SELECTED ABSTRACTS

POSTER PRESENTATIONS

IN ORDER OF PRESENTATION

157th Annual Meeting
AMERICAN OTOLOGICAL SOCIETY

May 17-18, 2024
Hyatt Regency Chicago
Chicago, IL

The Effect of Ventriculoperitoneal Shunts on Hearing: A Systematic Review

Emily Goodman, BA; Soroush Farsi, BS; Anna Bareiss, MD
Andrew Mangan, BS; John Dornhoffer, MD; Robert Saadi, MD

Objective: To review hearing outcomes following ventriculoperitoneal shunt (VPS) placement in the literature and to assess potential risk factors for hearing loss.

Data sources: Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Protocol, PubMed was queried for articles published between January 1980 to January 2023 describing hearing outcomes related to ventriculoperitoneal shunts.

Study selection: Search terms used were "ventriculoperitoneal shunt", "hearing loss", and "hydrocephalus" in the title/abstract. Abstracts were screened with subsequent full-text reviews of relevant publications.

Data extraction: Extracted data was divided into two categories: VPS resulting in hearing loss, and VPS relieving hearing loss.

Data synthesis: Of 246 abstracts initially identified, 23 met inclusion criteria. 11 articles reported VPS causing hearing loss. 7 of these were case reports with 4 immediate and 3 delayed presentations of hearing loss after VPS. Two prospective cohort studies showed rates of hearing loss following VPS to be 38.9% and 64.5%. One cross-sectional study showed that 10/12 (83%) children with hydrocephalus and VPS had ipsilateral hearing loss. One retrospective study showed higher rates of hearing loss in children with medulloblastoma who received chemotherapy and VPS 13/13 (100%) as compared to chemotherapy alone 14/20 (70%). Conversely, 6 articles reported VPS relieving hearing loss in patients with hydrocephalus, with one prospective study showing 14/20 (70%) had improved hearing.

Conclusions: VPS has the potential to impact hearing, positively or negatively. Pre-operative audiograms should be considered. There should be a low threshold for audiology referral for postoperative hearing concerns. Further studies are needed to fully understand anatomic and physiologic factors impacting this delicate balance between CSF pressure and inner ear fluid homeostasis.

Professional Practice Gap & Educational Need: There is no comprehensive review of current literature that addresses hearing outcomes after ventriculoperitoneal shunt placement.

Learning Objective: To understand how cerebrospinal fluid pressures alter the inner ear homeostasis and how hearing is impacted by placement of a VPS.

Desired Result: Our goal is to educate practitioners on the potential consequences of VPS placement, allowing them to better counsel their patients and assess for post-operative hearing loss.

Level of Evidence – Level 3

Indicate IRB or IACUC: Exempt

Assessment of Modes of Anesthesia for Cochlear Implant Surgery

Phuong H. Bao, BS; David R. Friedland, MD, PhD; Jazzmyne Adams, MPH
Julie K. Freed, MD, PhD; Masoud Khani, BS; Jake Luo, PhD

Objective: Otologic surgery has specific anesthetic requirements such as avoiding nitrous oxide and permitting facial nerve monitoring. However, little evidence exists for selecting the best anesthetic agent and it is often left to anesthesiologist preference.

Study Design: Retrospective review of 600 primary cochlear implant surgeries and associated anesthetic variables.

Setting: Tertiary academic medical center.

Patients: Adult patients undergoing cochlear implant surgery over 10 years by a single surgeon.

Interventions: Anesthesia regimen: Balanced, Gas, TIVA (total intravenous anesthesia).

Main Outcome Measures: 1) Emergence Time, 2) Time in Phases of Recovery, 3) Anesthetic agents

Results: Among 600 cochlear implant surgeries, a balanced regimen was most commonly used (84.3%) with less often use of gas (13.5%) or TIVA (2.2%) alone. Average surgical time was 72.1±18.5 minutes. Emergence from anesthesia averaged 13.7±5.4 minutes and was shortest with the use of TIVA (11.9±4.6 minutes) and longest with only gas (14.2±5.3 minutes). Univariate analyses demonstrated no statistically significant correlation between anesthesia regimen and emergence time, time in recovery, and time in phase II. Multivariate linear regression showed significantly shorter emergence times with TIVA anesthetic regimen versus gas alone (coeff: -5.29, p=.0027). No difference was noted by sex, race, or ASA class. Interestingly, N20 was administered in 18.8% of cases at an average of 8.3±18.3% without effect on emergence time.

Conclusions: TIVA anesthetic regimen is associated with shorter emergence time than gas alone. These findings may inform best practice for anesthesia in otologic surgical cases.

Professional Practice Gap & Educational Need: Balanced, gas, and TIVA are currently administered in cochlear implant surgery. A gap exists in the understanding of the relative efficacy of each anesthesia regimen relating to patient recovery.

Learning Objective: Understand recovery rates for cochlear implant surgery in different age demographics, anesthetics, anesthesia staffing, and anesthetic regimen.

Desired Result: For physicians to use evidence-based information when administering anesthesia during cochlear implant surgery.

Level of Evidence - IV

Indicate IRB or IACUC: PRO00045896

Do Patients Treated with Teprotumumab Meet American Speech-Language-Hearing Association (ASHA) Criteria for Ototoxicity?

Oliwia W. Mlodawska, BS; Molly M. Murray, MD; Mami K. Sow, MD; Adam Thompson-Harvey, MD
Erin A. Harvey, MD; Gerald J. Harris, MD; Michael S. Harris, MD

Objective: To determine if patients receiving teprotumumab (TEPEZZA®) therapy for thyroid eye disease (TED) demonstrate hearing loss consistent with American Speech-Language-Hearing Association (ASHA) criteria for ototoxicity.

Study Design: Retrospective Cohort Study

Setting: Tertiary Care Academic Medical Center

Patients: Adult patients receiving infusions of teprotumumab for TED between January 1, 2020 and June 1, 2023.

Interventions: Baseline, intra-treatment, and post-treatment audiograms when available.

Main Outcome Measures: 1) Hearing loss consistent with ASHA criteria for ototoxicity after receiving teprotumumab treatment; 2) Effect of teprotumumab on low-frequency, high-frequency, or overall pure-tone averages; 3) Association of age, BMI, previously identified hearing loss, and prior exposure to ototoxic medication with post-treatment audiologic outcomes.

Results: Out of 79 patients treated with teprotumumab for TED at our institution during the study period, 18 patients completed a baseline and intra- or post-treatment audiogram sufficient for analysis. Seven of these 18 patients (38.9%) met ASHA criteria (>20 dB pure-tone threshold increase at one frequency or >10 dB at two consecutive frequencies from baseline) for ototoxicity. Median composite data showed statistically significant differences in high frequency ($p=0.036$) and overall ($p=0.018$) pure-tone average between baseline and post-treatment audiograms. The change in overall frequency between pre- and post-treatment was significant when considering age <65 or ≥65 years ($p=0.047$) and pre-existing hearing loss ($p=0.023$).

Conclusions: Seven patients undergoing teprotumumab treatment in our study with sufficient audiologic evaluation met ASHA ototoxicity criteria, suggesting that teprotumumab may contribute to sensorineural hearing loss. Scheduled audiometric testing during treatment is necessary to monitor symptoms and prevent hearing loss.

Professional Practice Gap & Educational Need: Teprotumumab is the first and only Food and Drug Administration (FDA)-approved drug for the treatment of TED, making it an attractive option to avoid surgical intervention. Despite earlier reports raising concern for treatment-associated hearing loss, currently no recommendations exist for audiologic ototoxicity monitoring for patients receiving teprotumumab treatment.

Learning Objective: To understand the potential of teprotumumab-induced ototoxicity in patients undergoing this route of intervention and to recognize the need for ototoxicity surveillance to avoid hearing loss.

Desired Result: For physicians to provide an evidence basis for patient counseling regarding risks associated with teprotumumab and support for consistent ototoxicity monitoring alongside teprotumumab therapy for TED.

Level of Evidence - IV

Indicate IRB or IACUC: Medical College of Wisconsin IRB #1538127

Round Window Electrocochleography in Genetic Causes of Hearing Loss: Pediatric Case Series

Vivian F. Kaul, MD; Meghan Hiss, AuD; William J. Rigss, AuD, PhD
Oliver F. Adunka, MD, MBA

Objective: To describe a case series of patients with common genetic mutations which result in severe-profound hearing loss leading to cochlear implantation.

Study Design: Case series

Setting: Tertiary care free-standing pediatric hospital

Patients: 4 pediatric patients

Interventions: Genetic testing for hearing loss, round window electrocochleography (EcoG), and cochlear implantation

Main Outcome Measures: Cochlear microphonic responses

Results: Case 1 is a GJB2 homozygous mutation of c.35DelG who's EcoG total response (TR) was 17.7 decibel (dB). Case 2 is also a GJB2 homozygous of c.35DelG but did not have enough responses recorded intraoperatively for a TR. There were responses bilaterally at both 500 and 1000 Hz at 90 dB but not at 70 dB. Case 3 is a TMPRSS3 homozygous mutation of c.208delC. Her EcoG findings revealed an EcoG-TR of 17.3 dB with most cochlear microphonic responses composed of 250-1000 Hz. Case 4 is a Pendred compound heterozygous of 707T>C (p.L236P) and c.1-5A>G. Her EcoG findings revealed an EcoG-TR of 14.7 dB. All 4 cases resulted in cochlear implantation with good hearing results.

Conclusions: All four cases suggest some degree of poor development of the cochlear hair cells. When compared to previous levels, EcoG-TR responses for auditory neuropathy and normal hearing reach 40-50 dB. The four cases suggest significant hair cell loss compared to patients with auditory neuropathy spectrum disorder and those with normal hearing, yet reasonable evidence of hair cell activity that could be amenable to potential future gene therapies.

Professional Practice Gap & Educational Need: Practicing cochlear implant surgeons should be aware that while the current therapy for pediatric severe to profound sensorineural hearing loss is cochlear implantation, that may not be the case going forward. It is imperative to get genetic testing on patients, and moreover, the utility of electrocochleography can showcase the function and status of existing hair cells.

Learning Objective: To understand that routine ABR or behavioral audiometry do not always reflect intactness of residual hair cells in the cochlea. Objective near-field recordings of cochlear activity (i.e., electrocochleography) can be utilized in patients with severe to profound hearing loss due to genetic forms of hearing loss, to determine the level of the residual hair cells remaining. This approach is likely to be critical for clinicians as developments in potential advanced therapies such as gene therapies continue to emerge in clinical trials.

Desired Result: Education for cochlear implant surgeons to pursue genetic testing on their pediatric patients with severe to profound sensorineural hearing loss and to also evaluate the status of the residual cochlear hair cells.

Level of Evidence - Level V

Indicate IRB or IACUC: Ohio State University Wexner Medical Center Institutional Review Board approved protocol number 2015H0045.

All That Jazz: Emotional Responses to Music Among Unilateral Cochlear Implant Users

Isaac L. Alter, AB; Alexander Chern, MD; Meghan E. Kuhlmey, AuD
Meghan A. Despotidis, AuD; Scott Kelly, BS; Tiffany Hwa, MD
Anil K. Lalwani, MD

Objective: Emotional response to music following cochlear implantation, though central to music listening/enjoyment, remains poorly studied. In this study, we investigate emotional experience in single-sided deafness (SSD) and bimodal cochlear implant (CI) users.

Study Design: Cross-sectional analysis.

Setting: Tertiary academic center and community hearing loss groups.

Patients: SSD (N=13) and bimodal (N=23) cochlear implantees

Interventions: Participants listened (via an online survey) to ten previously validated 15-second musical clips representing multiple genres and wide range of valence (happiness vs. sadness) and arousal (excitement vs. calm) and rated the musical clips on validated nine-point visual analog scales of valence and arousal. Participants listened to each clip through implanted ear only, through non-implanted ear only, and through both ears simultaneously.

Main Outcome Measures: Range and error of valence and arousal.

Results: SSD participants demonstrated increased error in identifying each clip's valence (2.20 vs 1.46, p=0.01) and arousal (1.61 vs. 1.46, p=0.04) through their CI. Additionally, they experienced decreased range of valence (4.83 vs. 5.86, p=0.03) and decreased appreciation of low arousal (minimum arousal 2.18 vs. 1.63, p=0.04) when listening through their CI only compared to both ears together. Among bimodal participants, their error for valence and arousal was not significantly different across conditions. However, valence range was significantly lower when listening through CI only (4.59 vs. 5.77, p<0.001) compared with the both-ears condition, while arousal range was lowest in the hearing aid ear alone (4.89 vs. 5.81, p=0.01).

Conclusions: Unilateral cochlear implantees experience significantly different emotional response when listening through CI compared to NH or hearing-aided ear. This deficit likely contributes to reduced music enjoyment and represents a critical target for improvement.

Professional Practice Gap & Educational Need: While discrepancies in music perception and enjoyment are well-described among CI recipients, there is extremely limited research into emotional responses to music, and none that have included SSD participants. Given the centrality of emotion in music enjoyment, understanding this aspect of music listening could identify targets for improvement of music listening in CI users.

Learning Objective: To understand the effects of cochlear implantation on the ability to identify emotional content of a musical stimulus, and identify differences in emotional range in response to music between implanted and non-implanted ears.

Desired Result: To better illuminate potential deficits in a crucial aspect of music listening among CI users, paving the way for improved music enjoyment among this population.

Level of Evidence – Level III

Indicate IRB or IACUC: Columbia University Irving Medical Center Institutional Review Board (AAA43559).

Exploring the Association Between Secondhand Smoke Exposure and Hearing Loss Among U.S. Nonsmokers

Aashish Batheja, MPH; Daniel H. Coelho, MD

Hypothesis: Increased secondhand smoke exposure is associated with elevated hearing thresholds and greater odds for hearing loss in adult nonsmokers.

Background: Although tobacco usage is a well-established risk factor for hearing loss, secondhand smoke (SHS) exposure may also be implicated. However, there is a relative paucity of inconsistent findings with limited frequency-specific details. This study investigates the relationship between SHS exposure and hearing loss in adult nonsmokers in the U.S.

Methods: 1644 nonsmokers between ages 20 and 69 and without diabetes, stroke, or heart disease were isolated from the 2015-2016 National Health and Nutrition Examination Survey cycle. Serum cotinine level was used as a marker of SHS exposure. Outcomes included hearing thresholds at low-, mid-, and high-frequencies and hearing loss as defined by World Health Organization guidelines. Linear regression analyses between hearing thresholds and SHS exposure stratified by Body Mass Index (BMI) category and controlled for age, gender, race, income, and noise exposure. Logistic regression modeling hearing loss by SHS exposure controlled for the same.

Results: SHS exposure was associated with elevated hearing thresholds at low-frequencies ($p = 0.0329$) and mid-frequencies ($p = 0.012$), and only in the obese (BMI ≥ 30) population. SHS exposure was associated with greater risk of hearing loss (Odds Ratio: 1.163, 95% Confidence Interval: 1.053 – 1.285).

Conclusions: Although SHS exposure was associated with hearing loss overall, its relationship with hearing thresholds was not demonstrated across all hearing frequencies or BMI categories. Notably, SHS exposure was positively correlated with hearing thresholds at low- and mid-frequencies, and only in the obese population.

Professional Practice Gap & Educational Need: While published literature suggests there is a link between SHS exposure and hearing loss, an association is not consistently demonstrated across all frequencies and sample subgroups. There is a need to better understand the strength of this association and its clinical impact on patients. Additionally, the role of BMI in modulating the relationship between SHS exposure and hearing loss remains unclear and must be evaluated.

Learning Objective:

1. Characterize the relationship between SHS exposure and hearing loss among U.S. nonsmokers.
2. Discuss the potential for factors to modulate the relationship between SHS exposure and hearing loss.

Desired Result: Providers and researchers will better understand how SHS exposure may be related to hearing loss. Fostering discussion on this topic will encourage future studies that may further improve understanding in this area.

Level of Evidence - V

Indicate IRB or IACUC: Exempt

Correlation between Tinnitus and Life Stress

Beatrice Mumm, BS; David Friedland, MD, PhD; Jazzmyne Adams, MPH
Masoud Khani, BS; Jake Luo, PhD; Kristina Osinski, BS

Objective: To identify correlates of tinnitus severity including the characteristics of the tinnitus percept, measures of life stress, and auditory function.

Study Design: Retrospective cohort study

Setting: Tertiary Academic Center

Patients: Patients undergoing tinnitus evaluation at an academic Tinnitus Clinic between 2011 and 2022.

