

SELECTED ABSTRACTS

**POSTER
PRESENTATIONS**

IN ORDER OF PRESENTATION

Posters will be displayed on Friday & Saturday, May 17-18



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AMERICAN NEUROTOLOGY SOCIETY

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

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

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

Study Design: Retrospective cohort.

Setting: Two institutions.

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

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

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

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

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

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

Level of Evidence – Level III.

Indicate IRB or IACUC : Exempt.

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

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

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

Study Design: Longitudinal cohort analysis.

Setting: National Social Life, Health, and Aging Project

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

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

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

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

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

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

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

Level of Evidence - III

Indicate IRB or IACUC : Exempt

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

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

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

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

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

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

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

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

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

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

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

Level of Evidence – Level III

Indicate IRB or IACUC : Exempt

Risk Factors of Recurrence in Stage II Pars Flaccida Cholesteatoma

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

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

Study Design: Retrospective cohort.

Setting: University Hospital.

Patients: Consecutive 228 patients with stage II PF cholesteatoma.

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

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

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

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

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

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

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

Level of Evidence - Level IV

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

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

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

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

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

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

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

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

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

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

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

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

Level of Evidence - Level III

Indicate IRB or IACUC: Exempt

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

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

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

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

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

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

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

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

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

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

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

Level of Evidence: Level III

Indicate IRB or IACUC: Exempt

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

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

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

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

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

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

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

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

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

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

Level of Evidence - III

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

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

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

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

Study Design: Prospective case series

Setting: Tertiary referral center

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

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

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

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

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

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

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

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

Level of Evidence: Level III

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

Longitudinal Trends in Cochlear Implant Programming in Over 600 Implants

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

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

Study Design: Retrospective review

Setting: Tertiary academic center

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

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

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

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

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

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

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

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

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

Indicate IRB or IACUC : 22-000183

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

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

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

Study Design: Retrospective cohort

Setting: Tertiary academic cochlear implant (CI) referral center

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

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

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

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

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

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

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

Level of Evidence – Level IV

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

Post-operative Hearing Outcomes of Surgically Treated Jugular Foramen Schwannomas

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

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

Study Design: Retrospective case review- case series.

Setting: Tertiary referral care hospital.

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

Interventions: Therapeutic- Surgical resection

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

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

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

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

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

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

Level of Evidence - Level V

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

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

*Roya Azadarmaki, MD; Beth A. Kennedy, AuD; Rana S. Azad, BS
Asma Ahmad, BS; Zina Drott, RN; Genrieta Bochorishvili, PhD*

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

Study Design: Case Report

Setting: Private Practice Cochlear Implant Center.

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

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

Main Outcome Measures: Successful implantation in an ossified cochlea.

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

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

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

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

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

Level of Evidence - Level V

Indicate IRB or IACUC : Exempt-Case Report.

Audiologic Outcomes Following Spontaneous Temporal Bone Encephalocele and CSF Leak Repairs

*Avanish Yendluri, BA; Jen Ren, BA; Maria Mavrommatis, MD
Enrique R. Perez, MD, MBA; Maura K. Cosetti, MD
George B. Wanna, MD; Zachary G. Schwam, MD*

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

Study Design: Retrospective cohort study.

Setting: Tertiary academic neurotology practice.

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

Interventions: Surgical repair of TLEs and CSF leaks.

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

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

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

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

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

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

Level of Evidence - IV

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

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

*Stefanie A. Peña, MD; Matthew Wiefels, BS; Danielle Harris, BS
Olena Bracho, BS; Mikhail Marasigan, BS; Christine T. Dinh, MD*

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

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

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

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

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

Professional Practice Gap & Educational Need:

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

Learning Objective:

VS may have TSC properties that contribute to radiation resistance.

Desired Result:

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

Level of Evidence – N/A

Indicate IRB or IACUC: IRB#20150637

Recurrent Flight-Associated Facial Baroparesis Despite a Pressure Equalization Tube

Matthew Groysman MD; Nicholas Dewyer MD

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

Study Design: Retrospective case report

Setting: Academic Hospital

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

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

Main Outcome Measures: Resolution of flight-associated FB.

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

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

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

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

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

Level of Evidence - Level V

Indicate IRB or IACUC : Exempt.

Characterizing Human Vestibular Sensory Epithelia from Translabyrinthine Surgery

*Olivia A. Kalmanson, MD, MS; Frances Meredith, PhD; Tiffany Vu, BA
Samuel P. Gubbels, MD; Katie Rennie, PhD; Anna Dondzillo, PhD*

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

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

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

Results:

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

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

In the utricles of VS patients, average density of HCs was 0.25 \pm 0.19 cells per 100 μ m², ribbon synapses 10.1 \pm 7.5 per HC, and actin rods 0.27 \pm 0.31 per HC. As age increased, HC density decreased (p=0.04*). HC density did not correlate with Koos grade.

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

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

Learning Objective: Immunohistochemically examine human utricles and cristae

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

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

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

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

*Phillip Chung, BS; Elizabeth Bartlett, PhD; Suzan Parhizgar, MD; Megan Kuhlmeier, AuD
Francesca Zanderigo, PhD; Akiva Mintz, MD, PhD; Hae-Ok Ana Kim, MD*

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

Study Design: Observational longitudinal study.

Setting: Academic hospital.

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

Interventions: Cochlear implantation.

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

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

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

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

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

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

Level of Evidence – V

Indicate IRB or IACUC: Columbia University, IRB-AAAU0501

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

Jacob Schneider, BS; Maja Svrakic, MD, MEd

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

Study Design: Retrospective chart review and provider survey

Setting: Tertiary care center

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

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

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

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

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

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

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

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

Level of Evidence – Level IV

Indicate IRB or IACUC : Exempt

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

*Swar Vimawala, MD; Shivani Raizada; Alexander Luryi, MD
Donald Solomon, MD*

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

Study Design: Retrospective Review

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

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

Interventions: None

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

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

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

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

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

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

Level of Evidence - Level IV

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

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

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

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

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

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

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

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

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

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

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

Level of Evidence – N/A.

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

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

*Bailey H. Duhon, MS; Melanie Fisher; Kristin Thompson Thomas Fox
Vivian F. Kaul, MD; Arunark Kolipaka, PhD; Yin Ren, MD, PhD*

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

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

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

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

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

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

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

Level of Evidence - Level IV

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

Stria Vascularis Integrity in Implanted Cochlea: Histopathological Temporal Bone Study

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

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

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

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

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

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

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

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

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

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

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

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

*Nanki Hura, MD; Katie S. Traylor, DO; William A. Curry, MD
Georgios A. Zenonos, MD; Paul A. Gardner, MD
Andrew A. McCall, MD*

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

Study Design: Retrospective case series

Setting: Tertiary referral center

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

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

Main Outcome Measures: CSF leak rate

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

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

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

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

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

Level of Evidence – Level IV

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

Histiocytosis of the Temporal Bone in Children – A Systematic Review

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

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

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

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

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

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

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

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

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

Level of Evidence – Level III; Systematic Review

Indicate IRB or IACUC : Exempt

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

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

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

Study Design: Retrospective case series.

Setting: Academic tertiary medical center.

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

Interventions: Transmastoid labyrinthectomy with simultaneous cochlear implantation.

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

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

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

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

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

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

Level of Evidence – Level V

Indicate IRB or IACUC : HUM00235247 – University of Michigan

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

*Victor de Cos, BS; Christopher Hattori, BS; Omid Moshtaghi, MD
Peter Dixon, MD; Jeffrey P. Harris, MD, PhD, FACS*

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

Study Design: Retrospective review

Setting: Single tertiary care institution

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

Interventions: Diagnostic

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

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

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

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

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

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

Level of Evidence – Level IV

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

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

*J. Dixon Johns, MD; Christopher Zalewski, PhD; Noelle Allemang, AuD
Maxwell Laws, MD; Ihika Rampalli, BS; Prashant Chittiboina, MD
H. Jeffrey Kim, MD*

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

Study Design: Prospective natural history study of NF2.

