Singleton, MD
Inducted in 1972
Passed January 31, 2026