Interventions: None

Main Outcome Measures: 1) HR Stress inventory score, 2) THI/TRQ scores, 3) DPOAEs

Results: There were 785 patients (mean age 53.9±15.4, 52.6% male) undergoing tinnitus evaluation. Within this patient cohort, 76% reported having constant tinnitus. Whether the tinnitus was constant or intermittent as reported by patients had no correlation with HR stress scores or THI/ TRQ. Ringing was the most noted tinnitus sound in 52% of patients, followed by other (39%), buzzing (25%), tonal (11%), humming (10%), and static (9%). Patients that reported other tinnitus sounds had a higher HR stress level than those with more typical perceptions ($p=0.0009$). There was no correlation between the tinnitus sound and THI or TRQ. Normal high frequency right and left DPOAE's were statistically more likely to have a higher THI/ TRQ than DPOAEs that were absent/abnormal/uncertain ($p<0.05$). Ordinary Least Squares regression showed a statistically significant positive correlation of tinnitus awareness, TRQ, and THI scores with HR risk score. This score is a subcategorization of the overall HR stress score and predicts the risk of health issues from stress.

Conclusions: Validated measures of stress-related health risk correlate with tinnitus severity.

Professional Practice Gap & Educational Need: Tinnitus treatment is often associated with stress relief methods though the correlation between level of life stress and tinnitus severity is uncertain.

Learning Objective: Understand the importance of evaluating life stress in treating patients with complaints of tinnitus.

Desired Result: To increase the use of stress assessment tools in the treatment of patients with tinnitus.

Level of Evidence: IV

Indicate IRB or IACUC: IRB# 1538127; approved July 23rd, 2020

Age-Related Variations in Tinnitus Patient Profiles and Characteristics

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Objective: The diversity of tinnitus patient profiles often complicates tinnitus research and hinders result interpretation. This study investigates age-related factors among tinnitus patients' characteristics.

Study Design: Retrospective Case Review

Setting: Analysis of medical records at XXX National University Hospital

Patients: From January 2018 to March 2020, we conducted a screening of 421 consecutive patients (570 tinnitus ears) who had previously undergone Pure Tone Audiometry (PTA) up to 16kHz, psychoacoustic testing of tinnitus characteristics, including tinnitus frequency, loudness matching, minimum masking level, and residual inhibition after acoustic masking. In addition, we administered the Tinnitus Handicap Inventory (THI) and Visual Analog Scale (VAS) questionnaires, along with a supplementary questionnaire aimed at assessing associated factors such as subjective hyperacusis, headache, dizziness, neck or jaw pain, and psychiatric symptoms. Subsequently, we categorized these 421 tinnitus patients into three age groups: <30 years (n=111), 30-49 years (n=182), and ≥50 years (n=277).

Interventions: N/A

Main Outcome Measures: We compared PTA thresholds, psychoacoustic characteristics of tinnitus, THI scores, and VAS scores for subjective loudness, daily duration of awareness, annoyance, and impact on daily life in each age group. We also explored differences in the incidence of non-auditory factors, such as headaches, dizziness, neck or jaw disorders (potential somatosensory causes of tinnitus), psychiatric symptoms, and hyperacusis.

Results: The youngest group displayed the lowest pure-tone hearing thresholds and reported the lowest annoyance level, tinnitus loudness, and THI scores. Hyperacusis was most prevalent in the youngest group, with headaches and dizziness also frequently reported in this age category.

Conclusions: Our research highlights a notable disparity among tinnitus patients based on age, with those under 30 years old demonstrating significantly better hearing function and a higher prevalence of comorbid factors compared to their older counterparts. These findings underscore the potential benefits of implementing more comprehensive audiological assessments and exploring non-auditory factors in the management of tinnitus, particularly for younger patients.

Professional Practice Gap & Educational Need: Analyzing tinnitus patient characteristics across different age groups can help tailor management approaches based on age.

Learning Objective: Recognize distinct characteristics of tinnitus patients within different age groups.

Desired Result: Identify significant age-related factors for improved, individualized tinnitus management.

Level of Evidence: Level IV

Indicate IRB or IACUC: Institutional Review Board of Kangwon National University Hospital approved the study (IRB Approval: KNUH-2019-04-013-005).

Factors Driving Patient Selection of Cochlear Implant Brand

Michael H. Freeman, MD; Ankita Patro, MD, MS; Nathan R. Lindquist, MD
Elizabeth L. Perkins, MD; Katelyn Berg, AuD
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Objective: To assess the factors that drive a patient's selection of cochlear implant (CI) brand.

Study Design: Prospective survey study.

Setting: Tertiary referral center.

Patients: 104 adult patients undergoing primary CI in 2023.

Interventions: Survey administered in the preoperative area.

Main Outcome Measures: Sources of information regarding CI brand offerings, factors that were most important in deciding on a brand, brand ultimately selected.

Results: 104 patients were included (average age 63 years, 96% White race). The most popular sources of information to help patients choose a device were their audiologist (80.7%), company promotional materials (28.8%), Google search (26.9%), and their surgeon (20.19%). When asked their #1 reason for choosing their CI brand, the three most commonly cited reasons were technology (50.5%), cosmetics of the wearable portion (14.5%), and audiologist recommendation of that brand (13.6%). Audiologist recommendation of a specific brand was a top 3 deciding factor for 32.7% of patients, while surgeon recommendation was for 10.6% of patients. Of the 15 patients who cited cosmetics as their most important factor, 13 of them selected Cochlear Americas. When analyzing aspects of technology that patients found important, iPhone compatibility was popular among Cochlear Americas recipients and hearing aid pairing was popular among Advanced Bionics recipients. No dominant motivating factor was noted for Med El recipients. 10.6% of patients were not aware of which brand of implant they were receiving.

Conclusions: Although patients access multiple sources of information to choose their CI brand, their audiologist is influential in this decision. CI manufacturers should be aware of patient priorities in designing and marketing their devices.

Professional Practice Gap & Educational Need: Better understanding of the CI brand choice decision can help deliver patient-centered care.

Learning Objective: To identify factors of importance to patients in choosing a CI brand.

Desired Result: Providers will have improved understanding of the factors that patients prioritize as they choose a device company. This can help in counseling patients in an unbiased and informed fashion.

Level of Evidence: Level IV – cross section study.

Indicate IRB or IACUC: IRB 221926 (Vanderbilt University).

Antioxidant Therapies in the Treatment of Aminoglycoside-Induced Ototoxicity: A Systematic Review

Patrick J. Gaffney, BS; Kunal R. Shetty, MD; Sancak Yuksel, MD
Vivian F. Kaul, MD

Objective: To examine the effectiveness of antioxidant therapies in the treatment of aminoglycoside-induced ototoxicity in clinical trials.

Data sources: The databases Pubmed, Embase, Web of Science, and ClinicalTrials.gov were browsed for English-language articles published before July 2023.

Study Selection: This review sought randomized controlled trials conducted in humans discussing outcomes in aminoglycoside-induced ototoxicity following administration of antioxidants or medications intended to reduce oxidative stress.

Data Extraction: Each study was assessed for bias using the Cochrane risk of bias tool for randomized trials. Six criteria were assessed for each study.

Data Synthesis: NA

Conclusions: A literature search produced 1959 results, from which seven studies met our inclusion criteria. N-acetylcysteine was investigated in four studies, aspirin in two studies, and vitamin E in one study. Six studies examined the benefit of antioxidant treatments up to eight weeks after administration, while one study tested subjects' hearing after one year. In six of the seven studies, antioxidant therapy resulted in significant reduction of ototoxicity after administration of aminoglycosides. However, aspirin and N-acetylcysteine were much more effective at reducing ototoxicity than was vitamin E, which showed no prevention of aminoglycoside-induced ototoxicity compared to the placebo. The studies reviewed suggested that antioxidant therapies provide a promising therapeutic option for aminoglycoside-induced ototoxicity. Further study is necessary to examine whether aspirin and N-acetylcysteine provide long-term benefit.

Professional Practice Gap & Educational Need: Previous studies using animal models have suggested that myriad therapies targeting oxidative stress may prevent ototoxicity due to aminoglycosides. However, few clinical studies have evaluated treatments with this mechanism, and no studies have collectively evaluated these therapies in aminoglycoside-induced ototoxicity.

Learning Objective: To evaluate whether clinical benefits exist in the use of antioxidants for aminoglycoside-induced ototoxicity.

Desired Result: Encourage additional clinical and basic science research on therapies with a promising mechanism of action in treating aminoglycoside-induced hearing loss.

Level of Evidence – Level I

Indicate IRB or IACUC: Exempt

Levels of Inner Ear Biomarker, Otolin-1, are Related to Serum Calcium Levels

Mohsin Mirza, BS; Heather McClure, BS; Patrick Adamczyk, BS
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Objective: We hypothesize that levels of the inner ear biomarker, otolin-1, are influenced by serum calcium levels.

Background: Otolin-1 is an otoconia scaffolding protein expressed exclusively in the inner ear. Previous studies demonstrated high blood levels of otolin-1 in patients with benign paroxysmal positional vertigo (BPPV), suggesting that otolin-1 may serve as an inner ear biomarker for otoconia disorders. Prior work suggests that calcium carbonate and endolymphatic calcium levels influence otoconia.

Study Design: Case series.

Setting: Tertiary Care Center.

Patients: Patients with primary hyperparathyroidism (PHPT), the epitome of calcium disorders, were recruited. A total of 32 PHPT subjects consisting of 24 females and 8 males were enrolled with age ranging from 18 to 86 years, with a mean and median of 56 and 59 years, respectively.

Results: Subjects had a mean otolin-1 level of 600.92 ± 427.37 pg/mL. Otolin-1 was weakly associated with ionized calcium (r^2=0.21). With vitamin-D as a covariate, otolin-1 was moderately associated with corrected calcium (r^2=0.44) and ionized calcium (r^2=0.35). There was no significant correlation between otolin-1 and parathyroid hormone.

Conclusions: Otolin-1 is elevated in the setting of high serum calcium levels, implying that systemic calcium metabolism may influence otoconia health. Further research is needed to identify factors that influence otoconia health and determine their potential role in the pathogenesis of BPPV. This research may aid in developing new management options to supplement traditional canalith repositioning.

Professional Practice Gap & Educational Need: BPPV is a common disorder with a lifetime prevalence of 2.4% and recurrence rate between 13-65%. The mechanism of pathogenesis is not understood.

Learning Objective: Understand how systemic calcium metabolism can potentially influence otoconia.

Desired Result: Further elucidate the role of calcium metabolism in BPPV pathogenesis.

Level of Evidence: Level V

Indicate IRB or IACUC: IRB #23-206-2 at UConn Health.

Increasing Utilization of Intratympanic Injections among Medicare Providers

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Objective: To characterize national practice patterns and geographic variations in intratympanic injections among Medicare providers

Study Design: Cross-sectional analysis

Setting: Medicare Part B Public Use Files

Patients: Medicare B fee-for-service patients undergoing intratympanic injections from 2013 to 2021

Interventions: intratympanic injections (Current Procedural Terminology code 69801)

Main Outcome Measures: The Medicare Physician & Other Practitioner Public Use Files were used to identify all providers who performed in-office intratympanic injections from 2013 to 2021. Intratympanic injections were trended geographically over time. Medicare reimbursement rates were also tabulated.

Results: A total of 159,236 in-office intratympanic injections were performed. The Center for Medicare & Medicaid Services reimbursed $25,407,086; out-of-pocket patient costs were $6,591,514. The mean Medicare reimbursement rate and out-of-pocket cost per injection were $159.56 and $41.38, respectively. From 2013 to 2021, the number of intratympanic injections increased from 13,117 to 20,711 injections, representing a 57.9% increase. On linear regression, an additional 989.9 injections were performed each year (95% CI 766.4–1213.4, $p<0.001$). The number of providers performing injections also increased from 1,828 to 2,834 from 2013 to 2021 (b = 125.6 [95% CI 111.3–140.0], $p<0.001$). The population-controlled annual mean number of injections varied substantially across the U.S., ranging from 12.0 injections per 100,000 beneficiaries in Oklahoma to 255.2 injections per 100,000 beneficiaries in Alabama.

Conclusions: The number of intratympanic injections administered in the Medicare population has increased from 2013 to 2021. There is variability in practice patterns and utilization of intratympanic injections among otolaryngologists in the United States.

Professional Practice Gap & Educational Need: epidemiology and variations in practice patterns regarding intratympanic steroid injections

Learning Objective: to understand geographic variations and temporal changes in intratympanic injection practice patterns

Desired Result: to encourage self-evaluation in one's own practice patterns and encourage additional research into epidemiology and variations in otologic care

Level of Evidence – IV

Indicate IRB or IACUC: Exempt

I Want It Out! An Assessment of Patient Motivation Behind Cochlear Implant Removal

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

Objective: To assess indications behind cochlear implant (CI) removal without subsequent re-implantation

Study Design: Historical cohort study

Setting: Academic tertiary referral center

Patients: Patients who underwent CI explantation between January 2013 and December 2022

Interventions: Explantation of CI device

Main Outcome Measures: Indications for and audiometric testing prior to CI explantation

Results: Within a cohort of 743 CI patients, 16 patients (2%) underwent CI explantation without re-implantation (median age 54-years-old, interquartile range [IQR] 33-79), and 21 (3%) underwent explantation followed by re-implantation. The median time between CI insertion and removal was 28.5 months (IQR 13.2-78.4). Six explantations were due to infectious complications: 2 patients (13%) did not undergo re-implantation given illness severity, 1 (6%) underwent simultaneous contralateral implantation, 1 (6%) experienced insurance barriers preventing re-implantation, and 2 (13%) were lost to follow-up. Ten patients underwent explantation without re-implantation for non-infectious indications. Of these, 6 patients (38%) reported headache, otalgia, tinnitus, or vertigo, 3 (19%) required repeated MRIs and desired avoidance of peri-imaging procedures, and 1 patient (6%) had poor audiometric outcomes due to cochlear ossification. Compared to the aforementioned re-implantation cohort, patients who underwent explantation without re-implantation performed worse on AzBio (35%, n=7 versus 49%, n=11; p=0.43) and CNC testing (27%, n=3 versus 66%, n=4; p=0.03) after initial successful implantation, with only the latter achieving statistical significance.

Conclusions: Patients undergo explantation for a variety of reasons, with ill-defined symptoms being the motive in the majority of cases. These desires are compounded by poor postoperative audiometric performance, which likely hinders the patient's desire to undergo re-implantation and may also serve as an indication for proactive clinician involvement to prevent this outcome.

Professional Practice Gap & Educational Need: The practice gap includes identification of trends and motivation behind cochlear implant explantation rather than re-implantation.

Learning Objective: The listener should be able to identify why patients may desire removal of their cochlear implant across specific indications for explantation.

Desired Result: These data can assist the clinician in preoperative discussions and help identify situations where earlier intervention could prevent device removal.

Level of Evidence – Level IV

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

Multisensory Loss and Depression in the Atherosclerosis Risk in Communities Neurocognitive Study (ARIC-NCS)

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Varshini Varadaraj, MD; Caitlin W. Hicks, MD
Jennifer A. Deal, PhD; Alison R. Huang, PhD

Objective: Multisensory loss is a potentially modifiable risk factor for depression, but population-level evidence is lacking. This study quantified the association between multisensory loss across four senses (hearing, vision, smell, touch) and depressive symptoms in older US adults.

Study Design: Cross-sectional.

Setting: Data (N=812) were from the ARIC-NCS and the Eye Determinants of Cognition study joint cohort (2016-2017), an observational study of older adults from Washington County, MD and Jackson, MS.

Patients: 812 participants with complete data on hearing, vision, olfaction, peripheral neuropathy, depression, and demographic and health covariates were included. Sensory loss was measured using objective tests (pure tone audiometry [hearing], Early Treatment of Diabetic Retinopathy Study chart [vision], Sniffin' Sticks tests [olfaction], and monofilament tests [peripheral neuropathy]). Multisensory loss was analyzed as a count (0-4).

Interventions: None**.**

Main Outcome Measures: Depressive symptoms were measured by the 11-item Center for Epidemiologic Studies Depression (CES-D-11) scale. Scores were modeled continuously. Ratio of depressive symptoms associated with number of sensory losses was assessed using covariate adjusted negative binomial regression.

Results: Of 812 participants (aged 71-93 years, 62.7% female, 58.6% White, 43.3% with higher than a high school education) 30.3% had one sensory loss, 31.4% had two, 17.6% had three, and 5.3% had four. Each additional sensory loss was associated with a 10% (Ratio of CES-D-11 Score: 1.10; 95% CI: 1.02-1.20) increase in CES-D-11 score in the fully adjusted model.

Conclusions: Multisensory loss is associated with depression in older adults. Clinical awareness of this association is valuable for promotion of mental well-being among patients with sensory loss.

Professional Practice Gap & Educational Need: While associations between single sensory loss and depression have been characterized, the association between multisensory loss (hearing, vision, smell, touch) and depression has yet to be investigated with population-level studies.

Learning Objective: To describe the association between multiple sensory losses (hearing, vision, smell, and touch) and symptoms of depression in older adults.

Desired Result: It is essential to increase clinicians' awareness of the association between multisensory loss and depression in older adults in the US, so they can identify early signs of depression in patients with multisensory loss and refer them for care.