Setting: Quaternary research center.

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

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

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

Results: Initial and final tumor volumes (mm³) for right (1700.82±3716.192 vs. 2443.59±4208.71) and left (1323.55±2095.49 vs. 2261.38±3340) CVS were calculated, respectively. Specific growth rates (SGR) were calculated for right (3.87year⁻¹±2.30), left (4.21year⁻¹±2.45) and total CVS tumor volume (5.05year⁻¹±2.29). Increases in total CVS tumor volume significantly correlated (p<0.05) with decreases in high velocity step acceleration peak eye velocity and mid- to high-frequency angular VOR gain (0.02-0.64Hz). There were no statistically significant associations between ipsilateral tumor SGR and audiometric pure-tone averages or caloric peak eye velocity (p>0.05).

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

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

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

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

Level of Evidence: III

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

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

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

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

Study Design: Retrospective cohort study.

Setting: Single institution tertiary care center.

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

Interventions: Time after CI activation.

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

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

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

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

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

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

Level of Evidence - Level IV – Retrospective cohort

Indicate IRB or IACUC : Emory University IRB #00107266

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

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

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

Study Design: Retrospective cohort

Setting: Single institution tertiary care center

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

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

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

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

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

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

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

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

Level of Evidence - Level IV – Retrospective cohort

Indicate IRB or IACUC : Emory University IRB #00107266

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

*Lauren H. Tucker, BA; Maehar R. Grewal, MD
Michael W. Denham, MPhil; Katharine K. Brewster, MD
Justin S. Golub, MD, MS*

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

Study Design: Cross-sectional epidemiologic study

Setting: Tertiary care academic practices

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

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

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

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

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

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

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

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

Level of Evidence: IV

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

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

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

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

Study Design: Retrospective cohort study.

Setting: Academic tertiary healthcare center.

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

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

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

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

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

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

Level of Evidence - Level V

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

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

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

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

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

Setting: Household interviews and mobile examination sites.

Patients: Adults aged ≥ 70 years and older.

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

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

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

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

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

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

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

Level of Evidence: Level I

Indicate IRB or IACUC: Exempt.

Metastasis to the External Auditory Canal: A Systematic Review

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

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

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

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

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

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

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

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

Learning Objective:

- 1) Identify characteristics of EAC metastasis: common pathologic subtypes and sites of the primary malignancy
- 2) Understand presenting otologic symptoms, examination, and imaging findings seen in EAC metastasis
- 3) Recognize palliative treatment strategies and prognosis of EAC metastasis

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

Level of Evidence – N/A- Systematic Review

Indicate IRB or IACUC : Exempt

Electrode Array Position within the Scala Tympani Correlates with Hearing Preservation

*Miriam R. Smetak, MD, MS; Zachary H. Douglas, MD
Matthew Shew, MD; Cameron C. Wick, MD; Jacques Herzog, MD
Craig A. Buchman, MD; Nedim Durakovic, MD*

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

Study Design: Retrospective cohort study.

Setting: Tertiary academic center.

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

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

Main Outcome Measures: Postoperative preservation of acoustic hearing.

Results: Ninety-five patients met inclusion and exclusion criteria, and hearing was preserved in 25 (26%). Electrode arrays located near the modiulus and cochlear floor demonstrated improved HP compared to those in an anti-modiolar position and in closer proximity to the basilar membrane ($r^2=0.31$, $p<0.01$ and $r^2=0.32$, $p<0.01$ respectively) with an apparent dose-response relationship.

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

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

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

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

Level of Evidence - III

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

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

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

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

Study Design: Retrospective cohort study.

Setting: Tertiary single-academic institution.

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

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

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

Results:

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

Conclusions:

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

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

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

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

Level of Evidence – Level V

Indicate IRB or IACUC : IRB #180978

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

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

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

Study Design: Retrospective cohort study.

Setting: Tertiary single-academic institution.

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

Interventions: Middle cranial fossa approach for resection of VS.

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

Results:

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

Conclusions:

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

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

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

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

Level of Evidence – Level V

Indicate IRB or IACUC : IRB #180978

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

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

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

Study Design: Retrospective cohort study

Setting: Single institution, quaternary care center

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

Interventions: None

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

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

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

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

Learning Objective:

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

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

Level of Evidence – Level III

Indicate IRB or IACUC : Exempt

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

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

Objective: To identify the prevalence of positive autoimmune laboratory markers in idiopathic sudden sensorineural hearing loss (iSSNHL) and its impact on hearing prognosis.

Study Design: Retrospective cohort database study

Setting: A collaborative national database (TriNetX) sourced from 79 large healthcare organizations in the United States.

Patients: Adults (≥ 18 years old) diagnosed with iSSNHL (ICD-10 H91.2) treated with systemic steroids.

Interventions: Autoimmune laboratory markers and salvage intratympanic (IT) steroids for SSNHL (CPT 69801).

Main Outcome Measures: 1) Positivity of autoimmune laboratory markers—Rheumatoid factor (RF), ANCA, DNA double strand Antibody (Ab), Sjogren Syndrome A and B Abs, SCL-70 Ab, Cardiolipin IgG Ab, Jo-1 Ab, ANA, Mitochondria Ab; 2) Percent of patients that underwent salvage IT steroids, utilized as a proxy for hearing outcomes.

Results: Subjects with iSSNHL ($n=1,036$) were approximately 6 times more likely to be positive for at least one autoimmune laboratory marker compared to subjects without iSSNHL ($n=76,750$; 4.4% vs. 0.7%, $p<0.0001$). Of those with iSSNHL who received systemic steroid treatment, subjects with positive autoimmune markers ($n=919$) underwent salvage IT steroids at a similar rate to those with negative autoimmune markers ($n=41,747$; 14.5% vs. 13.2%, $p=0.25$). However, subjects with positive autoimmune markers underwent slightly more instances of IT steroids compared to those with negative autoimmune markers (0.38 vs. 0.30 injections/person, $p=0.034$).

Conclusions: Patients with iSSNHL have a significantly higher prevalence of positive autoimmune laboratory markers compared to the general population, however the presence of these markers does not predict treatment response or prognosis. Specifically, autoimmune markers did not predict the need for salvage IT steroids in iSSNHL. Although subjects with positive autoimmune markers underwent marginally more injections per person, this is unlikely to be clinically significant. Autoimmune laboratory testing may be useful in iSSNHL patients with additional symptoms suspicious for an autoimmune disorder. A generalized screening is not recommended as it is unlikely alter management or prognosis.

Professional Practice Gap & Educational Need: Previous studies have demonstrated an association between iSSNHL and systemic autoimmune disorders, however current AAO-HNS clinical practice guidelines recommend against obtaining routine laboratory tests in the workup of iSSNHL given the lack of treatment benefit with positive test results. There has been no large national database study analyzing the prevalence of positive autoimmune markers and its impact on iSSNHL prognosis.

Learning Objective: 1) Demonstrate the prevalence of positive autoimmune markers in iSSNHL compared to the general population. 2) Evaluate the impact of positive autoimmune markers on iSSNHL hearing prognosis and whether generalized autoimmune laboratory testing is appropriate.

Desired Result: Attendees will understand that generalized autoimmune marker testing in iSSNHL will not likely change prognosis or management. However, testing could be considered in select iSSNHL patients with other systemic autoimmune symptoms to aide in diagnosis given the higher prevalence of positive markers in iSSNHL.

Level of Evidence - IV

Indicate IRB or IACUC : Exempt

Characterizing the Predictive Power of Reported Auditory Symptom Resolution in the Immediate Post-Operative Period for Superior Canal Dehiscence Syndrome

Oren Wei, BS; Desi P. Schoo, MD; Jenny X. Chen, MD, EdM
Alexander Chern, MD; John P. Carey, MD

Objective: To determine if auditory symptom relief in the immediate post-operative period predicts longer-term relief for patients with superior canal dehiscence syndrome (SCDS).

Study Design: Retrospective case series.

Setting: Tertiary referral center.

Patients: Adults who underwent unilateral SCDS surgery between June 2021 and June 2023.

Interventions: Surgery for SCDS.

Main Outcome Measures: Patient-reported symptoms collected from pre-operative, immediate post-operative (<24 hours), and longer-term postoperative (12 weeks) clinical notes. Postoperative symptoms were categorized as no improvement from pre-operation, some relief, significant relief, and complete relief.

Results: Fifty-six patients (40 female, average age 49 years) underwent unilateral SCDS surgery (37 left, 19 right). Forty-seven (83.9%) approaches were middle fossa and 9 (16.1%) were transmastoid. Auditory symptoms of autophony, somatosounds, and pulsatile tinnitus were reported by 98.2%, 96.4%, and 73.2% of patients, respectively. For autophony, 52 (94.5%) patients reported significant or complete symptomatic relief at 12 weeks. Of these, 100% reported at least some relief within 24 hours of surgery. One patient reported no improvement of their autophony within 24 hours and subsequently no relief at 12 weeks. Patients who reported significant or complete relief within 24 hours were more likely to report significant or complete relief at 12 weeks (OR: 32.7, 95% CI: 2.3-471.0, $p=0.005$). Somatosounds showed a similar response rate at 12 weeks (96.3%) with all patients reporting improvement at 24 hours. Pulsatile tinnitus responses suggested delayed improvement with 70.7% reporting significant or complete relief at 12 weeks, 44.8% of whom reported improvement at 24 hours.

Conclusions: Auditory symptom improvement in the immediate post-operative period strongly predicts longer-term auditory symptom relief.

Professional Practice Gap & Educational Need: Superior semicircular canal surgery is considered the definitive treatment for patients with SCDS; however, some report persistent symptoms postoperatively. Determining the timeline for perioperative symptom response and its association with long-term symptom control may allow surgeons to prognosticate outcomes.

Learning Objective: To provide insights into how reported symptom resolution in the perioperative period may predict long-term symptom response for SCDS patients.

Desired Result: Participants will gain an understanding of the relationship between immediate post-operative and long-term symptom outcomes in SCDS patients.

Level of Evidence - V

Indicate IRB or IACUC : Johns Hopkins University School of Medicine Institutional Review Board (IRB00324480)

Effects on Hearing of Ventriculoperitoneal Shunt Placement in Patients with Normal Pressure Hydrocephalus: A Prospective Cohort Study

*Emily Wang, MD; Rosaly Goyette; André Turmel, MD; Paule Lessard-Bonaventure, MD
Louis Verret, MD; Yannick Nadeau, MD; Sylvie Nadeau, MD*

Background : Normal pressure hydrocephalus (NPH) is defined by a triad of dementia, gait disturbance and urinary incontinence. Treatment usually implies surgery for ventriculoperitoneal shunt placement. Complaint of subjective hearing loss is a frequent complication following ventriculoperitoneal shunt for NPH. It is seldom documented with audiometric testing.

Objective: We aim to determine the incidence of hearing loss after ventriculoperitoneal shunt placement in patients with normal pressure hydrocephalus

Study Design: Prospective cohort study

Setting: Tertiary academic reference center, ambulatory setting

Patients: patients aged from 65 to 85 years old with normal pressure hydrocephalus

Interventions: ventriculoperitoneal shunt placement

Main Outcome Measures: audiograms before the surgery and at 3 months post-operatively

Results: Preliminary data in our consecutive series of 10 patients that underwent ventriculoperitoneal shunt placement showed that all patients had hearing loss on preoperative audiogram. 60% are female and the mean age is 74 years old. Two patients complained of worsening hearing loss and one complained of aural plenitude. One patient developed significant asymmetrical hearing loss on post-operative audiogram three months following shunt placement. Loss of 35 dB was noted in the right ear for 250 Hz, 20 dB at 500 Hz, and 15 dB at 8000 Hz. Interaural difference of 40 dB at 250 Hz and 25 dB at 500 Hz. The left ear was stable. Nine other patients did not show significant hearing loss on post-operative audiometric testing.

Conclusions: Persistent and severe hearing loss seems to be under-documented in this at-risk population.

Professional Practice Gap & Educational Need: There is a limited number of case reports and case series documenting hearing loss following ventriculoperitoneal shunt placement. Audiograms are not routinely performed post-operatively for these patients.

Learning Objective: To describe the impact of procedures causing variation in cerebrospinal fluid pressure like ventriculoperitoneal shunt placement on hearing.

Desired Result: Integrate audiometric testing and otologic follow-up as part of a comprehensive management of patients undergoing shunt placement for normal pressure hydrocephalus. To raise awareness for providers of otologic service on the possible impact of shunt placement on hearing.

Level of Evidence – Level III

Indicate IRB or IACUC : Approved IRB00001242, CHU de Québec-Université Laval

Vestibular Migraine Among Dizzy Patients: A Single Institution Study

*Mustafa G. Bulbul, MD, MPH; Benjamin Clark, BS
Dominic Coutinho, BS; Brian M. Kellermeyer, MD*

Objective: To facilitate the diagnosis of vestibular migraine (VM) among new patients presenting with dizziness to Otolaryngology (as per criteria of the Barany and International Headache Society) and estimate prevalence of VM and other causes of dizziness in our clinic.

Study Design: Retrospective cohort study

Setting: Tertiary academic center

Patients: Adults (≥ 18 years old) presenting with a complaint of dizziness.

Intervention: We designed a survey to be provided to new patients presenting with a complaint of dizziness.

Main Outcome Measures: Prevalence of VM and other causes of dizziness amongst all dizzy patients presenting to our clinic, proportion of VM patients meeting diagnostic criteria.

Results: Eighty-nine patients were included in our study. Benign paroxysmal positional vertigo (BPPV) accounted for 22.5%, Meniere's for 14.6%, VM for 13.5% and vestibular neuritis for 9% of patients with dizziness. Of the patients with VM, 4 patients met the criteria for VM and 2 for probable VM; the remaining 6 patients did not meet the full criteria but were not better accounted for by another diagnosis. Of the BPPV patients, 7 reported migraines with symptoms and 4 associated symptoms with vertigo. Interestingly, 4 patients were diagnosed with cerebrovascular accident which was confirmed on imaging.

Conclusions: Surveys assist in identifying the different causes of dizziness and may help prevent important misses like cerebrovascular accidents. Even though 13.5% were diagnosed with VM, only 6/12 patients met the full criteria for probable VM or VM. Criteria for VM are strict and may miss a significant number of patients eligible for treatment.

Professional Practice Gap & Educational Need: VM is the most common cause of episodic dizziness, affecting around 2.7% of US adults. The diagnostic criteria for VM were first published in 2012 by Barany society and International Headache Society with a recent update in 2021 that was essentially with no changes. Previous studies have shown the criteria to be stringent and highly likely to exclude VM patients that might benefit from treatment. In a busy Otolaryngology practice, it might be hard to elicit all the symptoms needed for the diagnosis, thus we developed a survey to better capture patient complaints and accurately estimate the prevalence of VM in our clinic.

Learning Objective: Surveys are important adjuncts in identifying the diagnosis in dizzy patients. VM is hard to diagnose and is likely underdiagnosed due to stringent criteria which probably needs revised.