Level of Evidence - Level III

Indicate IRB or IACUC: Johns Hopkins School of Medicine **(**IRB00311861) & Johns Hopkins Bloomberg School of Public Health (IRB00012998)

Cochlear Implantation in Pediatric Patients with Cochlear Nerve Deficiency: A Systematic Review and Meta-Analysis

Susmita Chennareddy, BA; Kalena H. Liu, BS; Maria A. Mavrommatis, MD
Derek D. Kao, MD, MSCR; Aparna Govindan, MD
Zachary G. Schwam, MD; Maura K. Cosetti, MD

Objective: This study aims to evaluate pre- and post-operative speech and auditory outcomes of cochlear implantation (CI) in pediatric patients with cochlear nerve deficiency (CND).

Data Sources: Search queries were developed alongside a medical librarian and performed across Medline Ovid and Ovid Embase through November 2022. All languages were covered.

Study Selection: Any study of pediatric patients with radiographically confirmed CND who underwent CI was eligible for inclusion (n=460 studies). Studies were excluded if they did not include at least two patients with CND and CI. Review articles, non-English manuscripts, and studies without pre- and postoperative outcomes were also excluded.

Data Extraction: Extracted data included number of children with CND and CI (n=14 studies, 170 patients), demographic information, study characteristics, and results of speech perception and language development testing. Risk of bias assessment was completed using the Joanna Briggs Critical Appraisal Checklist for Case Series and Cohort Studies to assess quality and validity of included studies.

Data Synthesis: All scaled outcomes measuring auditory outcomes were quantitatively meta-analyzed. Outcomes were pooled using standardized mean differences (SMDs) and weighted using the inverse variance method. A random effects model was used to account for within- and between-study variance, and results were compared with a fixed effects model.

Conclusions: Indications for CI are progressively expanding as research demonstrates benefit in populations previously thought inappropriate. Our study contributes to this growing literature and demonstrates global postoperative improvement in speech and auditory outcomes in the pediatric CND population after CI (SMD 2.04, 95% CI 1.53–2.56).

Professional Practice Gap & Educational Need: Cochlear nerve deficiency (CND), characterized by absence or reduced caliber of the cochlear nerve, is commonly implicated in moderate-to-profound pediatric sensorineural hearing loss. While cochlear implantation (CI) was previously contraindicated in patients with CND, recent studies have demonstrated the potential for auditory response to CI in a subset of CND patients, though clinical outcomes remain variable. To the authors' knowledge, this is the first systematic review to assess the role of CI in pediatric patients with CND.

Learning Objective: This study aims to contribute to growing literature by comapring pre- and post-operative speech and auditory outcomes of CI in pediatric patients with radiologically confirmed CND, which may contribute to the future management of this patient population.

Desired Result: We hypothesize that pediatric patients with CND may experience improvement in speech perception and language development following CI, though these changes may be variable in specific subsets of patients.

Level of Evidence – Level III

Indicate IRB or IACUC: Exempt

Tegmen Defects and Otitis Media: A Case Series Supporting a "Two-Hit" Mechanism of Otogenic Meningitis

Isaac D. Erbele, MD; Gauri Mankekar, MD; Rahul Mehta, MD; Jacob B. Kahane, MD
Terry P. Murphy, MD; Samuel R. Barber, MD; Moisés A. Arriaga, MD

Objective: Propose bony tegmen defects in the setting of otitis media as a cause of otogenic meningitis

Study Design: Case series

Setting: Tertiary care

Patients: Fifteen sequential cases of bacterial meningitis with otitis media in 14 adult patients without prior surgeries to the involved ear, between 2017 and 2023

Interventions: CT temporal bone, surgical repair

Main Outcome Measures: CT findings, surgical findings, clinical course

Results: All 15 cases of bacterial meningitis with otitis media had tegmen defects on CT temporal bone (average age=63, standard deviation=14). Defects were surgically confirmed with middle cranial fossa repair in 14, each performed after their meningitis was successfully treated with intravenous antibiotics. One patient declined surgery. Ten cases had three or more tegmen defects. One case had a cerebral spinal fluid (CSF) leak and four had encephalic herniation. None had cholesteatoma or idiopathic intracranial hypertension. In one case, the tegmen defect was identified prior to the episode of meningitis.

Conclusions: In these sequential cases of otogenic meningitis, each had one or more defects of the tegmen. While circumstantial and requiring additional study, this series provides compelling support for the theory that exposing purulent middle ear secretions to bare, intact dura may be a substantial cause of otogenic meningitis, even in the absence of CSF fistula or encephalic herniation. We believe the simultaneous occurrence of (1) otitis media with (2) osseous tegmen defects to be a sufficient two-hit mechanism for otogenic meningitis.

Professional Practice Gap & Educational Need: Understanding causes of otogenic meningitis

Learning Objective: Identify the association between tegmen defects and osteogenic meningitis

Desired Result: Propose bony tegmen defects in the setting of otitis media as a significant cause for otogenic meningitis

Level of Evidence - Level IV

Indicate IRB or IACUC : LSU IRB#581

Postoperative Antibiotic Prophylaxis following Cochlear Implant Surgery in the United States

Nicole E. Smolinski, PharmD; Matthew R. Muschett, PharmD
Almut G. Winterstein, RPh, PhD; Patrick J. Antonelli, MD, MS

Objective: To determine prevalence and associated determinants of postoperative antibiotic prophylaxis following cochlear implant surgery

Study Design: Retrospective cohort study

Data Source: Merative™ Marketscan® commercial claims databases and Medicare Fee-For-Service data

Patients: Cochlear implant recipients, 2012-2018, with no cochlear implant surgery in the 6 months prior.

Main Outcome Measures: Antibiotic prophylaxis within 2 days following cochlear implant surgery

Results: Of 5,432 included patients (Marketscan: 3,531; Medicare: 1,901), 2,947 (54.2%) received postoperative antibiotic prophylaxis. 46% were males with an average age of 34 years (range 1 – 64) in the Marketscan cohort and 71 years in the Medicare cohort (18+). Age was a significant determinant of prophylaxis in the Marketscan cohort, with age 1-4 years being more likely to receive antibiotic prophylaxis compared to age 18-64 years (OR 4.84, 95% CI 3.66-6.39). Older children (12-17 years) were also more likely to receive antibiotics compared to adults (Marketscan OR 1.43, 95% CI 1.02-1.99). Significant regional differences in use of antibiotic prophylaxis were seen, markedly higher in the North Central compared to West region (Marketscan OR 2.28, 95% CI 1.79-2.90 and Medicare OR 2.75, 95% CI 1.85-4.10). Comorbidities, such as diabetes and immune deficiencies, had no impact on likelihood of antibiotic prophylaxis.

Conclusions: Postoperative antibiotic prophylaxis is commonly administered in cochlear implant recipients. Postoperative antibiotic prophylaxis prescribing appears to be nominally affected by patient factors. Further research is needed to assess drivers of such therapy and their impact on the risk of infectious complications following cochlear implant surgery.

Professional Practice Gap & Educational Need: It is not clear what factors drive postoperative antibiotic prophylaxis prescribing for cochlear implant surgery.

Learning Objective: To elucidate determinants of antibiotic prophylaxis use following cochlear implant surgery

Desired Result: Clinicians will more closely adhere to best practices with postoperative antibiotic prophylaxis use following cochlear implant surgery.

Level of Evidence – III

Indicate IRB or IACUC : University of Florida IRB201900262

Current Practices and Opinions on Auditory Training in Adult Cochlear Implant Recipients

James R. Dornhoffer, MD; Christine M. Lohse, MS; Terrin N. Tamati, PhD
Aaron C. Moberly, MD; Matthew L. Carlson, MD

Objective: To examine current practices/opinions of cochlear implant (CI) providers with respect to post-implantation auditory training

Study Design: Survey to the American Cochlear Implant Alliance

Setting: Electronic survey

Patients/respondents: 79 CI providers

Interventions: Survey reviewing current practice/opinions for post-implantation auditory training for adult CI recipients

Main Outcome Measures: Review of respondent practice environment and review of current usage/opinions on auditory training, including resources used and schedule of use.

Results: Most (79%) respondents reported working at academic centers, 34% at high-volume centers (>150 CIs/year), and 38% were surgeons. Considering practices/opinions, 99% recommend auditory training for adult CI recipients. For most (52%), training resources are provided to patients in a broad list of exercises from which a patient may select. For those (30%) who recommend a specific resource, this is generally a computer-based auditory training program (e.g.,AngelSound™). Regarding timing of training, median (IQR) preferred start-time was 0(0-1) months post-activation, sessions were preferably performed for 3(2-4) hours/week, and these continued for 12(6-12) months.
Recommendations for auditory training were fairly consistent between surgeon/nonsurgeon providers and by center volume. Non-surgeons more often had specific recommendations on training resources, benefits of music, and training condition (e.g.,contralateral ear plugged).

Conclusions: Despite a lack of clinical guidelines for adult post-implantation auditory training, a cross-sectional survey of providers' current practice/opinions demonstrates that these services are widely recommended and considered valuable. Training is almost universally patient-directed and believed to be most beneficial if started soon after activation. Interestingly, specific recommendations for which training approaches to use are not common, suggesting a gap in our knowledge of which resources are most efficacious.

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, beyond manipulation of programming, there exist few interventions to maximize implant outcomes. Auditory training may help to improve or hasten acquisition of speech recognition skills for new adult CI recipients. However, no standardized paradigm for auditory training exists for adults, and current opinions and practices are largely unknown.

Learning Objective: To explore current practices and opinions with respect to auditory training for new adult CI recipients.

Desired Result: Practitioners and researchers will recognize important trends in auditory training. Namely, they will see that auditory training is almost universally recommended for new adult CI recipients. Training is generally patient directed, with specific recommendations generally being for some form of computer-based auditory training. Training is also generally felt to be most beneficial when started soon after CI activation. These recommendations are largely consistent with only minor differences influenced by CI center volume and CI team role.

Level of Evidence – Level V: Survey of expert opinion

Indicate IRB or IACUC: Exempt

Barriers to Ototoxicity Monitoring in Head and Neck Cancer Patients Treated with Chemotherapy

Jena Patel, MD; Amiti Jain, BS; Jacob Beiringer, BS
Irina Middleton, AuD; Jacob B. Hunter, MD

Objective: To evaluate risk factors associated with failure to obtain pre-chemotherapy audiology evaluation in head and neck cancer (HNC) patients.

Study Design: Retrospective cohort study.

Setting: Tertiary academic center.

Patients: There were 182 patients treated with chemotherapy between March 2021 and June 2022 who were referred to audiology and contacted to schedule a baseline audiogram.

Main Outcome Measures: Main outcome measure was completion of a baseline audiogram. Post-treatment otologic symptoms and hearing aid uptake were also recorded.

Results: In our cohort mean age was 64 years; there were 133 males (73%). Cisplatin was used to treat 74% (n=135) of patients. When controlling for covariates, patients who received cancer treatment in a community setting and those with stage IV cancers were associated with failure to obtain a baseline audiogram (OR = 2.33, 95% CI = 1.21-4.47, p=0.011; OR = 3.41, 95% CI = 1.74-6.71, p<0.001, respectively). There was no significant difference in receiving a baseline audiogram based on age, gender, primary language, race, social deprivation index as determined by zip code, or insurance type (p>0.05). After treatment the most common patient-reported otologic symptoms were new-onset hearing loss (n=30, 16.5%) and tinnitus (n=8, 4%). Only 14.2% of patients (n=26) underwent a post-treatment audiogram; there were no significant predictors for post-treatment follow-up. Only seven patients acquired hearing aids.

Conclusions: Stage IV tumors and community-level cancer treatment may encumber patients' ability to obtain baseline audiogram before starting chemotherapy. Post-treatment audiogram and hearing aid utilization were low, thus emphasizing a need for interventions to improve long-term audiologic follow-up to decrease hearing loss in cancer survivorship.

Professional Practice Gap & Educational Need: Highlight gaps in head and neck cancer audiologic care and a need to improve post-treatment audiologic follow-up to diagnose and treat hearing loss in cancer survivorship.

Learning Objective: 1) Identify risk factors that may prevent head and neck cancer patients from obtaining a baseline audiology evaluation prior starting ototoxic chemotherapy. 2) Understand trends in post-treatment symptoms and follow up.

Desired Result: Findings from this study may inform interventions aimed at improving ototoxicity monitoring practices and reducing chemotherapy-induced hearing loss in cancer survivorship.

Level of Evidence – IV

Indicate IRB or IACUC: IRB 22E.298 Thomas Jefferson University Hospitals

Artificial Intelligence Versus Audiologist Generated Patient Education Materials for Tinnitus

Jena Patel, MD; Daniel Campbell, MD; Jacob Hulswit, AuD
Jacob B. Hunter, MD

Objective: To quantitatively compare patient education materials made by our audiology team versus artificial intelligence (AI) for tinnitus.

Methods: An audiologist created educational handout was compared to a ChatGPT generated handout containing responses to six common questions posed about tinnitus in September 2023. Validated metrics including Flesch-Kincaid Grade Level (FKGL), Flesch Reading Ease (FRE), Patient Education Materials Assessment Tool for printed materials (PEMAT-P), and Global Quality Score (GQS) were used to score each handout. Reviewers included three otologists and two audiologists; the handouts were distributed in a blinded fashion.

Results: Across both handouts (n= 30 graded answers), the ChatGPT handout had 27/30 answers (90%) and the Audiology handout had 21/30 answers (70%) with a GQS ≥4 (good quality); there was no significant difference in GQS between the two handouts (p= 0.10). Moreover, there was no significant difference in PEMAT-P score across all 17 scored domains between the two handouts (p= 0.17). The ChatGPT handout had a significantly higher grade level (FKGL) compared to the Audiology handout (14.47 ± 2.51 vs 12.12 ± 2.12; p= 0.002). Similarly, the ChatGPT handout had a significantly lower FRE score compared to the Audiology handout (25.28 ± 16.85 [college graduate level] vs 37.78 ± 15.47 [college level]; p= 0.01).

Conclusions: ChatGPT was able to create a well-organized and accurate patient handout for tinnitus education when compared to a traditional Audiologist made handout; however, both resources exceeded the recommended 6th grade reading level. As ChatGPT evolves it may serve as a valuable tool for creating accessible patient education materials.

Professional Practice Gap & Educational Need: To help physicians further understand the potential role for artificial intelligence in patient education.

Learning Objective: 1) Identify that artificial intelligence may be able to create patient educations materials comparable to the currently used materials. 2) Understand the impact artificial intelligence may have on the development of patient education materials in the field of otology.

Desired Result: To provide a critical evaluation of a commonly used AI platform for patient education on tinnitus.

Level of Evidence - V

Indicate IRB or IACUC: Exempt

Stapedectomy with a Dehiscent and/or Anomalous Facial Nerve

William B. Thedinger, MD; Chloe Verducci, BS; Matthew Kircher, MD
Sam Marzo, MD; John P. Leonetti, MD

Objective: To determine the rate of completed stapedectomy cases in patients with a dehiscent and/or anomalous facial nerve.

Study Design: Retrospective chart review

Setting: Tertiary care academic medical center

Patients: Patients who underwent stapedectomy or revision stapedectomy at our institution from January 2007 to December 2022.

Intervention: We analyzed stapedectomy or revision stapedectomy operative reports on patients with a dehiscent and/or anomalous facial nerve along with their pre and postoperative audiograms.

Main Outcome Measures: Outcome measures included surgical details, audiologic outcomes, and facial nerve complications.

Results: Seven hundred twenty stapedectomy cases were reviewed, of which 62.5% were female, with a mean age of 47. Of these patients, 61 (8.5%) had either dehiscent or anomalous facial nerves. There were no facial nerve related complications. Forty patients had completed pre and postoperative audiograms excluding 2 patients with prosthesis related complications and 1 with postoperative profound sensorineural hearing loss. The average preoperative air-bone gap was 33±8 (13-48) dB, with an average postoperative gap of 11±8 (0-31) dB.

Conclusions: Stapedectomy with a dehiscent or anomalous facial nerve can be safely completed with successful air-bone gap closure in select cases.

Professional Practice Gap & Educational Need: Based on prior studies, 11.4% of stapedectomy cases encounter a dehiscent facial nerve while 7% experience a prolapsed or “overhanging” nerve. Few studies have examined how these anomalies impact intraoperative approach and postoperative outcomes in stapedectomy cases.

Learning Objective: To describe successful stapedectomy in most cases with a dehiscent or anomalous facial nerve.

Desired Result: To report safe and successful air-bone gap closure of patients undergoing stapedectomy with a dehiscent or prolapsed facial nerve.

Level of Evidence: Level III

Indicate IRB or IACUC: IRB #216830, Loyola University Medical Center

Endoscopic Stapedectomy: Does Oval Window Packing Matter?