Desired Result: Adoption of surveys in Otolaryngology clinics for dizzy patients. Revision of VM diagnostic criteria.

Level of Evidence – Level III

Indicate IRB or IACUC: IRB approval was obtained (WVU Protocol #2106339604 September 29, 2021)

Surgical Characteristics, Complications and Outcomes with an Active Transcutaneous Bone Implant: A Systematic Review

Alma Jukic, BA; Christopher C. Munhall, MD; Shawn M. Stevens, MD

Objective: An active transcutaneous bone conduction device (BCD) was approved in 2019 in the US. This systematic review sought to evaluate early outcomes of Osia-2 implantation.

Data Sources: PubMed, Scopus, Cochrane CENTRAL, and CINAHL were queried using the search terms: active transcutaneous hearing device, bone conduction implant, hearing loss, conductive hearing loss, Osia, bone-anchored hearing aid through April 2023.

Study Selection: Studies were included if they described audiometric, surgical characteristics/complications, or adverse events associated with this BCD. Exclusion criteria included: non-English studies, nonhuman studies, reviews/meta-analyses, case reports, database studies.

Data Extraction: PRISMA guidelines were used to extract data from 18 studies. ROBINS-I tool was utilized to assess the risk of bias across seven domains: bias due to confounding, bias due to the selection of participants into the study, bias due to classification of interventions, bias from missing data, bias in outcome measurements, and bias in the selection of reported results.

Data Synthesis: A total of 836 studies were screened, and 18 met inclusion criteria. 336 patients were included. The average age was 37.9 years. 79.5% of patients had MHL/CHL and 19.5% had SSD/SHL. Mean operative time was 71.6 minutes. Mean PTA gain from unaided conditions was 35.4 dB. Mean PTA gain at high frequency (6k Hz and above) from aided conditions was 16.1 dB. Mean improvement in speech recognition thresholds was 19.1 dB from unaided conditions. Adverse events/complications occurred in 20.1% of cases. The global rate of postop infections for the included cohort was 5%. 2% of patients had magnet retention issues, while 1.65% of cases were complicated by hematomas.

Conclusions: Initial results of this new BCD show a low rate of postoperative complications, relatively short surgical time, and greater hearing restoration at higher frequencies.

Professional Practice Gap & Educational Need: Currently, there is no systematic review that describes the surgical characteristics and adverse events associated with this active, transcutaneous device. A need remains for synthesis of the available literature for the Osia-2 implant system.

Learning Objective: To review the various surgical characteristics, adverse events, and audiologic outcomes to help improve our current understanding of active, transcutaneous devices with piezoelectric technology.

Desired Result: Describe patient demographics, indications, operative findings, complications and audiometric outcomes associated with the Osia-2 implant.

Level of Evidence – III

Indicate IRB or IACUC: Exempt.

Outcomes after Microsurgery and Stereotactic Radiation for Vestibular Schwannoma: A Retrospective Multinational Database Analysis

*Heather J. Smith, BM; Jason L. Steele, BS; Mana Espahbodi, MD
Neil S. Patel, MD; Richard K. Gurgel, MD, MSCI*

Objective: To compare outcomes in patients with sporadic vestibular schwannoma (VS) treated with microsurgery and stereotactic radiotherapy (SRT) using a multinational database.

Study Design: Retrospective cohort

Setting: Patient data were identified from TriNetX, a global health research database with data from 117 million patients across 79 participating healthcare organizations. 95% of data used in this study were from 2005-2023.

Patients: Adults with benign neoplasm of cranial nerve (ICD-10 D33.3), used as an approximation for VS, with CPT codes for skull base microsurgery or SRT, without a diagnosis of neurofibromatosis type 2.

Interventions: Microsurgical resection and SRT

Main Outcome Measures: Risks of repeat treatment with microsurgery or SRT, tinnitus, dizziness, cranial nerve 3-7 dysfunction, meningitis, and hearing rehabilitation surgery

Results: 5,032 adults were identified who underwent microsurgery for initial treatment of VS (mean age at surgery 51.8 ± 13.9 years), and 1,541 patients initially treated with SRT (mean age at SRT 62.0 ± 13.2 years). Of the surgical cohort, 5.0% underwent repeat microsurgery (median time to treatment 68 days) and 3.1% underwent salvage SRT (median time 1.1 years). Of the SRT cohort, 2.1% had subsequent microsurgery (median time 2.8 years), while 2.2% had repeat SRT (median time 1.6 years). When matched for age, patients who underwent surgery had a higher risk of subsequent surgery than SRT patients (RR: 1.80, 95% CI: 1.15-2.81), but risk differences for subsequent SRT and for any further treatment were not significant. Patients treated with surgery were at higher risk than age-matched SRT patients for facial paralysis (RR: 4.32, 95% CI: 3.47-5.37), meningitis (RR: 5.23, 95% CI: 2.90-9.43), and cranial nerve 3-6 dysfunction (RR: 1.49, 95% CI: 1.04-2.14). SRT patients were at higher risk for tinnitus (RR: 0.77, 95% CI: 0.66-0.90). There was no significant difference between risk of dizziness between surgical and SRT treated cohorts.

Conclusions: Failure rates after treatment of sporadic VS in adults were less than 10%. Surgery-treated patients were at a higher risk than SRT-treated patients for complications including facial nerve dysfunction; this finding may be confounded by tumor size. SRT patients were at higher risk of tinnitus than surgery patients.

Professional Practice Gap & Educational Need: The decision of whether to surgically resect, radiate, or observe a VS is complex, and post-treatment outcomes are not fully understood. A better understanding of the risks of repeat treatments and other complications is necessary to guide decision-making.

Learning Objective: To examine risks of repeat treatments and other complications after VS treatment.

Desired Result: Attendees will have a better understanding of post-treatment outcomes in adults with sporadic VS.

Level of Evidence: Level IV

Indicate IRB or IACUC: Exempt

Treatment Outcomes in Patients with Neurofibromatosis Type 2-Associated Vestibular Schwannoma: A Retrospective Analysis using a Multinational Database

*Heather J. Smith, BM; Jason L. Steele, BS; Mana Espahbodi, MD
Neil S. Patel, MD; Richard K. Gurgel, MD, MSCI*

Objective: To compare outcomes in patients with neurofibromatosis type 2 (NF2)-associated vestibular schwannoma (VS) treated with microsurgery, stereotactic radiotherapy (SRT), and bevacizumab.

Study Design: Retrospective cohort

Setting: Patient data were identified from TriNetX, a global health research database with data from 117 million patients across 79 participating healthcare organizations. 95% of data included in this study were from 2009-2023.

Patients: Adults with ICD-10 and CPT codes for NF2, skull base microsurgical excision, SRT, and bevacizumab.

Interventions: Microsurgical excision, SRT, and bevacizumab

Main Outcome Measures: Rates of initial and repeat VS treatment, absolute and relative risks of tinnitus, dizziness, and cranial nerve 3-7 dysfunction.

Results: 3,530 adults with NF2 were identified (mean age at diagnosis 41.5±19.5 years, 55% female, 67% white). Of these, 8.13% underwent microsurgery and 1.36% underwent SRT for initial treatment of VS. Rates of subsequent VS treatment after initial surgery or SRT were 18.47% and 12.50%, respectively. These rates were higher than that of an age-matched cohort of sporadic VS patients (RR 2.40, 95% CI: 1.84-3.11 and RR 2.92, 95% CI: 1.33-6.40). Of 229 NF2 patients started on bevacizumab prior to any VS treatment, 4.8% subsequently underwent microsurgery and 1.3% underwent SRT. When compared with a cohort of 3,277 patients never on bevacizumab, 7.8% of those on bevacizumab underwent microsurgery and 1.7% underwent SRT, but the differences between these two cohorts were not statistically significant.

Conclusions: NF2 patients with VS were at higher risk than sporadic VS patients of repeat treatment. The rate of repeat treatment after surgery likely reflects a shift toward function preservation and subtotal tumor resection. Given that the rate of retreatment after SRT is higher than that for sporadic tumors, it remains likely that NF2-related VS are more radioresistant. The effect of bevacizumab on VS progression in NF2 patients remains unclear. Limitations of this study include small sample size of patients treated with bevacizumab and coding limitations.

Professional Practice Gap & Educational Need: A better understanding of the post-treatment outcomes of NF2-related VS is needed to guide decision-making. The use of bevacizumab in NF2 patients is promising, but its effect on tumor growth and need for treatment is not yet fully understood.

Learning Objective: To examine risks of repeat treatments and other complications after treatment of VS with observation, microsurgery, radiation, and/or bevacizumab in adults with NF2.

Desired Result: Attendees will have a better understanding of post-treatment outcomes in adults with NF2-related VS.

Level of Evidence: Level IV

Indicate IRB or IACUC: Exempt

Do Measurements of Vestibular Schwannoma Volume or Linear Dimension Better Predict Postoperative Outcomes?

*Heather J. Smith, BM; Jason L. Steele, BS; Nicole Ewer, BS; Mana Espahbodi, MD
Neil S. Patel, MD; Richard H. Wiggins, MD; Richard K. Gurgel, MD, MSCI*

Objective: To examine the relationship between vestibular schwannoma (VS) volume, greatest linear dimension, and outcomes after microsurgical resection.

Study Design: Retrospective chart review

Setting: Tertiary academic referral center

Patients: Patients with histologically-confirmed VS who underwent microsurgical resection between 2016 and 2018.

Interventions: Microsurgical resection of VS

Main Outcome Measures: Preoperative greatest linear dimension in the axial plane and tumor volume (total and anterior to a line drawn through the midpoint of the internal auditory canal) measured using manual three-dimensional volumetric analysis of heavily-weighted T2 MRI images; preoperative and postoperative House-Brackmann (HB) facial nerve function, divided into the following groups: HB 1-2 or $HB \geq 3$; postoperative complications.

Results: 105 subjects were identified who underwent VS resection (55.2% female, 90.5% white, mean age at surgery 46.3 ± 14.1). Median tumor volume was 0.61 cm^3 (interquartile range [IQR] 0.12-4.48), and median greatest linear dimension was 1.56 cm (IQR 0.91-2.63). Twenty subjects (19%) experienced postoperative complications; 12 of these were cerebrospinal fluid (CSF) leaks. Nearly all (99.0%) patients had HB 1-2 facial nerve function preoperatively; 63.1% and 67.6% of patients had HB 1-2 facial nerve function immediately postoperatively and at the last follow-up (median follow-up 12.0 (IQR 2.25-37.00) months), respectively. On univariate logistic regression analysis, tumor volume was associated with immediate postoperative facial nerve function (OR 1.19, 95% CI 1.07-1.31), and facial nerve function at last follow-up (OR 1.12, 95% CI 1.03-1.21), but was not associated with incidence of CSF leak. Greatest linear dimension and anterior tumor volume were also associated with immediate and last follow-up postoperative facial nerve function on univariate analyses. On multivariate binary logistic regression including greatest linear dimension and anterior tumor volume, tumor volume was not associated with immediate postoperative facial nerve function, but remained associated with facial nerve function at last follow-up (OR 1.31, 95% CI 1.02-1.69). Greatest linear dimension was not associated with facial nerve function at either timepoint on multivariate analysis.

Conclusions: Larger VS tumor volumes were significantly associated with HB 3-6 facial nerve function at last follow up after microsurgical resection, but greatest linear dimension of the tumor was not. Tumor volumes were not associated with CSF leak.

Professional Practice Gap & Educational Need: Associations between VS diameter and postoperative facial nerve outcomes have been frequently reported in the literature. There is limited data available regarding VS tumor volume and postoperative outcomes. Using volumetric analysis to accurately measure tumor volume may help inform decision-making and patient counseling.

Learning Objective: To explore the associations between VS volume, diameter, and postoperative outcomes.

Desired Result: Attendees will have a better understanding of volumetric tumor analysis and its utility in predicting postoperative outcomes.

Level of Evidence: IV

Indicate IRB or IACUC: IRB_00045048; University of Utah

Geographic Distribution of US Veterans with Severe Hearing Loss and Associated Treatment

*Sarah E. Loheide, BS; Andrew Nicholson, MSPH; Scott E Sherman, MD
Joshua Chodosh, MD; David R. Friedmann, MD*

Objective: The VA is the largest health care system in the US and offers comprehensive hearing services. In this study, we map and analyze geographic variations in treatment among US Veterans with severe hearing loss.

Study Design: Retrospective cohort

Setting: Tertiary referral centers

Patients: US Veterans with severe or worse hearing loss (four frequency pure tone average > 70 dB HL) and bilateral speech recognition scores < 50% between 2015-2019.

Interventions: Therapeutic

Main Outcome Measures: Primary outcome of this study is the geographic distribution of Veterans with severe hearing loss and treatment received (hearing aids or cochlear implants) while accounting for rural status, Veterans Integrated Services Networks (VISN) classification and distance to VA CI facilities. VA Audiometric Repository data was analyzed using Geographic Information System (GIS) software.

Results: 34,793 US Veterans were included and 1,112 received CI. Significantly more CI recipients lived in urban areas compared to rural ($X^2 = 6.04$, $p = 0.0487$). There was no significant difference between patients with and without CI in driving time or distance to primary care center ($t = -1.28$, $p = 0.1994$ and $t = -1.06$, $p = 0.2889$ respectively). Capitol Health Care Network (VISN 5) had the greatest proportion of SHL patients receiving CI (6.6%) and NY/NJ Health Care Network (VISN 3) had the lowest (1.1%).

Conclusions: While Veterans in this cohort resided predominantly in urban areas, the proportion receiving CI was similar across rural classifications. Variations in CI frequency by VISN may reflect differences in access rather than burden of disease. This highlights how geography may influence practice variations in treatment.

Professional Practice Gap & Educational Need: US Veteran hearing healthcare accessibility

Learning Objective: Convey the geographic distribution of US Veterans with severe hearing loss and the rates of cochlear implantation within this population using variables that relate to patient access to hearing health care.

Desired Result: Identify geographic patterns that influence Veteran access to treatment modalities for severe hearing loss and highlight any potential gaps in care.

Level of Evidence – Level III

Indicate IRB or IACUC : New York Harbor VA Health Care System #1575049-13. Approved on 10/1/2018

Performance Following Cochlear Reimplantation Utilizing a Different Manufacturer

*Justin Cottrell, MD; Emily Spitzer, AuD; Bruce Gantz, MD
Jacques Herzog, MD; Craig Buchman, MD; Susan Waltzman, PhD
J. Thomas Roland Jr., MD*

Objective: To better understand cochlear implant (CI) performance following reimplantation with a different device manufacturer.

Study Design: Multicenter retrospective case review

Setting: Tertiary referral centers

Patients: Patients greater than four years of age who received a CI and subsequently underwent CI re-implantation with a different manufacturer over a 20-year period.

Interventions: *NA*

Main Outcome Measures: Difference in the best CNC score obtained with the primary CI, compared to the most recent CNC score obtained following reimplantation.