Maria A. Mavrommatis, MD; Jun Yun, BS; Jennifer Ren, BA; Maura K. Cosetti, MD
Enrique Perez, MD; George B. Wanna, MD; Zachary G. Schwam, MD

Objective: To determine whether audiometric or vestibular differences exist between three different approaches to oval window packing after endoscopic stapedectomy.

Study Design: Retrospective chart review

Setting: Academic tertiary care otology-neurotology practice.

Patients: Patients who underwent endoscopic stapedectomy years 2017-2023.

Interventions: Oval window reinforcement was performed with one of three techniques: lobular fat graft, promontory blood seal, or none.

Main Outcome Measures: Our primary outcome measures were postoperative vertigo and change in air-bone gap (ABG) and pure-tone average (PTA). Patient and surgical variables such as age, sex, laterality, surgeon, primary versus revision surgery, laser versus drill stapedotomy, degree of footplate drillout, and prosthesis type were secondarily investigated.

Results: 241 patients (mean age 47.4 +/- 13.0 years) were included for analysis, with 137 receiving promontory blood seal, 54 receiving fat graft, and 50 receiving no reconstruction. There was no difference in incidence of postoperative vertigo between groups (p>0.05). Similarly, average improvements in ABG and PTA were not significantly different between groups (p>0.05). There was also no significant difference in percentage of patients achieving ABG closure to within 10dB or within 20dB (p>0.05). There were no cases of postoperative profound sensorineural hearing loss.

Conclusions: There does not appear to be audiometric or vestibular consequences of oval window reconstruction with blood patch, fat graft, or no reconstruction at all in endoscopic stapedectomy.

Professional Practice Gap & Educational Need: Since the paradigm shift in otosclerosis surgery from complete stapedectomy to stapedotomy, the utility of packing around the oval window has been questioned.

Learning Objective: The practice of oval window packing may not have audiometric or vestibular consequences in endoscopic stapedectomy.

Desired Result: An understanding that the material used in oval window reconstruction after endoscopic stapedotomy, and even the existence of reconstruction itself, may not have any effect on audiometric or vestibular outcomes.

Level of Evidence - Level IV

Indicate IRB or IACUC: STUDY-22-01733

Hybrid Canal Wall Up Mastoidectomy with Intracanal Atticotomy

Michael S. Castle, MD; Matthew M. Carter, BS; Benjamin J. Greene, MD
Paul Allen, PhD; Paul O. Dutcher, MD

Objective: To determine the long-term efficacy of a hybrid technique (canal wall up and intracanal atticotomy (CWU-IA)) for the treatment of cholesteatomas.

Study Design: Retrospective case review.

Setting: Tertiary academic hospital.

Patients: Children and adults with cholesteatoma who underwent a CWU-IA by a single surgeon.

Interventions: Tympanomastoidectomy with a hybrid canal wall up and intracanal atticotomy without "bone bridge" preservation with or without ossicular chain reconstruction.

Main Outcome Measures: Disease recurrence rates, hearing outcomes (pure tone averages in speech frequencies (1000- 4000 Hz), speech recognition scores), need for second look procedures, and conversion rate to a canal wall down procedure.

Results: Eighteen patients underwent the CWU-IA procedure. Patients were followed for an average of 73 months (1-132 months). Two patients (11%) had recurrence of disease. Fourteen out of eighteen (78%) of patients had stable dry ears after surgery. Three patients (17%) ultimately required a canal wall down mastoidectomy, two for disease recurrence and one for suspected recurrence by another surgeon. Patients averaged about 5 dB of improved hearing on pure tone averages in speech frequencies.

Conclusions: The CWU-IA procedure is an option for treatment of cholesteatomas. It provides the benefits of in office surveillance of a high-risk region of cholesteatoma recurrence, without committing the patient to a canal wall down cavity, spares most patients a second procedure, and on average provides a modest improvement in hearing in most patients.

Professional Practice Gap & Educational Need: There is significant variation in management strategies for cholesteatoma (canal wall up vs canal wall down). There likewise are variable surveillance strategies (second look vs imaging). Each strategy has both pros and cons in disease control and patient quality of life. The CWU-IA procedure attempts to maximize the pros of each strategy while minimizing its cons. To date there is limited literature on the effectiveness of this approach.

Learning Objective: To describe the CWU-IA procedure for treatment and surveillance of cholesteatoma. To compare and contrast this treatment strategy to the current common strategies of attic cholesteatomas.

Desired Result: To describe another treatment and surveillance strategy for cholesteatoma management and discuss some potential benefits and limitations of this strategy with other more well-known strategies.

Level of Evidence - V

Indicate IRB or IACUC: IRB, URMC STUDY 00008668

Facial Nerve Dysfunction Severity Determination by Facial Recognition Software and Machine Learning

Lee M. Bauter, MD; Nolan Lwin; Nick Johnson; Bingnan Hao, BS
Keith W. Buffinton, PhD; Joshua V. Stough, PhD.; Arun K. Gadre, MD

Objective: We utilized computational image processing for the quantification of facial nerve dysfunction (FND). As proof-of-concept, we hope to construct a model that detects and quantifies facial landmarks while detecting and grading the severity of FND. Ultimately, we hope that an accessible computer-driven evaluation will eliminate biases which exist in the current assessment of these patients.

Study Design: Proof-of-Concept; Non-Randomized Control Trial

Setting: Otolaryngology Clinic; Computer Science/Mechanical Engineering Laboratory

Patients: Open-source data sets; Adult patients over the age of 18 years; Normal volunteers and patients with various degrees of unilateral FND.

Interventions: A constructed model will detect facial landmarks and features automatically. This model will assess images of patients with FND. Using topographical features and machine learning abilities, clinical grading will be performed.

Main Outcome Measures: Primary endpoint: the ability of the model to perform accurate facial landmark detection. Secondary endpoint: the ability of the model to detect the presence/severity of FND when compared to trained physicians.

Results: Utilizing computer software, we have processed open-source images and images of healthy volunteers. We demonstrated that a computer model in the form of a mobile application can quantify facial landmarks reliably. We are continuing to train the model to detect FND and grade its severity utilizing patient images.

Conclusions: Numerous grading systems have been developed to quantify the severity of the FND. The objective of this proof-of-concept study/non-randomized control trial is to eliminate the subjectivity from the diagnosis and treatment by utilizing an accurate and accessible computational machine learning model.

Professional Practice Gap & Educational Need: Subjectivity of diagnosis of FND. Need for further standardization for the diagnosis of FND.

Learning Objective: Discuss the current diagnosis of FND and the potential for utilization of an objective machine learning model for future diagnosis and treatment.

Desired Result: The development of an accessible computational model that can be widely used for the diagnosis of FND.

Level of Evidence: II

Indicate IRB or IACUC: GEISINGER IRB NUMBER: 2022-0746. IRB Approved: 06/28/2023

Systemic and Intratympanic Steroid Treatment for Limited Sudden Sensorineural Hearing Loss

Ryan C. Higgins, MD; Lina M. Adwer, BS; Geoffrey C. Casazza, MD
Anne K. Maxwell, MD

Objective: To compare treatment outcomes in patients who either did or did not meet NIDCD audiometric criteria for sudden sensorineural hearing loss (SSNHL).

Study Design: Retrospective cohort study of patients with SSNHL with a 30-dB loss over 3 consecutive frequencies (Group 1 "Full Criteria") or with more limited loss not meeting this criteria (Group 2 "Limited SSNHL") and were treated with oral and/or intratympanic steroids.

Setting: Single tertiary-care institution from January 1, 2017 – May 24, 2023.

Patients: Adults (≥19 years) with unilateral, audiometrically-confirmed SSNHL treated with high-dose oral prednisone and/or intratympanic dexamethasone injection.

Interventions: High-dose oral prednisone, intratympanic dexamethasone.

Main Outcome Measures: Post-treatment pure-tone average (PTA), speech reception threshold (SRT), word recognition score (WRS).

Results: 130 patients met inclusion criteria with 78 from Group 1 and 52 from Group 2. Group 1 had an average difference in PTA, SRT, and WRS after treatment of 19.1 dB, 21.6 dB and 30.2%, respectively. Group 2 had an average difference in PTA, SRT, and WRS after treatment of 6.3 dB, 6.3 dB, and 2.8%, respectively. The percent of patients who experienced WRS improvement was significantly greater in Group 1 (79.0%) than Group 2 (28.6%; $p<0.001$). The percent of patients who experienced improvement in PTA or SRT did not differ significantly between groups ($p=0.459$ and $p=0.278$; respectively).

Conclusions: Oral and intratympanic steroids should be considered for adult patients with SSNHL, regardless of whether or not they meet full NIDCD audiometric criteria. Future prospective studies may consider including these patients, thus expanding the potential recruitment pool.

Professional Practice Gap & Educational Need: Treatment for sudden sensorineural hearing loss in patients that do not meet NIDCD audiometric criteria.

Learning Objective: To discuss treatment outcomes for patients with limited SSNHL that do not meet strict audiometric criteria for SSNHL

Desired Result: To understand if patients with more limited SSNHL respond to steroid therapy, and whether these patients should be included in future research studies for SSNHL.

Level of Evidence – Level III

Indicate IRB or IACUC: IRB PROTOCOL # 0389-23-EP

Treatment Patterns of Complex Patients Dually Diagnosed with Vestibular Migraine and Meniere's Disease: A Retrospective Single-Center Cohort Study

Jennifer Ren, BA; Susmita Chennareddy, BA; Jennifer Kelly, PT; Andrea Feghali, NP
Maura K. Cosetti, MD; Zachary G. Schwam, MD; Enrique Perez, MD

Objective: To study the diagnostic and treatment complexity of patients with dual diagnoses of vestibular migraine (VM) and Meniere's disease (MD).

Study Design: Retrospective cohort study

Setting: Academic tertiary care otology-neurotology clinic

Patients: Adult patients with VM, MD, or both seen September 2021-September 2023

Interventions: N/A

Main Outcome Measures: Demographics, treatment patterns

Results: 338 patients were eligible (235 MD-only, 81 VM-only, and 22 dual-diagnosis). 22 patients were randomly selected in each cohort for preliminary analysis. Chi-square and Student's t-tests were used. The majority of VM or dual-diagnosis patients were female (p=0.02), but no significant differences existed for race, ethnicity, or insurance status. Dual-diagnosis patients were significantly more likely to receive diagnostic vestibular testing (p=0.004), though no significant difference existed for vestibular rehabilitation referral rates. Dual-diagnosis patients were on average prescribed significantly more medications (4.6) than single-diagnosis cohorts (2.4 MD-only, 2.6 VM-only, p <0.001), though there was no difference in number of medications between single-diagnosis cohorts. Only dual-diagnosis patients were managed with ablative or surgical treatment (n=4, p=0.01).

Conclusions: The diagnosis and management of vestibulopathy can be particularly challenging when overlapping VM and MD disorders exist. In our study, patients with dual diagnoses of VM and MD received more aggressive medical and surgical treatment than patients with VM or MD alone. Consistent with gender differences in migraine prevalence, the majority of VM and dual-diagnosis patients were female. Furthermore, all patients who received ablative/surgical treatment were female.

Professional Practice Gap & Educational Need: Given the overlapping clinical presentations between vestibular disorders, recent literature suggests that many vestibular disorders, including vestibular migraine (VM) and Meniere's disease (MD), exist on a continuum. Some patients with particularly complex constellations of symptoms may receive multiple diagnoses and increasingly aggressive clinical management. Additional studies are needed to better understand the demographic, diagnostic, and treatment profiles of dual-diagnosis vestibular patients.

Learning Objective: To identify patterns of diagnostic workup and treatment in patients diagnosed with VM and MD, which may contribute to better understanding of complex vestibular disorders.

Desired Result: Complex patients with dual diagnoses of VM and MD have different demographic patterns, receive increased vestibular testing, and receive more aggressive treatment than either of their single-diagnosis counterparts.

Level of Evidence - Level IV

Indicate IRB or IACUC: STUDY-22-01733, Mount Sinai Health System

Superior Results for Mastoidectomy with Obliteration Using Bioactive Glass versus Mastoidectomy Alone in treating Chronic Suppurative Otitis Media

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Rick van de Langenberg, MD, PhD; David R. Colnot, MD, PhD
Jasper J. Quak, MD, PhD

Objective: To present the outcomes of mastoidectomy with obliteration using S53P4 bioactive glass (BAG) for chronic suppurative otitis media (CSOM) and compare this to the results of mastoidectomy alone.

Study Design: Retrospective comparative cohort study

Setting: Single-center

Patients: Patients underwent canal wall up (CWU) or canal wall down (CWD) mastoidectomy with or without mastoid obliteration in the period 2005–2022 for CSOM. Other inclusion criteria were minimal six months of follow-up, otorrhea as main preoperative symptom and involvement of mastoid air cells, defined as opacification on preoperative CT imaging.

Interventions: Mastoid obliteration using S53P4 BAG

Main Outcome Measures: Otorrhea, indicated by the postoperative Merchant grade at most recent follow-up moment, and hearing outcomes

Results: In total, 164 cases underwent mastoidectomy with mastoid obliteration and 73 cases underwent mastoidectomy alone. The median follow-up time in years was 3.0 (IQR 1.4-5.2) and 3.2 (IQR 1.8-6.1), respectively. The dry ear rate at the most recent follow-up moment, as indicated by Merchant grade 0-1, was 95% (n=155) in the obliteration group and 67% (n=49) in the non-obliterative group (Odds ratio 8.4, 95%CI 3.7-19.4, $p<0.001$). In the obliteration group, no cases suffered from Merchant grade three, compared to 11 cases (15%) in the non-obliterative group. Hearing outcomes were comparable for both groups.

Conclusions: In cases of CSOM with mastoid involvement, obliteration of the mastoid cavity using BAG is associated with superior results compared to mastoidectomy alone.

Professional Practice Gap & Educational Need: Obliteration following both CWU and CWD mastoidectomy is gaining in popularity. However, comparative studies are lacking and therefore no standard of care can be determined. Additional education on the outcomes of obliterative techniques, especially in comparison with non-obliterative techniques are warranted.

Learning Objective: The differences in outcomes between obliterative and non-obliterative techniques for CSOM, with arguments in favor and against mastoid obliteration after mastoidectomy for CSOM.

Desired Result: That ENT-surgeons will consider utilizing mastoid obliteration following mastoidectomy in cases of CSOM with mastoid involvement.

Level of Evidence – III

Indicate IRB or IACUC : Exempt by Medical Research Ethics Committees United, reference number W21.162, date 22-02-2023

Superior Canal Dehiscence and the Risk of Additional Dehiscences: A Retrospective CT Cohort Study

Ahjeetha Shankar, BS; Nimesh Nagururu, BS; Monica S. Pearl, MD
John P. Carey, MD; Bryan K. Ward, MD

Objective: Determine if superior canal dehiscence (SCD) found on flat-panel CT increases the risk for other defects in the same otic capsule.

Study Design: Retrospective cohort study

Setting: Tertiary care center

Patients: 100 ears (50 with SCD and 50 matched controls without SCD).

Interventions: Flat-panel CT imaging

Main Outcome Measures: (1) Prevalence of other dehiscences in SCD ears, (2) Dehiscences in controls and (3) Otic capsule thickness in other reported dehiscence locations (cochlea-carotid, lateral semicircular canal (SCC) and mastoid, facial nerve-lateral SCC, vestibular aqueduct, posterior SCC-jugular bulb, posterior SCC-posterior fossa).

Results: There was a mean of 0.08 additional dehiscences in the SCD group (not including the SCD) and 0.06 in the controls. Four SCD ears (8%) had an additional dehiscence, while three controls (6%) were incidentally found to have a dehiscence ($p=0.70$). The most common location of the second dehiscence in ears with SCD was between the cochlea and carotid artery (n=3 ears) and between the facial nerve and lateral SCC in controls (n=2 ears). As a group, SCD ears had wider vestibular aqueducts (0.68mm±0.20mm vs. 0.51mm±0.30mm, $p<0.01$), and thinner bone between the posterior SCC and posterior fossa (3.12mm±1.43mm vs. 4.34mm±1.67mm, $p<0.01$). The bone between the facial nerve and lateral SCC was thicker in SCD ears (0.77mm±0.23mm vs. 0.55mm±0.27mm, $p<0.01$) and no different for cochlea-carotid, and lateral SCC and mastoid ($p>0.05$).

Conclusions: SCD does not increase the likelihood of a second dehiscence in the same otic capsule. Compared to controls, SCD patients may have congenitally smaller otic capsule bones, particularly near the posterior SCC, where the vestibular aqueduct may be enlarged.

Professional Practice Gap & Educational Need: Previous literature has reported multiple dehiscences in patients as occurring at high rates. However, using a flat panel CT that we have validated against surgical findings, patients with SCD are no more likely to have a second dehiscence than controls are to have an incidental dehiscence.

Learning Objective: Ascertain the prevalence of various types of dehiscence in SCD and control patients.

Desired Result: Gain a better understanding of the prevalence of various types of dehiscence in SCD and control patients and see what interventions may be most efficacious in treating these individuals.

Level of Evidence – Level III

Indicate IRB or IACUC: Johns Hopkins University School of Medicine, IRB #: IRB00279939, Approved 4/26/2021

A Description of Tool to Tissue Forces during Robotic-Assisted Mastoidectomy

Ahjeetha Shankar, BS; Mohammad Salehizadeh, PhD; Henry H. Joo, BS
Yuxin Chen, MSE, BS; Manish Sahu, PhD; Russell H. Taylor, PhD
Deepa J. Galaiya, MD

Introduction: We have previously validated a force-sensing otologic drill used with a cooperative control robotic arm. Force sensing instruments can be used to measure tool to tissue forces and enforce virtual force barriers during robotic surgery. The forces typically applied by the drill to bone during a mastoidectomy have not been previously described. Here we use a validated force sensing otologic drill to measure the forces during mastoidectomy at various stages of the procedure.

Methods: Seven cadaveric temporal bones were drilled by three otologists. Mastoidectomy was divided into seven phases, and drilling forces were recorded. For each temporal bone, a CT scan was obtained at four time points to assess volume loss. After each temporal bone was drilled, subjects completed a survey consisting of the NASA Task Load Index and open-ended survey questions about robotic assistance for mastoidectomy.

Results: Drilling the cortex of the temporal bone generated forces of 1.18N$\pm$0.34N (mean$\pm$standard deviation), while drilling the trabeculated portion of the cortical mastoidectomy generated tool to tissue forces of 1.07N$\pm$0.33N. Thinning bone edges along the tegmen and posterior ear canal wall with a 6mm and 4mm cutting bur respectively generated forces of 0.95N$\pm$0.21N and 0.71N$\pm$0.15N. Opening the antrum generated forces of 0.84N$\pm$0.29N. Finally, identifying the facial nerve with a 3mm diamond bur and drilling the facial recess with a 2mm diamond bur generated forces of 0.85N$\pm$0.26N and 1.00N$\pm$0.31N respectively. At all stages of the procedure, the volume of bone removed for each Newton-second of applied force was 0.01cm^3/N, indicating a constant bone milling rate. Survey results showed minimal perceived temporal demand and frustration with robotic-assisted mastoidectomy at 20/100$\pm$3.54/100 and 39/100$\pm$29.03/100 respectively.

Conclusions: We employed a validated force-sensing drill to characterize the tool-to-tissue forces in robot-assisted mastoidectomy with 0.01N precision, the first reported description of drilling forces in mastoidectomy.

Professional Practice Gap & Educational Need: Tool-to-tissue force characterization is necessary for the development of virtual force barriers and higher fidelity haptic feedback during robot-assisted surgery.

Learning Objective: Quantify the forces exerted at each stage of the mastoidectomy procedure by OHNS surgeons of various levels of training.

Desired Result: By understanding the actual forces exhibited during critical stages of a mastoidectomy, more accurate haptic feedback and force limitations can be developed and applied force can be translated to obtain desired performance in robot-assisted otologic surgeries.

Level of Evidence - Level V

Indicate IRB or IACUC: Johns Hopkins University School of Medicine, IRB # IRB00326913, Approved 10/6/2022.

Active Transcutaneous Bone-Anchored Auditory Implants: Surgical and Audiologic Outcomes

Darius Kohan, MD; Ilana Yellin, MD

Objective: To assess surgery and hearing outcomes after implantation with most recent FDA approved active transcutaneous bone-anchored hearing devices.

Study Design: Retrospective cohort study.

Setting: Tertiary academic otology-neurotology practice including ambulatory surgery center.

Patients: Adults 18 or older with hearing loss meeting criteria for active transcutaneous bone-anchored auditory implants having failed non-surgical options from April 2019 to March 2023.

Interventions: Implantation of one of two active transcutaneous bone-anchored hearing devices.

Main Outcome Measures: Percentage of maximum potential gain achieved in pure tone average (PTA4), qualitative patient satisfaction Abbreviated Profile of Hearing Aid Benefit (APHAB), dural or sigmoid sinus exposure/compression, use of lifts, implant location, surgical and postoperative complications.

Results: There were 44 patients undergoing implants during the study period performed by the same surgeon/audiologist team. 23 patients met the study criteria. 9 patients had the Cochlear Osia OSI200 (Sidney, Australia) designated "IO," 14 patients had the MED-EL BONEBRIDGE BCI 602 (Innsbruck, Austria) designated "IB." 61% of patients chose IB due to its size and MRI compatibility. There were overlapping etiologies for hearing loss, most common being: cholesteatomas (48%), chronic suppurative otitis media (26%), single sided deafness (13%), and otosclerosis (13%). 17 procedures were performed concurrent with other otologic interventions. IB: required lifts in 3 patients, bony island dural compression occurred in 4 patients, 3 placements were retro sigmoid. The only complication was with one IB patient 3 weeks post-surgery requiring explant and reimplant a few months later. Percentage of maximum potential PTA4 gain was 57% for SSD regardless of implant type, 52% with IO and 75% with IB for pure conductive hearing loss (CHL), and 100% with both implants for mixed hearing loss (MHL). Otosclerosis patients had overclosure with both devices driving better outcome. Excluding them brings the rate for MHL to 70% regardless of device. Cosmetic issues of prominent implant profile occurred in 2 IO patients. All patients had measurable audiologic benefits from implants, with overall patient satisfaction at 78% and APHAB score better for IO versus IB. One IO and 1 IB are non-users.

Conclusions: Both IO and IB provide excellent auditory benefit (including both high and low frequencies) in patients not amenable to aural rehabilitation with standard amplification. Surgical complications are very low. Devices size, MRI compatibility, and finances prefer IB. Auditory outcomes are better in patients with conductive or mixed hearing loss versus sensorineural deficits.

Professional Practice Gap & Educational Need: Challenges in constantly evolving technology on implantable active bone-conduction auditory devices relative to indications, applications, surgery, risks and audiologic benefits to be derived from different devices.

Learning Objective: 1. Understand indications for different active transcutaneous bone-anchored hearing devices. 2. Learn surgical techniques and risks associated with these devices. 3. Learn the audiologic benefit and patient satisfaction with these devices.

Desired Result: For otolaryngologist and audiologists to become familiar with the surgical and audiologic indications for active transcutaneous bone-anchored hearing devices, to become familiar with the surgery associated with them and the risks involved, and to have realistic expectations on the audiologic benefits and limitations.

Level of Evidence: Level IV

Indicate IRB or IACUC: IRB # 22-0342 Approval of Hofstra Medical School, Northwell Health

Postoperative Middle Ear Effusion is Rare following Middle Cranial Fossa Spontaneous Cerebrospinal Fluid Leak Repair

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

Objective: Assess the rate of unilateral middle ear effusion (MEE) at 1 month after middle cranial fossa (MCF) repair in patients with spontaneous cerebrospinal fluid (sCSF) leaks.

Study Design: Retrospective cohort

Setting: Tertiary referral center

Patients: Patients with sCSF leak who underwent MCF repair

Interventions: MCF sCSF with bone cement, one-month postoperative exam, and audiogram

Main Outcome Measures: Middle ear effusion 1 month postoperatively, preoperative and postoperative audiometry.

Results: 66 patients underwent sCSF leak MCF repair with bone cement from 8/2019-3/2023. Mean post-operative follow-up was 229 (±307) days and there were no recurrent unilateral leaks. On one-month postoperative otomicroscopy, 65 (99%) had no MEE. One patient had mucoid drainage from a tube and after removal, there was no MEE at 2-month follow-up. There was significant improvement in mean PTA (12.17 [10.6] dB; $p < 0.001$; Cohen $d = 0.95$) and ABG (14.8 [9.3] dB; $p < 0.001$; Cohen $d = 0.88$) after repair. 96% of preoperative tympanograms were type B, 93% of postoperative tympanograms were type A. Average age was 56 (±11.6) years and 67% were female with an average BMI of 38.89 (±9.9) kg/m2. Only 2 (3%) had a history of previous ear disease including prior unilateral tympanoplasty and recurrent otitis media, yet neither had active chronic ear disease at the time of evaluation. 5 patients developed a contralateral sCSF leak.

Conclusions: Prior ear disease is rare in sCSF leak patients. CSF effusion is extremely rare after MCF repair with bone cement and significant audiometric improvement is expected.

Professional Practice Gap & Educational Need: The rate of concomitant Eustachian tube dysfunction and sCSF leak is unknown. This study describes the rate of MEE following MCF sCSF leak repair.

Learning Objectives: Postoperative MEE is rare following MCF repair of sCSF leaks

Desired Results: Define the rate of postoperative MEE after MCF repair of sCSF leaks.

Level of Evidence: IV

IRB: Indiana University IRB #1907071217.

A Multi-Institutional Review of the Impact of Social Determinants of Health on Vestibular Schwannoma Management

Objective: Evaluate the effect of social determinants of health (SDoH) on initial treatment recommendations for vestibular schwannoma (VS).

Study Design: Retrospective Muti-institutional Review

Setting: 8 tertiary referral centers

Patients: 4,350 patients with sporadic VS newly diagnosed between January 1, 2010, and December 31, 2020.

Interventions: Treatment recommendation including surgical management, radiation therapy, or observation

Main Outcome Measures: Differences in initial treatment recommendation as influenced by various SDoH including age, race, ethnicity, insurance status, and area deprivation index (ADI)

Results: When individual determinants were examined for overarching patterns of treatment recommendations, slight differences were seen across several SDoH. As national ADI increased (indicating increasing disadvantage), recommendation for radiation decreased. Dimensionality reduction of SDoH alongside factors such as hearing status, tumor size, tumor location, and Charlson Comorbidity Index was performed with principal component analysis to visualize data clustering. Age was found to be the major factor which influenced clustering of data into treatment groups. Machine learning modeling using random forest was also applied to the data in comparison to standard statistical modeling. Hearing status, tumor characteristics, and SDoH were considered in parallel in the analysis. Preliminary analysis showed stronger influence on treatment recommendation from age in both models and tumor size in the machine learning model. Potential contribution from other SDoH on data trends was small.

Conclusions: While several small differences in treatment recommendations for patients with VS were seen in the overall view of the data, the data clustering indicates a lack of strong influence from SDoH except for age. However, limitations in this dataset including uneven distribution of patients across SDoH groups may affect the data modeling. Further investigation is necessary to better understand the implication of these findings on patient outcomes and guide how these factors should be considered when managing patients.

Professional Practice Gap & Educational Need: The effect of SDoH on treatment recommendations for VS is not well defined.

Learning Objective: Understanding if SDoH influence physicians' treatment recommendations for VS.

Desired Result: Identification of any social determinants which affect the treatment recommendation patterns for VS.

Level of Evidence - Level III.

Indicate IRB or IACUC: Exempt

Otologic Benefits of High-Fidelity Earplug Use at Social Music Venues

Matthew E. Lin, MD; Ryan Long, MD; Oluwatobiloba Ayo-Ajibola, BS (presenter)
Eric X. Wei, MD; Janet S. Choi, MD MPH; Joni K. Doherty, MD, PhD

Objective: Identify differences in hearing-related beliefs, exposure history, and otologic symptoms between those who use high-fidelity earplugs (HFE) and other hearing protection (OHP) modalities.

Study Design: Cross-sectional survey.

Setting: Online music communities.

Patients: Adult community participants.

Interventions: Diagnostic survey.

Main Outcome Measures: Otologic symptoms following hearing protection use at music events.

Results: Respondents (n=2,352) were primarily male (61.26%), white (71.52%), and young (mean age (S.D.)=28.68 years (6.95)). Among hearing protection users, HFEs were the most used (57.49%). HFE users were more likely than OHP counterparts to cite experiencing hearing-related symptoms after event attendance ($p<0.001$), non-impact on music quality ($p<0.001$), and accessibility ($p<0.001$) as why they used hearing protection. HFE users were less likely than OHP users to report difficulty hearing others ($p<0.001$), difficulty hearing high-pitched sounds ($p<0.001$), and dizziness/loss of balance ($p=0.002$) after events. Relative to OHP users in a multivariable logistic regression, HFE users were less likely to be female ($p=0.044$) and primarily attend country ($p=0.020$), hip-hop/R&B ($p<0.001$), and pop ($p=0.013$) events relative to electronic music events.

Conclusions: HFEs, a convenient alternative to OHPs, may offer users increased protection without affecting subjective music enjoyment.

Professional Practice Gap & Educational Need: Hearing protection use at social music venues is understudied despite these events' popularity and propensity for causing noise-induced hearing loss. HFEs, reusable options that attenuate noise exposure by 20 dBA while anecdotally preserving sound quality, are similarly understudied.

Learning Objective: After this presentation, readers should understand the otologic benefits of HFEs and factors associated with HFE use.

Desired Result: Increased awareness of HFEs may encourage healthier hearing habits among music venue attendees.

Level of Evidence: III

Indicate IRB or IACUC: University of Southern California IRB #UP-22-00936 (11/10/2022).

Charcot Marie Tooth Disease and Hearing Loss: A Systematic Review with Meta-Analysis

John F. Mills, BS; Luke D. Heiland, BS; Shaun A. Nguyen, MD
Michaela F. Close, MD; Ted A. Meyer MD, PhD

Objective: To characterize the pattern of hearing loss in Charcot Marie Tooth Disease (CMT) to help guide clinical management.

Data sources: A systematic review of CINAHL, PubMed, and Scopus databases was conducted according to PRISMA guidelines from inception to July 31, 2023.

Study selection: Two independent investigators ultimately selected 6 prospective studies (N=197) on patients with pure tone average (PTA) and auditory brainstem response (ABR) data. Case reports, case series <5 patients, and data that overlapped with another study were excluded.

Data extraction: Two independent reviewers performed data extraction, quality rating, and risk of bias assessment using the Newcastle-Ottawa Scale.

Data synthesis: Meta-analysis of mean difference using fixed/random effects models was used. Also, significant differences between objective measures were analyzed using a weighted one-way analysis of variance, with post-hoc Tukey's test for comparison.

Results: CMT4C had significantly worse hearing as measured by PTA when compared to CMT1A (Δ 28.93 dB, 95%CI 18.34 to 39.52) and CMT2A groups (Δ 28.3 dB, 95%CI: 15.98 to 40.62). For the CMT1A subtype, there were significantly prolonged ABR latency values across wave III (0.20 ms, 95%CI: 0.05 to 0.35), wave V (0.20 ms, 95%CI: 0.01 to 0.39), wave I-III (0.20 ms, 95%CI: 0.01 to 0.39), and wave I-V (0.20 ms, 95%CI: 0.01 to 0.39) when compared to controls.

Conclusions: Patients with CMT generally have normal hearing thresholds, apart from the CMT4C subtype which presents with mild hearing loss on average. The ABR interpeak latency values for some CMT subtypes are delayed when compared to controls, possibly indicating a central brainstem processing delay.

Professional Practice Gap & Educational Need: Patients with CMT have been shown to have varying patterns of hearing loss. A better characterization of this hearing loss can help guide clinical management.

Learning Objective: To better understand the pattern of hearing loss in patients with CMT. Often, patients can present with complaints of hearing with otherwise normal audiograms.

Desired Result: The use of technologies that can improve sound discrimination in noisy environments most likely offer the greatest benefit for these patients, although individual subtypes of CMT may require additional amplification or interventions.

Level of Evidence – Level II

Indicate IRB or IACUC: Exempt.

Teprotumumab and Hearing Loss in Patients with Thyroid Eye Disease: A Population Database Study

Bryce Hambach, BS; Natalie M. Perlov, BS; Zachary D. Urdang, MD, PhD
Thomas O. Willcox, MD; Dennis Fitzgerald, MD
Rebecca C. Chiffer, MD; Jacob B. Hunter, MD

Objective: To explore whether patients with thyroid eye disease are more likely to develop sensorineural hearing loss (SNHL) after teprotumumab treatment compared to patients with standard of care.

Study Design: Retrospective cohort study with propensity score matching.

Setting: TriNetX Research Network (2004-2023).

Patients: Approximately 215,145 adult patients with thyroid eye disease and no prior hearing loss or exposure to ototoxic medications.

Main Outcome Measures: Patients were divided into two cohorts based off of teprotumumab treatment. The primary outcomes of interest were diagnosis of SNHL and other conditions of the inner, middle, and external ear within 1.5 years of teprotumumab or control exposure. Cohorts were balanced using propensity-score matching (PSM) based on demographic variables and SNHL-related comorbidities, including diabetes mellitus and ischemic diseases. $P<0.05$ was set as the threshold for statistical significance.