Results: The best average CNC score achieved by adult patients following primary cochlear implantation was 46.2% (n=16), measured an average of 14 months (range: 3 -36 months) post-operatively. When looking at the most recent CNC score of adult patients prior to undergoing reimplantation, the average CNC score dropped to 19.2% (n=17). Following reimplantation, the average 3–6 month CNC score was 48.3% (n=12), with most recent average CNC score being 44.4% (n=17) measured an average of 19 months (range: 3 – 46 months) post-operatively. There was no statistically significant difference ($p=0.321$; $t(11)=0.48$) identified in performance between the best CNC score achieved by adult patients following primary cochlear implantation, and the most recent score achieved following reimplantation (n=12). Analysis of pre- and post-revision speech performance was not possible in pediatric patients (<18yo) due to differences in tests administered.

Conclusions: Cochlear reimplantation with a different manufacturer is a viable option for patients when CI reimplantation is considered.

Professional Practice Gap & Educational Need: Studies looking at re-implantation outcomes demonstrate that most patients achieve similar or improved performance following revision surgery. Although the majority of patients choose a new device from the same manufacturer, a subset of patients may choose a different device manufacturer for a variety of reasons. Factors that may affect post-implantation speech performance following manufacturer change are not well characterized in the reimplantation literature.

Learning Objective: To understand speech performance outcomes and considerations when completing cochlear reimplantation with a different manufacturer.

Desired Result: Improved patient communication and surgical decision making when faced with cochlear implant failure and indication for reimplantation.

Level of Evidence – Level III

Indicate IRB or IACUC : IRB # s22-01390 at NYU Langone Health

Accuracy of Trans-Impedance Matrix for Cochlear Implantation in Patients with Abnormal Anatomy: Characterizing Patterns and Sensitivity

*Justin Cottrell, MD; Arianna Winchester, MD; Daniel Jethanamest, MD
Mario Svirsky, PhD; William Shapiro, AuD
Sean McMenomey, MD; J. Thomas Roland Jr., MD*

Objective: To assess false positive and negative rates of trans-impedance matrix (TIM) heatmap interpretation within patients at risk of labyrinthine abnormality, to better understand characteristic TIM heatmap patterns, and potential limitations.

Study Design: Single center retrospective case review

Setting: Tertiary referral center

Patients: Patients >6 months of age at risk for labyrinthine abnormality that underwent cochlear implantation and had both TIM testing and post-operative x-ray available.

Interventions: NA

Main Outcome Measures: TIM heatmap assessment was compared to post-operative x-ray assessment to determine the false positive and negative rates of TIM.

Results: Seventy-seven patients were evaluated. Twenty-five percent (n=19) of patients had a concern for an abnormal TIM pattern, which were further analyzed and separated into eleven novel and mutually defined objective categories. Overall, 9% (n=6) of electrodes were malpositioned on intra-operative x-ray, of which 50% (n=3) were under inserted, 17% (n=1) were over inserted, 17% (n=1) demonstrated a tip foldover, and 17% (n=1) demonstrated a coiled electrode. The false positive TIM rate was 18% (n=14), and false negative TIM rate was 3% (n=2) for the entire cohort.

A newly defined skip heat pattern was identified in patients with IP2/Mondini malformation and interscalar septum width <0.5mm at the cochlear pars ascendens.

Conclusions: Sensitivity for tip foldover remained high. Detection of under and over insertion was low, and false positive rate was moderate. Novel objective patterns for TIM heatmap characterization is provided to facilitate comparative research moving forward. In doing so, a newly described pattern termed skip heat with potential anatomic explanation and clinical relevance is highlighted.

Professional Practice Gap & Educational Need: Trans-impedance matrix (TIM) technology has demonstrated high sensitivity and specificity for detection of electrode malposition within the normal cochlea, and is used as a sole modality of electrode placement confirmation at some centers. The effect of labyrinthine abnormality on TIM performance is poorly understood and is important for ensuring optimal placement in this patient cohort.

Learning Objective: To better understand TIM heatmap interpretation in patients at risk of labyrinthine abnormality.

Desired Result: Improved understanding of the strengths and limitations of TIM heatmap technology to optimize cochlear implant electrode placement.

Level of Evidence – Level III

Indicate IRB or IACUC : IRB S23-00953 at NYU Langone Health

An Investigation of Robotic Assisted vs Manual Cochlear Implant Insertion Forces

Nathan C. Kemper, MD; Allan M. Henslee, PhD; Marlan R. Hansen, MD

Hypothesis: We hypothesize that robotic insertion (either skull-mounted or handheld) of a cochlear implant (CI) electrode array will decrease the maximum insertion force and variation compared to manual insertion.

Background: Although advances in CI technology have established “hearing preservation” techniques to reduce intracochlear trauma, outcome variability remains high. To address this issue, a robotics-assisted insertion system was designed to aid the surgeon in inserting CI electrode arrays with consistent speeds. This study evaluates whether robotic skull-mounted vs. handheld vs. manual insertion techniques affect the maximum insertion force and variability.

Methods: Three surgeons with varying otologic surgical experience were tasked with manual (n=18) and fixated robotic assisted CI insertions (n=18) in a standardized 3D-printed synthetic cochlea. Insertion forces were characterized with a load cell detecting both maximum insertion force (mN) and force variation (mN/sec). A third sample using a handheld robotic insertion is being collected currently.

Results: The robotic assisted system showed a statistically significant reduction in the insertion force variation of 24.3 mN vs 109.5 mN ($p < 0.001$) at 0.1 mm/sec, and 32.1 mN/sec vs 105.0 mN/sec ($p = 0.007$) at 1.0 mm/sec. Similarly, it showed a statistically significant reduction in the maximum insertion force of 32.1 mN vs 64.9 mN ($p = 0.049$) at 0.1 mm/sec, and 32.9 mN vs 48.0 mN ($p = 0.046$) at 1.0 mm/sec.

Conclusions: These results indicate a significant reduction in maximum force and force variation with a robotic insertion versus current manual insertions. Robotics-assisted results may indicate the ability to improve patient outcomes with hearing preservation techniques.

Professional Practice Gap & Educational Need: Current manual CI implantation techniques can result in high maximum insertion forces and variations due to human kinematics and tremor, despite experience. We seek to demonstrate how the implementation of a fixated or handheld robotic device vs. manual insertion technique can significantly decrease insertion forces.

Learning Objective: To demonstrate an atraumatic robotic CI implantation technique, significantly decreasing both maximum insertion force and force variation.

Desired Result: Increase participant understanding of novel “trauma reduction” implantation techniques with a robotic system to decrease cochlear trauma.

Level of Evidence - Level V

Indicate IRB or IACUC : Exempt

Exploring Meniere's Disease Treatment Patterns Among Neurotologists

*Karen Tawk, MD; Joshua K. Kim, BS; Harrison W. Lin, MD
Mehdi Abouzari, MD, PhD; Hamid R. Djalilian, MD*

Objective: To document current treatment practices for Meniere's disease (MD) among members of the American Neurotology Society (ANS).

Methods: An online survey was conducted among 304 ANS members to capture their treatment patterns in caring for MD patients.

Results: Sixty-two (20%) surveys were completed by ANS members. Among these respondents, 52% worked in academic practices while 34% practiced in private settings. Notably, 57% had over a decade of clinical experience and 47% managed large cohorts of patients (>50 cases) annually. As a first-line treatment approach for MD, 97% recommended MD diet and lifestyle modifications, while 50% opted for migraine diet and lifestyle modifications, and 39% prescribed diuretics. As for second-line treatments, diuretics (47%), intratympanic (IT) steroids (32%), betahistidine (29%), and migraine prophylactic medications (28%) were the prominent choices. For MD cases unresponsive to medication, 70% of respondents chose IT steroids, while other choices included migraine diet and lifestyle modifications (45%) and migraine prophylactic medications (32%). If surgical management failed, 57% opted for reoperation with a different surgical approach. When confronted with bilateral MD, respondents recommended MD diet and lifestyle modifications (95%), diuretics (53%), and migraine diet and lifestyle modifications (52%) as the first-line treatment, with IT steroid as the preferred second-line option (40%). Finally, when one side was deaf due to MD and the other developed MD, 52% advocated for migraine diet and lifestyle modifications and 26% suggested migraine prophylactic medications as the first-line approach.

Conclusion: The current patterns of care for MD from a sample of ANS members reveal an increasing trend in the use of migraine diet and lifestyle modifications and prophylactic medications. These findings will guide the development of a new comprehensive treatment algorithm for MD patients.

Define Professional Practice Gap & Educational Need: The pathophysiology and management of MD have remained a subject of debate. Previous studies have highlighted the challenges in treating MD patients due to the absence of a definitive treatment algorithm. Consequently, there is a need to capture the current treatment patterns among experts in the field of neurotology to develop a definitive treatment approach.

Learning Objective: To propose a treatment algorithm for MD patients based on the practice patterns among ANS members, particularly considering evolving pathophysiological theories. This implies the development of a more comprehensive management approach for MD patients while staying informed of the latest recommendations.

Desired Result: Informing neurotologists of current treatment practice patterns for MD among members of the ANS that could guide the development of a treatment algorithm to improve the management of patients with MD.

Level of Evidence – Not applicable.

Indicate IRB or IACUC: Not applicable.

Intracochlear Electrocochleography Estimates Favorability of Intrascalar Position with the Slim Modiolar Electrode

*Jordan J. Varghese, MD; Tim Holden, BSE; Matthew A. Shew, MD
Cameron C. Wick, MD; Jacques A. Herzog, MD;
Nedim Durakovic, MD; Craig A. Buchman, MD*

Objective: To evaluate the degree that intracochlear electrocochleography (ECoChG) estimates favorable intrascalar position of the slim modiolar electrode (SME) on postoperative computed tomography (CT).

Study Design: Prospective cohort.

Setting: Tertiary referral center.

Patients: Sixteen adult cochlear implant (CI) recipients implanted with the SME from July 2022 to September 2023.

Interventions: Intraoperative ECoChG monitoring with tone-bursts presented from 250 Hz to 2 kHz at 108 to 114 dB HL and intracochlear recordings off the SME. A fast Fourier transform (FFT) allowed for frequency-specific evaluation of ECoChG response and patterns were identified based on tonotopic expectations.

Main Outcome Measures: Postoperative CT was used for intracochlear measurements. An unfavorable position was indicated by proximity to the basilar membrane (i.e., high vertical displacement) and an anti-modiolar position (i.e., high lateral displacement). The middle third of the array had the greatest variability in intrascalar position at a clinically critical portion of the cochlea.

Results: Seven patients had tonotopic ECoChG patterns and nine had non-tonotopic patterns. Independent sample t-test evaluated the difference in intrascalar position for the middle third of the SME. Non-tonotopic cases (mean lateral displacement=0.51, SD=0.08) were positioned more anti-modiolar compared to tonotopic cases (mean=0.41, SD=0.06; mean difference=0.10, 95%CI: 0.02 to 0.17). Non-tonotopic cases (mean vertical displacement=0.56, SD=0.08) were closer to the basilar membrane compared to tonotopic cases (mean=0.47, SD=0.08; mean difference=0.09, 95%CI: 0.01 to 0.18).

Conclusions: Intracochlear ECoChG provides insight into intrascalar SME position. Early findings suggest that tonotopic ECoChG indicates the array is closer to the modiulus and the cochlear floor.

Professional Practice Gap & Educational Need: Variability in intracochlear position contributes to CI performance outcomes. Given the microscopic and delicate anatomy of the cochlea, malposition of the internal array during insertion is a valid concern and there is minimal feedback available to the surgeon about final array position. Intraoperative ECoChG provides real-time feedback that gives an “electrophysiologic window” into CI seating within the cochlea. This study prospectively evaluated the degree by which ECoChG patterns predict position of the internal array on postoperative imaging.

Learning Objective: To better understand the utility of intracochlear ECoChG on estimating SME position in real-time.

Desired Result: Clinical practitioners and researchers will gain deeper understanding of the unique value and feasibility of ECoChG during cochlear implantation for predicting clinical outcomes and providing real-time surgical feedback. This knowledge could be an important factor to guide future decisions regarding the utility of electrophysiology monitoring programs with ECoChG at CI centers.

Level of Evidence – Level III

Indicate IRB or IACUC: Washington University in St. Louis IRB #202007087 (Initial approval on 08/06/2020; Continuing review approved on 05/16/2023)

Big Data Analysis of Surgical Outcomes Between Microsurgery and Stereotactic Radiosurgery for Patients with Acoustic Neuroma

Robert E. Africa, MD; Brian J. McKinnon, MD, MPH, MBA

Objective: To evaluate the functional outcomes, debilitation, and risks between microsurgery and stereotactic radiosurgery (SRS) in a large multicenter database.

Study Design: Retrospective cohort study with deidentified data

Setting: 79 healthcare centers in the U.S. TriNetX Database

Patients: 712 patients who were diagnosed with acoustic neuroma

Interventions: Microsurgery vs SRS

Main Outcome Measures: The differences in functional outcomes, debilitation, and risks including dysarthria, dysphagia, the need for facial nerve reanimation, re-intervention with the other treatment, the need for physical/occupational therapy, and tinnitus. All outcomes were measured at 6 months, 1 year, 3 years, 5 years, and 10 years posttreatment as relative risks (RR).

Results: Propensity score matching created two statistically similar cohorts with either intervention. Primary microsurgery was associated with a higher rate of functional impairments at 6 months including dysphagia (RR: 3.4; 95% CI: 1.71-6.78), facial nerve reanimation (RR: 2.7; 95% CI: 1.33-5.50), and the need for physical therapy/occupational therapy (RR: 13.5; 95% CI: 7.27-25.07). The rate of tinnitus after microsurgery was initially higher up to 1 year (RR: 1.3; 95% CI: 1.03-1.65), but at 3 years the rate was similar with SRS (RR: 1.18; 95% CI: 0.96-1.45). Microsurgery after SRS was significant at 5 years (RR: 0.05; 95% CI: 0.003-0.81). Radiation after microsurgery was significant after 10 years (RR: 2.7; 95% CI: 1.33-5.50). Dysarthria was similar (RR: 1.1; 95% CI: 0.47-2.56).

Conclusions: Microsurgery is associated with higher rates of functional outcomes and debilitation than SRS. The rate of re-intervention with microsurgery after SRS was earlier than radiation after microsurgery.

Professional Practice Gap & Educational Need: Large data analysis of patients from multiple healthcare centers can provide important information regarding outcomes, risks, and complications for two major procedures treating acoustic neuroma. An evaluation of when re-intervention was performed after initial treatment with the alternative procedure may help in planning and determining salvage treatment.

Learning Objective: To temporally demonstrate the differences in outcomes and risks between microsurgery and SRS, and to determine the need for the other major treatment option as salvage therapy.

Desired Result: Recognition of the higher debilitation of patients undergoing microsurgery in a large database. Understand that patients may require microsurgery after primary SRS treatment earlier than the need for salvage radiation after primary microsurgery.

Level of Evidence - III

Indicate IRB or IACUC: Exempt

5 Principles for Reliable 3D Printing of Temporal Bones

Michelle K. Higgins, MD, PhD

Hypothesis: Design methodology can optimize 3D printable temporal bone surgical simulators.

Background: 3D printed synthetic temporal bones are important educational tools for teaching ear anatomy and safe surgery. Creators of these simulators increasingly strive to produce them on consumer-grade machines using material extrusion with goals for validity and low cost per unit. A design perspective and iterative process that respects additive manufacturing constraints can provide relevant advantages for more users when creating new temporal bone datasets.