Results: A 1:1 PSM analysis showed the teprotumumab cohort ($n=654$) had 6.69-increased odds [OR:95%CI, p] for developing all HL (6.69: 3.40-13.1, $p<0.0001$) compared to controls ($n=654$). Specifically, patients who received teprotumumab had 3.71-increased odds for developing bilateral SNHL disease (3.71: 1.82-7.53, $p<0.0001$) compared to controls.

Conclusions: Our study suggest patients with thyroid eye disease treated with teprotumumab had a significantly greater risk of developing hearing loss compared to those without teprotumumab exposure. Our study is the largest study to date looking at this association. These findings underscore the need for hearing screening and workup in these patients to manage unintended immune-related adverse events.

Professional Practice Gap & Educational Need: The prevalence of thyroid eye disease in the US adult population is 0.25%, with significant morbidity and mortality surrounding sight and aesthetic functional concerns. Biologic therapies, like teprotumumab, are used to manage the disease and may impact hearing health. Previous studies in this area lack controls and are limited by small sample sizes. This study is the largest to date; increased data on the otologic effects of these therapies may have important implications for management of patients afflicted by thyroid eye disease.

Learning Objectives: 1. Understand the association of hearing loss with teprotumumab for thyroid eye disease. 2. Guide clinicians to consider screening at-risk patients for these sequelae to manage otologic care.

Desired Result: 1. Increase awareness of unintended side effects of biologic treatment for thyroid eye disease on hearing health. 2. Inform clinical management and screening of these patients to optimize hearing health.

Level of Evidence – Level III

Indicate IRB or IACUC: Exempt

Ototoxicity in Cancer Patients Undergoing Immune Checkpoint Inhibitor Therapy: A National Database Study

Pablo Llerena, BS; Bryce Hambach, BS; Kathryn Nunes; BS
Praneet Kaki, BS; Jena Patel MD; Jacob B. Hunter MD

Objective: This study aims to investigate the impact of immune checkpoint inhibitor (ICI) therapy on the audiovestibular system in cancer patients.

Study Design: Retrospective cohort study design using the TriNetX clinical database.

Setting: TriNetX, a global research database with approximately 110 million patients.

Patients: Patients were categorized into three distinct groups: those diagnosed with lung and esophageal cancer (LEC), head and neck cancer (HNC), and melanoma. Cancer patients who received pembrolizumab post-diagnosis were compared to patients with the same diagnoses who had not received ICI treatment (cemiplimab, avelumab, atezolizumab, nivolumab, and durvalumab). The study excluded patients with prior exposure to cisplatin, aminoglycosides, or furosemide, and those with a history of hearing loss. Propensity score matching (PSM) was employed to account for 21 covariates.

Interventions: Observational

Main Outcome Measures: Odds ratios (OR) for developing sensorineural hearing loss (SNHL), vertigo, and dizziness within three months for cancer patients who received pembrolizumab

Results: Following PSM, patients with LEC who received pembrolizumab (n=6,131) exhibited an increased risk of developing vertigo and dizziness with an OR of 1.9 (95% CI: [1.3-2.7]). Similarly, those with melanoma (n=6,213) and HNC (n=2,679) receiving pembrolizumab also showed an increased risk of vertigo and dizziness: (3.1, [2.1-4.6]) and (1.4, [1.1-3.2]), respectively. However, cancer patients receiving pembrolizumab did not demonstrate an increased risk of SNHL: LEC, (0.7, [0.3-1.5]); HNC, 0.6, ([0.3-1.4]); and melanoma, 0.8, ([0.5-1.1]).

Conclusions: Employing PSM using a large global research database, pembrolizumab is linked to the development of vertigo and dizziness, but not with SNHL.

Learning Objective: Examine the impact of pembrolizumab therapy on the audiovestibular system in cancer patients.

Desired Result: Better understand the ototoxic effects of ICI in cancer patients.

Level of Evidence – III

Indicate IRB or IACUC: Exempt.

Exacerbation of Preexisting Otologic Conditions following COVID-19 Infection

Omer Baker, BS; Víctor de Cos, BS; Timothy J. Sears, BS; Olivia La Monte, BS
Omid Moshtaghi, MD; Peter Dixon, MD; Jeffrey P. Harris, MD, PhD

Objective: We aim to investigate whether pre-existing otologic conditions increase the likelihood of otologic symptom incidence and severity following COVID-19 infection.

Study Design: Retrospective review

Setting: Single tertiary care center

Patients: This study investigated patients ≥18 years of age who tested positive for COVID-19 infection between January 2020 and September 2022; of these patients, 63.2% were female, 87.5% were white, and the mean age was 58 years.

Interventions: Surveys were administered to patients ≥18 years of age who tested positive for COVID-19 infection between January 2020 and September 2022.

Main Outcome Measures: Incidence of otologic symptoms immediately following COVID-19 infection was compared between participants with a pre-existing otologic condition and control participants.

Results: Of 1,499 patients who tested positive for COVID-19, 721 (48%) reported a pre-existing otologic condition, with loss of hearing (25.5%) and history of dizziness (18.8%) being most highly represented among this sub-cohort. Individuals were more likely to report dizziness post-COVID-19 infection if they had a pre-existing history of dizziness (29.1% vs 17.8%, $p < 0.001$) or pre-existing history of vestibular neuritis (58.8% vs 19.5%, $p < 0.001$) than those who did not. Similarly, individuals with a history of vestibular migraine were more likely to report migraine symptoms post-infection than those who did not (27.9% vs. 7.2%, $p < 0.001$). Of patients with a pre-existing condition, 35.5% subjectively reported that they believed COVID-19 infection had worsened otologic symptoms of their condition.

Conclusions: These findings indicate that certain preexisting otologic conditions may be associated with a greater likelihood of exacerbation following COVID-19 infection and may help guide treatment protocols for those at greater risk.

Professional Practice Gap & Educational Need: Currently, there is a very limited clinical understanding of the relationship between COVID-19 infection and pre-existing otologic symptoms.

Learning Objective: The learning objective is to evaluate the effects of COVID-19 infection on certain preexisting otologic conditions.

Desired Result: The aim of this presentation is to inform physicians of the exacerbating symptoms that may arise for patients with preexisting otologic conditions that experienced COVID-19 infection, which can potentially improve patient counseling.

Level of Evidence – Level IV

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

Preoperative Hearing Aid Use Associated with Device Usage after Cochlear Implantation

Natalie Schauwecker, MD; Ankita Patro MD, MS; Connie Ma, MD; Nathan R. Lindquist, MD
Michael H. Freeman, MD; David S. Haynes, MD; Elizabeth L. Perkins, MD

Objective: Device usage contributes to improved cochlear implant (CI) outcomes. This study aims to identify whether preoperative hearing aid (HA) use affects postoperative device usage in hearing preservation (HP) candidates.

Study Design: Retrospective cohort.

Setting: Tertiary referral center.

Patients: 404 Adult HP CI recipients from 2012 to 2022.

Main Outcome Measures: Device usage at 1, 3, 6 and 12 months.

Results: Hearing aids were worn preoperatively in 279 (69.1%) patients. HA users were older (67 vs 64 years, p=0.012) but similar in gender distribution and duration of deafness compared to non-HA users. HA users had higher preoperative scores (CNC 19.9 vs 14.6 p=0.002; AzBio 29.2 vs 20.7, p=<0.001). On multivariate analysis including pre-operative PTA(p=0.143), CNC (p=0.103), AzBio (p=0.076), age (p=0.948), and hearing aid use, pre-operative HA use significantly predicted higher datalogging at 6 and 12 months (p=0.020). No factor was predictive of higher datalogging at 1 or 3 months.

Conclusions: Pre-operative hearing aid use predicted greater long-term device use in our cohort, which in turn, has shown to influence post-operative speech performance. Clinicians should emphasize the importance of full time CI use especially with non-HA users.

Professional Practice Gap & Educational Need: Improved methods to predict CI use and performance.

Learning Objective: Pre-operative candidacy demographics can assist in CI use and performance prediction.

Desired Result: Assistance in pre-operative and post-operative counseling for improved CI performance.

Level of Evidence -- Level IV, Historical Cohort

Indicate IRB or IACUC: Vanderbilt University Medical Center IRB# 221833

Comparison of Achievement and Time to Benchmark Cochlear Implant Performance for Traditional, Single-Sided Deafness, and Hearing Preservation Candidates

Natalie Schauwecker, MD; Ankita Patro MD, MS; Connie Ma, MD; Michael H. Freeman, MD
David S. Haynes, MD; Elizabeth L. Perkins, MD

Objective: To assess achievement of and time to benchmark performance for traditional, single-sided deafness (SSD), and hearing preservation (HP) cochlear implant (CI) candidates.

Study Design: Retrospective cohort.

Setting: Tertiary referral center.

Patients: 866 CI ears implanted from 2012 to 2022 (traditional: 378, HP: 437, SSD: 51)

Main Outcome Measures: Speech recognition scores; achievement of and time to "benchmark score," defined as 80% of institution's median speech recognition score.

Results: Compared to the other groups, SSD patients were younger (51y, $p<0.001$), and traditional candidates had longer duration of deafness (6.9y, $p<0.001$). A higher proportion of the HP group (68%) achieved CNC scores compared to SSD (43%) and traditional (57%) candidates ($p<0.001$). Time to benchmark CNC performance was equivalent ($p=0.410$). Achievement of ($p=0.283$) and time to benchmark ($p=0.568$) AzBio quiet scores were not significantly different among groups. For AzBio in noise, benchmark achievement was equivalent ($p=0.467$). However, traditional candidates (5.7 months) and SSD (6.2 months) took longer to meet benchmark AzBio in noise than HP (4.8 months, $p=0.033$). Datalogging was significantly lower at 3, 6, and 12 months for the traditional and HP patients who failed to attain benchmark scores ($p<0.001$). Age and duration of deafness did not impact benchmark achievement.

Conclusions: Compared to HP patients, traditional and SSD candidates achieved benchmark speech performance less frequently and took longer to do so. Patients who did not meet benchmark scores had lower device usage. These findings can assist with counseling and establishing follow-up frequency to optimize performance.

Professional Practice Gap & Educational Need: Improved methods to predict CI performance.

Learning Objective: Pre-operative candidacy type can assist in CI performance prediction.

Desired Result: Assistance in pre-operative counseling and post-operative follow-up for expected CI performance.

Level of Evidence - Level IV, Historical Cohort

Indicate IRB or IACUC: Vanderbilt University Medical Center IRB# 221833

Self-Referral vs Physician Referral: Hearing Aid Adoption Rates and Perceptions and Attitudes of Prospective Hearing Aid Users

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Objective: To investigate motivating factors and perceptions of prospective hearing aid (HA) users.

Background: While about 80 percent of hearing loss cases are treatable with HA use, only one in four individuals who may benefit from them pursue them. Alongside audiologists, physicians are integral parts of the hearing healthcare team and should be aware of factors that influence their patients' perceptions and choices.

Methods: Retrospective cohort study conducted between January 2018 and December 2022 conducted across five clinical sites, four of which are considered satellite offices. Adult patients with a primary complaint of hearing loss who received a HA evaluation were sent either an email or physical copy of a 17-question survey assessing demographic characteristics and factors related to HA adoption.

Results: Of 3,164 patients surveyed, there were 321 respondents, for a response rate of 10.1%. The sample was largely female (n=182, 57%), White/Caucasian (n=274, 86%), and geriatric (n=144), with 45% of patients >75-years-old. HA adoption rates were statistically different between White/Caucasian (n=193, 70%) and Black/African American (n=9, 39%) patients (X^2=9.56, p=0.0020), but not between other race categories. There were no significant differences in the racial composition of patients who were evaluated at the five sites included in this analysis (X^2=11.85, p=0.46). Approximately 80% of patients proceeded with HA after evaluation, with cost (n=164, 27%), insurance coverage (n=99, 17%), and physician recommendation (n=76, 13%) being the most popular factors that influenced their decision. Among factors influencing patients' decisions not to adopt HA, cost (n=71, 20%) and insurance (n=43, 12%) were the most cited reasons, though 169 respondents (48%) indicated the reason was one not listed on the survey. Chi-square analysis comparing these factors between patients who did or did not adopt HA were significantly different from one another (X^2=177.8, p<0.0001). With multiple regression analysis, while age, race, and gender were not predictors of HA adoption, patients' knowledge of multiple clinical locations offering HA (95% CI, 0.23-0.98; p=0.045) and the office at which they were evaluated (0.12-0.85, p=0.019) were significant predictors of HA adoption.

Conclusions: Responses from this study align with previous research on motivating factors in HA pursuit, though there are significant differences between patients who pursued HA and those who did not. Despite response bias, these data suggest that multiple office locations offering HA services may be beneficial to increasing HA adoption rates. These findings provide physicians, audiologists, and other members of the hearing healthcare team with insights into the factors which impact HA adoption.

Professional Practice Gap & Educational Need: Hearing aid adoption rates are low in eligible patients. Physicians play an integral role in potentially having a patient purchase a hearing aid. There is an educational need for physicians to be aware of the factors influencing hearing aid utilization, as physicians are a part of the hearing healthcare team.

Learning Objective: Explore which factors impact hearing aid adoption in patients with hearing loss.

Desired Result: Provide insight into the factors which impact hearing aid adoption and help to develop a more individualized care plan for patients with hearing loss during initial evaluations for hearing aids.

Level of Evidence – IV.

Indicate IRB or IACUC: iRISID-2022-1267, Thomas Jefferson University

Phenotyping of Hearing Instability: Correlating Longitudinal Changes in Endolymph Volume and Electrocochleography

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Objective: Evaluate the relationship between electrocochleography (ECochG) measurements and inner ear fluid quantifications.

Study Design: Longitudinal observational cohort study.

Setting: Tertiary referral center

Patients: Patients aged 29 – 69 shown to experience hearing fluctuation or sudden hearing loss.

Main Outcome Measures: Changes in electrocochleography potentials over time in patients experiencing hearing fluctuation compared with changes in inner ear fluid volumes extracted from MRI imaging.

Results: Patients were followed for 6-8 visits at approximately 3-month intervals. At each visit, contrast enhanced delayed FLAIR imaging was obtained alongside audiometric and vestibular testing including electrocochleography using TM electrodes. A custom developed image analysis software was used to characterize inner ear fluid volumes from MRI imaging including total volumes, endolymphatic volume, endolymph to perilymph (E/P) ratio, and endolymph to total volume (E/T) ratio for the entire labyrinth, cochlea alone, and vestibule alone. Electrocochleograms were obtained and used to calculate SP/AP area ratios. Visualization of the percent change in data across visits did not suggest that changes in SP/AP ratio follow changes in E/T ratio, E/P ratio, total volumes, endolymph volumes. Overall, hydropic ears, all of which showed some evidence of hearing instability during longitudinal observation, did not show significantly different SP/AP area ratios compared to non-hydropic ears ($p = 0.36$). Preliminary comparison of all ears of affected patients to a cohort of healthy volunteers also showed no significant difference ($p = 0.35$).

Conclusions: Preliminary analysis suggests that SP/AP area ratios do not differ in patients with MRI-proven hydrops who demonstrate evidence of hearing instability compared with healthy patients. SP/AP area ratios also do not appear to fluctuate along with endolymph to perilymph ratio fluctuation.

Professional Practice Gap & Educational Need: Change in ECochG measurements in patients with hearing instability over time is not well understood.

Learning Objective: Understand the relationship between changes in ECochG potentials and inner ear fluid volume in patients with hearing instability.

Desired Result: Characterize any relationship between SP/AP area ratios and inner ear fluid volumes, particularly with endolymph volume changes.

Level of Evidence – III

Indicate IRB or IACUC : Protocol #000141-DC

Impact of Acute Auditory Deprivation on Adaptive Head Movements during a Complex, Combined Speech-in-Noise and Localization Task

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Objective: Characterize adaptive head movements during a combined localization and speech-in-noise (SIN) task for normal hearing subjects before and after simulation of acute unilateral hearing loss with ear plugging to better understand how adaptive behaviors emerge.

Study Design: Prospective Study

Setting: Tertiary Referral Center

Patients: Normal hearing adults (n=22)

Interventions: Testing was completed in a semi-anechoic chamber with 24-speakers spaced equally in a 360-degree azimuthal configuration. Orienting stimulus followed by Harvard IEEE sentences were played from single speakers in the presence of diffuse pink noise with variable signal-to-noise ratio (SNR). Participants were asked to repeat the sentence and indicate perceived location while moving naturally to optimize listening. Head movements were recorded via an electromagnetic tracking system. Acute hearing loss was simulated with a combination of a deeply-seated foam earplug and supra-aural earmuff.

Main Outcome Measures:
1) Localization accuracy: Root-mean-square (RMS) error (degrees), linear best-fit across targets
2) Head movement: Movement delay (ms), total response time (ms), total head displacement (degrees)
3) SIN: Percent correct across SNR

Results: Statistical analyses were performed using ANOVA and Wilcoxon rank sum tests. Acute simulated unilateral hearing loss resulted in decreased localization accuracy, increased response delay and total response time, increased total head displacement, and decreased SIN percent correct compared with the unoccluded condition.