Methods: Test cases of open-access 3D human temporal bones from the OpenEar Library were iteratively adapted for 3D printing. Methodology from process design, design for six sigma, human-centered design, and open education were systematically applied until five key principles were distilled. Reliable 3D files are safe to manufacture, fit the intended usage context (education or research), maintain accuracy (anatomy, color, haptic feedback), minimize waste (material, production time, post-processing steps), and are freely open (to retain, reuse, revise, remix, and redistribute copies).

Results: High quality, reliable, ready-to-3D-print open datasets of human temporal bones achieve performance consistency across workflow outcomes. The optimized 3D files reproducibly made over 600 units tested in over 20 materials on five desktop 3D printers with production costs ultimately approaching \$4 per unit, printing time averaging 6 hours per 4-color unit, and requiring only 6 minutes human labor per unit.

Conclusions: A set of five design principles can guide decision making for more cost-effective, highly reliable 3D printing that accounts for typical additive manufacturing constraints. Reliable production expands global access to temporal bone surgical simulators for surgical training and education, and rapid testing of biomimetic materials for research.

Professional Practice Gap & Educational Need: Practitioners who utilize synthetic temporal bones can learn how to design for more reliable, sustainable, and accessible production.

Learning Objective: Apply a set of design principles to optimize reliable 3D printing of temporal bone surgical simulators.

Desired Result: Creators of 3D temporal bone models will consider designing for typical constraints of additive manufacturing to achieve wider access and utilization of their work.

Level of Evidence - Level V

Indicate IRB or IACUC: Not applicable

National Practice Patterns in Repair of Lateral Skull Base CSF Leak: Analysis of the NSQIP Database

Matthew D. Adams, MD; Ryan M. Kong, MD; Matthew B. Hanson, MD

Objective: To examine current surgical practice patterns and outcomes in the management of lateral skull base CSF leaks in the United States.

Study Design: Retrospective cohort study.

Setting: Multiple institutions participating in the American College of Surgeon's National Surgical Quality Improvement Program (ACS-NSQIP).

Patients: The ACS-NSQIP database from 2005 to 2020 was queried for patients undergoing middle cranial fossa (MCF) or transmastoid (TM) repair of lateral skull base CSF leak.

Interventions: Lateral skull base CSF leak repair via middle cranial fossa MCF or TM approach.

Main Outcome Measures: Patient demographics, medical co-morbidities, operating time, complications.

Results: A total of 462 patients were identified, 354 (76.6%) underwent MCF repair and 108 (23.4%) underwent TM repair. The MCF and TM groups had significant differences in race/ethnicity ($p < 0.001$), but no other significant differences in demographics or medical co-morbidities. The MCF group had higher rates of ASA class > 2 [219 (61.9%) vs 45 (41.7%); $p < 0.001$] and lower average operative time [175 (std 111.8) vs 208.1 (std 145.9) minutes; $p = 0.016$] compared to the TM group. Higher rates of any adverse event were observed in the MCF group [66 (18.6%) vs 11 (10.2%); $p = 0.039$], as well as rates of severe complications [59 (16.7%) vs 9 (8.3%); $p = 0.031$]. Multivariate analysis demonstrated similar odds ratios between the MCF and TM groups for any adverse event [0.53 (0.26-1.09); $p = 0.083$] and severe complications [0.46 (0.21-1.00); $p = 0.050$].

Conclusions: MCF repair of lateral skull base CSF leak is more common than TM, and with lower average operating time. However, MCF repair is associated with higher rates of complication.

Professional Practice Gap & Educational Need: The choice of surgical approach to lateral skull base repair is nuanced, with contributions from both patient factors and surgeon preference. Our study reports current practice trends and surgical outcomes that may help inform surgeons to educate patients and contribute to future investigation.

Learning Objective: To understand current practice trends as well as surgical outcomes and complications in patients undergoing repair of lateral skull base CSF leak.

Desired Result: Change physician knowledge regarding practice patterns and encourage surgical quality improvement in repair of lateral skull base CSF leak.

Level of Evidence – Level III

Indicate IRB or IACUC: Exempt

Does Preoperative Hearing Predict Postoperative Facial Function for Patients with Large Vestibular Schwannomas?

*Cody M. Anderson, MD; Nicole Ewer, BS; Heather J. Smith, BM
Jason L. Steele, BS; Mana Espahbodi, MD; Neil S. Patel, MD
Richard K. Gurgel, MD, MSCI*

Objective: It is rare for patients with large vestibular schwannomas (VS) to have functional hearing before surgery. Numerous studies have examined factors that contribute to postoperative facial (CNVII) function. In patients with large tumors, could preoperative hearing status provide insight into tumor adherence to both the facial and vestibulocochlear nerves? The objective of this study is to evaluate the effect on preoperative hearing on postoperative CNVII function following microsurgical resection for patients with large VS.

Study Design: Retrospective chart review

Setting: Tertiary care center

Patients: From 2016-2018, a total of 36 subjects underwent microsurgery for resection of large (greater than or equal to 2.3cm greatest linear dimension or 1.5cm in the cerebellopontine angle [CPA]) VS.

Interventions: Microsurgical resection of VS

Main Outcome Measures: Postoperative CN VII Function

Results: Median age at time of surgery was 46 (IQR 34.25-59.75) years; 45% of subjects were male. Median (IQR) tumor greatest linear dimension and volume were 2.84 (2.3-3.3) cm and 6.06 (3.55-11.82) cm³, respectively. Preoperative facial nerve function was House-Brackmann (HB) 1 in 94%. Most (83.3%) tumors were resected via a translabyrinthine approach; the remaining 16.7% were resected via a retrosigmoid approach. Gross total resection was achieved in 86.1%. Median (IQR) duration of follow up from time of surgery was 15.22 (8.25-48.59) months. At time of last follow up, 50% of subjects had HB 1-2 facial nerve function (38.9% had HB 1 function, 11.1% HB 2 function); 50% had HB 3-6 facial nerve function (25% had HB 3 function, 13.9% HB 4 function, 5.6% HB 5 function, and 5.6% HB 6 function). Preoperative word recognition score (WRS) was associated with postoperative facial nerve function at the last follow up visit. Median (IQR) preoperative WRS was 80 (45.75-94.50)% in patients with postoperative HB 1-2 function, and 36 (0-77.75)% with postoperative HB 3-6; on logistic regression decreased preoperative WRS is associated with increased odds of HB 3-6 function postoperatively (odds ratio 0.980, 95% confidence interval 0.961-0.999). In this select population of patients with large tumors, patient age, tumor volume, approach, extent of resection, and preoperative pure tone average were not associated with immediate or long-term postoperative CNVII function on logistic regression analysis ($p > 0.05$).

Conclusions: Preoperative word recognition score was associated with postoperative facial nerve function in microsurgical resection of vestibular schwannoma greater than or equal to 2.3cm, which suggests CNVIII neural integrity of the eight nerve may be a proxy for CNVII neural integrity.

Professional Practice Gap & Educational Need: Predictive tools and counseling patients regarding expected CNVII function after microsurgical resection of a vestibular schwannoma is critical. The utility of preoperative audiometric data in predicting postoperative facial nerve function has not been well described.

Learning Objective: To elucidate if preoperative hearing can assist with predicting postoperative CN VII function after microsurgical resection of VS greater than or equal to 2.3cm.

Desired Result: To increase understanding of risk factors for postoperative facial nerve function in the resection of VS greater than or equal to 15 mm in the CPA.

Level of Evidence – Level IV

Indicate IRB or IACUC : IRB_00045048, AM Tracking trends in the management of vestibular schwannoma. University of Utah.