Conclusions: Acute unilateral deprivation leads to sharp decline in localization accuracy and SIN performance. This provides key initial insight into adaptive listening strategies that SSD individuals may acquire and utilize in complex listening environments. Future study comparing acute auditory deprivation to chronic SSD will further enhance our understanding of these adaptations.

Professional Practice Gap & Educational Need: SSD individuals have difficulty localizing sound and understanding SIN. They may develop adaptive listening strategies with specific head movement patterns to optimize monaural localization and speech understanding in noise. Granular understanding of these adaptive behaviors and how they develop over time may better inform aural rehabilitation in SSD.

Learning Objective: To characterize adaptive head movement listening strategies during a complex, combined localization and SIN task for those with acute unilateral hearing loss with ear plugging to better understand how adaptive head movements and behaviors emerge.

Desired Result: To provide improved understanding of development of adaptive listening behaviors with acute unilateral hearing loss, which may inform future aural rehabilitation options in the SSD population.

Level of Evidence – III

Indicate IRB or IACUC : University of Michigan HUM00190678

Risk Factors for Otitis Media in Rural Alaska Native Children

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Objective: Characterize the relationship between otitis media incidence and environmental, nutritional, and genetic risk factors in Alaska Native children

Study Design: Prospective cohort study

Setting: Thirteen communities in rural northwest Alaska

Patients: Alaska Native children ages 1-4

Interventions: Tympanometry and distortion-product otoacoustic emissions were used to evaluate ear and hearing status. Parent/guardian questionnaire assessed exposures to environmental and genetic risk factors. A six-month prospective chart review extracted ICD-10 codes for otitis media.

Main Outcome Measures: 6-month odds of otitis media infection

Results: Of 236 enrolled children, 53% were homozygous for CPT1A, 72% of children were breastfed, 23% lacked household running water, and 6% were exposed to wood smoke. The mean ratio of smokers to adults in the household was 0.4. The mean number of people in the household was 6.2. One or more otitis media episodes were diagnosed in 53% of children over six months. No significant associations were found between environmental and genetic factors and 6-month odds of otitis media.

Conclusions: No associations were found between risk factors and otitis media in rural Alaska Native children. However, results should be interpreted cautiously as the COVID-19 pandemic affected study duration, sample size, and risk of enrollment bias.

Professional Practice Gap & Educational Need: There is a need to better understand potential limitations to prospective research, such as low sample size and recruitment bias.

Learning Objective: To understand the effects of the COVID-19 pandemic on sample size, study length, and enrollment strategy.

Desired Result: Attendees should be better equipped to avoid potential pitfalls associated with unexpected changes to study methodology.

Level of Evidence - III

Indicate IRB or IACUC : Pro00105507, 5/06/2020, Duke IRB

Superior Semicircular Canal Dehiscence is Associated with Global Skull Thinning

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Objective: To assess whether development of superior semicircular canal dehiscence (SSCD) may be related to isolated intracranial skull base thinning, global skull bone thinning, or an alternative process.

Study Design: Retrospective cohort study.

Setting: Tertiary referral center.

Patients: Patients with CT IAC including calvarium and zygoma either with or without SSCD as confirmed by primary author

Main Outcome Measures: Thickness of calvarium and ipsilateral extracranial zygoma in SSCD and control patients as measured using standardized 3D slicer measurements of high-resolution temporal bone computed tomography scans obtained at a tertiary referral center and height of the internal auditory canal (IAC).

Results: 41 SSCD patients (21 with bilateral SSCD) and 32 control patients were assessed for thickness of ipsilateral calvarium and extracranial zygoma. Age and BMI were similar between the cohorts ($p=0.07$ and $p=0.09$, respectively). Females comprised 25 (61%) of SSCD patients and 22 (69%) of control patients while 39 (95%) of SSCD patients and 24 (77%) of control patients were white. Calvarium thickness was significantly reduced in SSCD patients (1.94 [0.36] cm) compared to control patients (2.40 [0.51]) ($p<0.001$) as was zygoma thickness ($p<0.001$). SSCD patients also had significantly reduced calvarium-to-zygoma ratio ($p=0.01$). IAC height was significantly shorter in SSCD patients (2.9 [0.9] cm) compared to control patients (4.9 [1.4] cm) ($p<0.001$).

Conclusions: SSCD patients appear to have global thinning of cranial bones despite similar rates of obesity compared to the general population. The global nature of skull thinning suggests that SSCD may occur from a developmental process.

Professional Practice Gap: Etiology of SSCD is poorly understood. This study attempts to elucidate whether SSCD occurs as a result of an isolated skull base defect, a more systemic process, or perhaps a process yet to be explained.

Learning Objective: Patients with SSCD appear to have global skull bone thinning

Desired Result: Clinicians will gain further understanding regarding the pathophysiology of SSCD prompting additional research into understanding this complex disease process

Level of Evidence: IV

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

Preoperative Superaddativity Predicts Cochlear Implant Postoperative Audiologic Outcomes

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Objective: To assess predictive ability of multi-modal audiovisual (AV) City University of New York (CUNY) sentence test scores on postoperative AzBio sentence scores in cochlear implant (CI) patients

Study Design: Retrospective cohort study

Setting: Tertiary referral center

Patients: Patients undergoing CI with preoperative CUNY testing

Main Outcome Measures: Impact of superadditivity—(SA) defined as the combined AV CUNY score subtracted by the sum of the audio only (AO) and visual only (VO) scores—of combined audio and visual CUNY scores on postoperative AzBio testing Effect of SA was assessed using paired t-tests to compare "high performers" vs. "low performers" based on a pre-operative SA cutoff of 25 or greater for "high performers."

Results: Patients implanted from 2017-2023 with available pre-operative audio and visual CUNY testing were considered for this study. Thirty-seven patients—44 ears, as seven patients underwent implantation of both ears during the study period—met criteria and were included in this study. Most patients were white (92%) while mean implant age was 53 years. High performers had significantly higher mean (standard deviation) postoperative AzBio scores compared to low performers [63.6 (30.1)% vs. 40.5 (39.8)%, p=0.037]. There were no statistical differences in age (p=0.795), duration of deafness (p=0.586), or preoperative pure tone average (p=0.077) between the groups. Across all patients, age (p=0.88) was not predictive of postoperative AzBio score, while shorter duration of deafness (p=0.002) was associated with improved AzBio scores.

Conclusions: Patients with excellent preoperative multisensory audiovisual integration, shown using CUNY scores, and shorter duration of deafness may have improved cochlear implant outcomes.

Professional Practice Gaps: As many potential candidates pursue cochlear implantation, identifying good candidates for CI is imperative.

Learning Objectives: Patients exhibiting multisensory processing may predict improved postoperative CI performance.

Desired Results: Patients with hearing loss often utilize visual cues for communication. The effect of patient multisensory processing capacity on postoperative CI results is yet to be determined.

Level of Evidence: V

IRB: Indiana University IRB #16904 (approved 10/14/2022)

Impact of Perioperative Anticoagulation and Antiplatelet Therapy on Hearing Preservation Outcomes

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Objective: Report hearing preservation (HP) outcomes following cochlear implantation based on anticoagulation and antiplatelet therapy use (blood thinner, BT).

Study Design: Retrospective cohort.

Setting: Tertiary referral center.

Patients: 338 adult patients (361 ears: no BT = 210, BT held = 86, BT continued = 65) implanted between 2012 and 2021 with preoperative residual hearing, defined as low frequency pure-tone average (LFPTA) $\leq$65 dB HL.

Main Outcome Measures: Postoperative HP, defined as LFPTA $\leq$65 dB HL, at 1, 3, 6, and 12 months.

Results: Compared to no BT, BT continued and held groups were older (60.7 vs. 72.7 vs. 73.0 years, $p<0.001$) and had diabetes (10% vs. 22% vs. 30%, $p<0.001$). Electrode type, steroid use, surgical approach, and preoperative LFPTA were equivalent among groups. Postoperative HP was significantly higher for no BT than the BT continued and held groups at 1 (31% vs. 14% vs. 13%, $p<0.001$) and 3 (36% vs. 20% vs. 19%, $p=0.012$) months, with equivalent results at 6 and 12 months. When patients were stratified by type of BT, there were no significant differences in HP outcomes. After controlling for age and diabetes on multivariable analysis, BT status was not a significant predictor of HP rates at 1 or 12 months. Younger age was the only significant predictor of 1-month (OR 0.95, 95% CI 0.93-0.97, $p<0.001$) but not 12-month HP rates.

Conclusions: BT use, regardless of whether held for surgery, was associated with inferior early HP outcomes. After controlling for age, BT status was not a significant predictor of HP, suggesting inherently poorer cochlear health in BT patients.

Professional Practice Gap & Educational Need: Minimizing blood getting into the cochlea is a key target during hearing preservation surgery. However, to our knowledge, hearing preservation outcomes in the setting of blood thinners has not been reported in the literature. As risks and benefits of holding blood thinners for our CI patients should be appropriately weighed, it is critical to identify the impact of blood thinners on postoperative hearing preservation outcomes.

Learning Objective: To understand the differences in hearing preservation based on blood thinner status for patients undergoing CI surgery.

Desired Result: Providers will have knowledge of worse hearing preservation outcomes for patients on blood thinners. As holding blood thinners does not impact rates of hearing preservation, patients should be counseled on likely poorer cochlear health and older age being drivers in decreased hearing preservation after CI surgery. Providers can also consider continuing blood thinners, especially in patients who may have significant risks if their blood thinner is held.

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

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

Inpatient Audiometry: Perspectives and Impact on Clinical Decision Making

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Objective: Evaluate the impact of inpatient audiometry on in-hospital outcomes and decision making. Assess stakeholder perspectives on the practice of inpatient audiometry and associated financial impact.

Study Design: Retrospective case review and quality improvement (stakeholder perspective and cost analysis).

Setting: Academic tertiary referral center.

Patients: Retrospective chart review of inpatients (2015-2022) who underwent inpatient audiometric evaluation.

Main Outcome Measures:
1. Changes to management plan resulting from inpatient audiometric evaluation.
2. Impact of inpatient audiometry on clinical decision making quantified by descriptive statistical analysis, including percentage of consultations resulting in change to inpatient management.
3. Test-retest reliability of inpatient vs outpatient audiograms (change in thresholds [dB] speech discrimination [%]).
4. Focus group and survey driven input from Audiology stakeholders.

Results: 701 records are being reviewed. Preliminary data yields common requests for inpatient audiograms include hearing loss, ototoxic medication monitoring, acute otitis media, ear fullness, trauma, and otorrhea. 20% of inpatient audiometric testing resulted in changes to inpatient treatment. 40% of requested evaluations were performed the same day. Focus group and survey results will elucidate the practice impact on a primarily outpatient-focused Audiology clinic. An estimate of financial cost of an inpatient relative to an outpatient audiogram will be determined.

Conclusions: Inpatient audiometry is time- and resource-intensive without significant data supporting impact and clinical utility. Results suggest that inpatient audiometry has a minor impact on clinical outcomes and that outpatient audiograms may suffice for the majority of otologic consults in combination with a thorough history and physical exam. Additional study across institutions with variable practice would be beneficial to establish broader recommendations.

Professional Practice Gap & Educational Need: Audiometry is a critical component of a detailed assessment of many otologic and neuro-otologic concerns. Clinical practice at some institutions may include obtaining an inpatient audiogram for quick assessment of hearing sensitivities in the acute setting, however the value of an inpatient evaluation relative to a delayed, outpatient audiogram has not yet been demonstrated in the literature. To our knowledge, this study will be the first to thoroughly characterize data from a large academic institution's inpatient audiometry practice. Data presented here will help guide practitioners in determining when inpatient assessment is indicated.

Learning Objective:
1. To assess the clinical significance, as well as expected versus realized improvement in outcomes, related to inpatient audiometry.
2. To quantify the test-retest reliability of inpatient audiometric evaluation compared with outpatient testing.
3. Understand stakeholder perspectives on integration of inpatient audiometric evaluation in an academic Audiology Department

Desired Result: We aim to provide context around the clinical value of an inpatient versus outpatient audiogram for providers. Ultimately, determining the clinical value of the inpatient audiogram will guide and improve clinical management when evaluating an Otologic or Neuro-Otologic concern.

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

Indicate IRB or IACUC: University of Michigan HUM00225111 – Exempt.

Correlation of Endolymphatic Volume with Disease Subtype, Symptom Duration, and Vestibular Testing in Meniere's Disease Patients

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Objective: Meniere's disease (MD) is hypothesized to arise from a heterogenous group of etiologies. Recently, our group described two MD subtypes based on distinct angular trajectories of the vestibular aqueduct measured on computed tomography (CT): degenerative (MD-dg) and hypoplastic (MD-hp). Historically, the hallmark of MD has been the histopathologic finding of endolymphatic hydrops on cadaveric temporal bone sections, but delayed gadolinium (Gd)-enhanced high-resolution magnetic resonance imaging (MRI) allows for in vivo visualization of hydrops. Here, we investigated whether endolymphatic volume measured on MRI correlates with MD subtype, symptom duration, and clinical vestibular testing.

Study Design: Retrospective cohort study

Setting: Tertiary academic medical center

Patients: Adults with unilateral/bilateral MD.

Interventions: N/A

Main Outcome Measures: Endolymphatic volume measurements on MRI calculated using OsiriX, angular trajectory of vestibular aqueduct on CT, cervical vestibular evoked myogenic potential (cVEMP).

Results: 44 adults (age: 56.4 (15.5), females: 18) were included in the analysis. Of the 18 patients (23 ears) with CT imaging, 39% (9 ears) were classified as MD-hp subtype. No significant difference was observed between the endolymphatic volumes of MD-hp and MD-dg ears. Abnormally elevated cVEMP thresholds were not associated with larger endolymphatic volumes. MD disease duration did not correlate with severity of endolymphatic hydrops.

Conclusions: Endolymphatic hydrops is an irreversible downstream effect of MD. Our study findings suggest that MD etiology and disease duration may not contribute to severity of hydrops. Additional research is required to investigate whether other factors (e.g. environmental, genetic, autoimmune) may influence endolymphatic volume.

Professional Practice Gap & Educational Need: Explore the possibility that MD arises from a diverse array of heterogeneous etiologies with a common downstream pathway resulting in endolymphatic hydrops.

Learning Objective: Etiology of Meniere's disease and symptom duration do not appear to contribute to the severity of endolymphatic hydrops.

Desired Result: Broader recognition of the ability to subtype Meniere's disease based on clinical, radiologic, and histopathologic features.

Level of Evidence – Level III

Indicate IRB or IACUC : 2019P000438, Massachusetts Eye and Ear (Exempt)

Optimizing Insertion of a Cochlear Apical Electrode Utilizing CT Measures and Techniques to Guide Surgical Placement.

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Objective: To better understand cochlear apex anatomy in relation to important anatomical landmarks and critical structures to optimize procedural success and standardize technique for an apical electrode placement.

Study Design: Retrospective imaging review and anatomical dissection.

Setting: Tertiary referral center and temporal bone lab.

Patients: Pediatric and adult cochlear implant candidates.

Interventions: NA

Main Outcome Measures: Cochlear apex measures, and distances to surrounding critical structures or identifiable surgical landmarks. Special measures were developed to assist with further surgical triangulation. Five cadaver dissections were completed to help confirm radiologic validity.

Results: Eighty-two temporal bones (50% left, 50% right) were analyzed in 44, males and 38 females, with an average age of 56.4. The mean height of the cochlea was 3.4mm (stdev 0.3), height of the apex 1.0mm (stdev 0.2mm), and width of apex 3.3mm (stdev 0.3). The mean lateral promontory width was 1.2mm (stdev 0.3), and superior promontory width 1.3mm (stdev 0.3). The minimum distance to critical structures such as the ICA and labyrinthine facial were 1.4mm and 0.6mm respectively. The craniocaudal relationship of the cochleiform process and apex demonstrated variability. A vector though the stapes crus provided a relatively reliable means of identifying the superior apical border, while a parallel line through the round window delineated the inferior border.

Conclusions: This study characterizes cochlear apex anatomy and relationships, while describing a new method to delineate the superior and inferior apical boundaries. In doing so, it provides surgeons with a more accurate blueprint for performing an apical cochleostomy than historical teachings.

Professional Practice Gap & Educational Need: A return electrode placed within an apical cochleostomy following standard cochlear implant electrode insertion can reshape electrical fields to stimulate the cochlear apex and improve low frequency precept. Atraumatic and accurate apical cochleostomy is required to achieve success, however prior anatomical apex characterization is poor in the literature.

Learning Objective: Better understand cochlear apex anatomy and learn new measures to assist in cochlear apex triangulation within the surgical theatre.

Desired Result: Increased surgeon familiarity and confidence in performing a minimal, atraumatic, cochlear apex cochleostomy for apical electrode insertion.

Level of Evidence – Level V

Indicate IRB or IACUC: IRB# s20-01964 at NYU Langone Health.

Adverse Outcomes Following Cochlear Implantation in Adults: A Multinational Database Analysis

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Objective: Rare sequelae of cochlear implantation (CI) in adults include meningitis, labyrinthitis and facial nerve disorders. The purpose of this study is to examine the complications of CI using TriNetX, a multinational database.

Study Design: Retrospective cohort study using TriNetX. When cohorts were smaller than 33,333,333, 1:1 propensity score matching (PSM) for age and sex was performed. All cohorts of 1-10 patients are reported as 10 in TriNetX, limiting estimations of risk ratios (RRs) in these cases.

Setting: TriNetX is a multinational database including 79 health care organizations, with an average of 12-14 years of data per heath care organization. 95% of patient data used in this study is from 2003-2023.

Patients: Adults with CI with a comparison group of adults with sensorineural hearing loss (SNHL) without CI.

Main Outcome Measures: RR and 95% confidence intervals (95% CIs) for incident meningitis, facial nerve disorders (including facial nerve weakness, lagophthalmos and eyelid weight placement for lagophthalmos), and labyrinthitis. Preoperative risk factors were also examined.

Results: Patients with CI (n=13,242) had an increased risk of meningitis at any time after surgery when compared to the SNHL without CI cohort (RR: 2.66, 95% CI: 1.98-3.56). Absolute risk for meningitis after CI was 1.25%. The risk of labyrinthitis any time after surgery was increased in the CI cohort (RR: 2.04, 95% CI: 1.44-2.89). The risk for facial nerve disorders any time after surgery was not increased (RR: 1.3, 95% CI: 0.59-2.88). A preoperative history of meningitis (RR: at least 7.0, 95% CI: 3.66-13.37), otitis media (RR: 3.5, 95% CI: 1.74-7.03) and otorrhea (RR: 2.4, 95% CI: 1.16-4.97) increased the risk of postoperative meningitis in those undergoing CI.

Conclusion: The risk of meningitis and labyrinthitis are significantly increased after CI compared to those with SNHL who have not undergone CI, while the risk of facial nerve disorders is not significantly elevated. Adults with a history of preoperative meningitis are at highest risk of meningitis after CI.

Professional Practice Gap & Educational Need: While cochlear implant surgery is safe and widely available, updated analyses of risks with large patient cohorts are needed.

Learning Objective: To describe the risks of cochlear implantation using a multinational database.

Desired Result: Increased understanding of risks of CI and patients who are at higher risk of adverse outcomes.

Level of Evidence: IV

Indicate IRB or IACUC: Exempt

Cautious Gait while Dual Tasking in People with Bilateral Hearing Loss

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Gerald Voelbel, PhD; Katherine Scigliano, AuD; Maura Cosetti, MD

Objective: Bilateral sensorineural hearing loss (BHL) is associated with balance problems and increased fall risk. This study aimed to understanding the underlying mechanism of this relationship. We hypothesized that people with BHL would demonstrate reduced attentional capacity during walking with a dual task (DT) paradigm due to increased attentional demands associated with loss of auditory information.
Study Design: Cross sectional study.

Setting: Motion analysis laboratory.

Patients: Normal hearing (N=28, PTA <25dB; mean age 59.14, Standard Deviation (SD)=11.96), Mild BHL (N=16, PTA 26-40dB; 74.69, SD=8.67) and Moderate or worse BHL (N=15, PTA >41dB; 70.93, SD=13.59).

Interventions: Wearing inertial measurement units, participants walked for one minute twice: single task (ST) or performing a serial-3 subtraction task (DT).

Main Outcome Measures: Gait speed, stride length, stride time

Results: Gait speed and stride time did not differ between groups on either task. The Mild BHL group had shorter stride length in ST (p=.034) and DT (p=.032) compared to Normal hearing. In DT, the Mild group had larger variability (p=.024) compared to Normal. In addition, people who exercise demonstrated longer stride length (100% of the Moderate group vs. 62.5% of the mild group reported exercising regularly).

Conclusions: Shorter stride length, suggesting a cautious gait pattern, and larger between-group differences in stride length variability while DT, suggesting limited attentional capacity, were found in people with Mild BHL but not Moderate BHL, differently than expected. The Moderate BHL group were all physically active and had a higher percentage of men potentially influencing their gait performance. Future research is needed to elucidate mechanisms underlying fall risk in individuals BHL.

Professional Practice Gap & Educational Need: Understanding why people with BHL are at an increased risk for falls will help strategize a fall prevention plan. Future research should investigate whether hearing interventions can improve walking performance and decrease fall risk in people with BHL.

Learning Objective: To explain the differences in walking dual task and attentional capacity while dual tasking between healthy and hearing loss older adults.

Desired Result: At the end of the presentation participants will understand the differences in walking dual task and attentional capacity while dual tasking between healthy and hearing loss adults.

Level of Evidence - Level IV

Indicate IRB or IACUC: The Mount Sinai Program for Protection of Human Subjects: STUDY-21-01026 and the Institutional Review Board (IRB), New York University -IRB-FY2021-5400.

Barriers to Hearing Healthcare for Rural Northern US Communities

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Meredith E. Adams, MD, MS

Objective: To examine awareness of hearing loss, rehabilitation options, and barriers to hearing healthcare for rural communities in Minnesota, the third best ranked state for public hearing healthcare benefits.

Study Design: Cross-sectional study

Setting: Community based screening at Driven to Discover Research Facility (Beltrami County, Minnesota).

Patients: Adults ≥ 18 years

Interventions: In-person survey and audiometric screening performed at 25 dB across four frequencies.

Main Outcome Measures: Descriptive analysis of sociodemographics, awareness of hearing loss and hearing healthcare, and Brief Health Literacy Screening (BHLS). Hearing loss was defined as failing at least 1 frequency in 1 ear.

Results: 82 participants were included with mean age of 54.5 years (18-92), 48.8% male and 92.7% white. 79.3% were from a rural area or small city/town and health literacy was adequate based on 13.5 (4-15) mean BHLS score. 50% reported subjective hearing loss and 56.1% demonstrated audiometry-measured hearing loss. 8.5% currently wear hearing aids and 10.9% have used a hearing assistive device. Among participants with audiometry-measured hearing loss, 18.3% were unaware of their hearing loss. The rates of recent formal or screening hearing tests were low at 46.3% and 20.7%, respectively. The most common reasons given for not undergoing testing were "don't know" (20.7%), or "my healthcare provider never mentioned it" (20.7%). Participants had low awareness of Over-The-Counter hearing aids (47.5%) and of state hearing healthcare benefits (28.7%).

Conclusions: Despite hearing healthcare benefits and self-perceived accessible care in health-literate rural communities, few patients received hearing healthcare. Increasing public health initiatives in rural primary care offices may increase uptake and awareness.

Professional Practice Gap & Educational Need: This study aims to identify barriers to hearing healthcare for rural residents of the Northern US where public insurance benefits afford greater coverage than in other previously described rural US regions. Prior studies have identified that patients in rural communities are unable to obtain hearing healthcare due to lack of providers and insurance coverage. In spite of excellent insurance coverage and access to hearing healthcare, patients in Northern rural US communities do not receive adequate healthcare due to poor self-perception of hearing loss, lack of recommendation to pursue formal testing, and lack of awareness of insurance benefits.

Learning Objective:

1. To determine prevalence of hearing loss and participant awareness of hearing loss and rehabilitation options.
2. To understand barriers to access of hearing healthcare for rural Northern US communities.
3. To identify public awareness of healthcare benefits in a state with excellent public insurance hearing healthcare coverage.

Desired Result: To recognize new pathways to promote hearing healthcare in Northern US rural communities.

Level of Evidence: Level V

IRB: IRB Study # 00019167, University of Minnesota (June 22, 2023).

Risk Factors and Prevalence of Vestibular and Auditory Dysfunction in a Pediatric Sickle Cell Disease Population

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Objective: To identify the pathophysiology and occurrence of auditory deficits and vestibular dysfunction in children with sickle cell disease (SCD).

Study Design: Retrospective chart review where demographic, hematologic, audiometric, and clinical history data were collected.

Setting: Johns Hopkins Kennedy Krieger Institute: tertiary care referral center.

Patients: One-hundred and eighty-seven children with SCD who presented to the SCD clinic between January 2000 and September 2016.

Interventions: Non-interventional study.

Main Outcome Measures: 1) Hearing loss: pure tone average (PTA) >15 dB hearing level (HL).
2) Vestibular dysfunction (VD): at least 1 episode of acute onset vertigo severe enough to present to the clinic or emergency department.

Results: The median age was 14.3 years (range 7–23); 47% were female sex, 96% were Black, and 60% were SS genotype, 29% SC, 9% SB^+, and 2% SB^0. Fifty-five (29.4%) and 36 (19.3%) patients were identified with hearing loss and VD, respectively. Forty-four patients (23.6%) received chronic transfusions, and 99 (52.9%) received hydroxyurea therapy. Older age (OR 1.01, CI 1.00–1.02, p=0.007), higher baseline hemoglobin (OR 1.36, CI 1.09–1.75, p=0.012), and hydroxyurea treatment (OR 4.71, CI 1.76–14.19, p=0.003) predicted VD. History of retinopathy (OR 3.08, CI 1–9.59, p=0.048) and tobramycin (OR 11.4, CI 1.3–100, p=0.043) were associated with hearing loss. Chronic transfusion approached significance for predicting hearing loss (OR 2.2, CI 1–4.86, p=0.051).

Conclusions: Vestibular and auditory symptoms are common in pediatric patients with SCD. Novel risk factors like hemoglobin and treatment history may improve understanding of the cause of inner ear symptoms in SCD.

Professional Practice Gap & Educational Need: Sickle Cell Disease (SCD) affects approximately 100,000 Americans and impacts multiple organ/body systems. Children with SCD have an increased risk of hearing loss, but the pathophysiology of auditory deficits and the occurrence of vestibular dysfunction in this population is largely unclear. Identifying risk factors and treatment paradigms associated with hearing loss and vestibular dysfunction can inform providers about best practices to protect this vulnerable population from preventable injury to inner ear structures and function.

Learning Objective: Readers should be able to understand the importance of questioning patients with SCD about auditory and vestibular symptoms. Furthermore, they should recognize the role of some SCD treatments in potentially exacerbating these pathologies and remember to be thoughtful in utilizing these therapies.

Desired Result: The desired result of this study is to identify any novel risk factors or hematologic associations for the development of hearing loss and vestibular dysfunction in children with SCD.

Level of Evidence - Level IV

Indicate IRB or IACUC: Johns Hopkins IRB00087766.

Sound Localization in Single Sided Deafness: Compensatory Head Movements and Localization Performance Measures

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Objective: Evaluate sound localization accuracy and compensatory head movements in patients with single-sided deafness (SSD) with a cochlear implant (CI) or active transcutaneous bone conduction implant (atBCI).

Study Design: Nonrandomized, prospective study.

Setting: Academic tertiary referral center.

Patients: 14 SSD patients (6 CI, 8 atBCI) and 22 normal hearing controls.

Interventions: Subjects underwent localization testing in a dark semi-anechoic chamber with 24 speakers 15º apart. Stimuli included broadband and narrowband noise (500 Hz, 1000 Hz, 4000 Hz). Subjects indicated target source while wearing a head tracker. Accuracy was measured by comparing their perceived stimulus angle to the presented location. Statistical analyses between groups were performed using ANOVA and Wilcoxon rank sum tests.

Main Outcome Measures:
1. Localization accuracy (degrees root-mean-square [rms] error and linear best-fit across targets).
2. Head position changes (response time [ms], direction, absolute total displacement [degrees], and movement delay [ms]).

Results: Individuals with SSD demonstrate decreased localization accuracy (rms and linear best-fit), increased response time (ms), increased absolute total head displacement (degrees), and increased movement delay (ms) compared with controls, with device use resulting in relatively limited improvement across domains that was greater in CI compared with atBCI users. Head movement patterns indicate a preference for the better-hearing ear for individuals with SSD.

Conclusions: Individuals with SSD demonstrate decreased accuracy and distinct patterns of compensatory head movements when compared to controls, with relative limited improvement with device use. Further study is needed to evaluate the effect of these head movements on performance outcomes and the degree to which compensatory head movements impact binaural hearing rehabilitation.

Professional Practice Gap & Educational Need: Head movement impacts sound localization ability by altering acoustical cues for optimal performance on binaural auditory tasks. However, in individuals with SSD localization ability and the associated complex compensatory head movements remain incompletely characterized. Moreso, data on CI and atBCI modulation of sound localization in SSD is limited. Head movement and localization ability data, as well as detailed characterization of the impact of CIs and atBCIs in SSD, is critical for optimization of prosthetic device programming, efficacy, and use – ultimately laying the foundation for improved device benefit in binaural tasks for individuals with SSD.

Learning Objective: Patients with SSD demonstrate unique compensatory head movements to optimize monaural listening cues when localizing sound and have significantly decreased sound localization ability. CI use results in a limited improvement in localization with associated changes in head movements, while atBCI use results in a modest but likely not clinically significant improvement across domains relative to normal hearing individuals.

Desired Result: To provide an improved and detailed understanding of complex compensatory head movements and sound localization ability in individuals with SSD using our rigorous testing paradigm, and the ways in which localization ability is impacted by CI and atBCI use. This testing paradigm will allow us to formally characterize the reflexive behavior behind sound localization in individuals with SSD in both aided and unaided conditions, inform device programming – particularly for CIs, evaluate device benefit for patients with SSD, and add an additional variable to configure and adapt prosthetic devices for maximal functionality.

Level of Evidence - III - Cohort and case-control studies

Indicate IRB or IACUC: Approved 1/28/21, University of Michigan HUM00190678

Realistic Approach to Managing Extensive Cholesteatoma

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Objective: To evaluate outcomes of extensive cholesteatoma following canal wall down (CWD) mastoidectomy with reconstruction of the external ear canal (EEC), tympanoplasty, and mastoid obliteration using Bonalive®, a volume-replacing, bone-regenerating, and anti-infectious material.

Study Design: Retrospective case review.

Setting: Tertiary referral center.

Patients: 127 ears with extensive cholesteatoma followed up for 1-4 years after surgery and fully aligned with the post-operative structured clinical-imaging follow-up (FU) protocol. 52.8% of these had undergone previous ipsilateral mastoid surgery.

Interventions: CWD mastoidectomy, tympanoplasty, EEC reconstruction and mastoid obliteration with Bonalive®.

Main Outcome Measures: Achieving completely epithelialized and dry ear, developing tympanic membrane (TM)-EEC retraction, developing retraction pocket (RP) and residual cholesteatoma.

Results: Despite repeated emphasis on the importance of follow-up (FU), attendance to FU visits declined from 100% (127/127) to 65.0% (41/63) between the first and fourth yearly postoperative FUs. Mean annual prevalence of a 'disease-free' ear (completely epithelialized, dry, not retracted, and free of cholesteatoma) was 88.5%. Complete epithelialization and dryness achieved within the 1st post-op year in 96.8% (123/127). Percentage of ears remained dry throughout the entire 4-year FU period was 83%. Prevalence of TM or posterior superior EEC wall retraction development increased with time from 13.4% (17/127) at the 1st yearly visit to 34.1% (14/41) at the 4th yearly visit. Recovering of retraction did not occur, and 23.2% of the 43 ears diagnosed with TM-EEC retraction at any point during the FU developed RP cholesteatoma later on. RP cholesteatoma was diagnosed in 15 ears (11.8%). In 10 cases (66%), the cholesteatoma was preceded by retraction that had occurred 1 year or more earlier. Residual cholesteatoma was diagnosed in 9 ears (7.0%). All looked normal prior to the residual cholesteatoma diagnosis.

Conclusions: Mean annual 'Disease-free prevalence' reached 88.5% within the initial four postoperative years. However, it appears that eliminating residual and RP cholesteatoma recidivism is not attainable with surgery alone in extensive cholesteatoma, even with meticulous procedures. Despite efforts to clarify to patients/parents the importance of follow-up, attendance to follow-up visits declined over time.

Professional Practice Gap & Educational Need: There is a need for new effective solutions to eliminate tiny matrix nests and for control of middle ear under-aeration.

Learning Objective: 100% elimination of cholesteatoma, both of RP and of residual cholesteatoma is not achievable with surgery alone. This emphasizes the importance of ongoing otoscopic and MRI FU, even in cases where the ear and MRI appear normal.

Desired Result: To subtly emphasize the idea that non-surgeon professionals should be trained to perform effective postoperative micro-otoscopy, as ear surgeons should prioritize tasks that demand their unique skills like surgery and immediate post-operative follow-up.

Level of Evidence: Level III

Indicate IRB or IACUC: 0004-19-ASMC, Assuta medical center.