SELECTED ABSTRACTS

POSTER PRESENTATIONS

in numerical order

57th Annual Spring Meeting

AMERICAN NEUROTOLOGY SOCIETY

April 29 - 30, 2022
Hyatt Regency Dallas
Dallas, TX

Posters will be viewed on Friday & Saturday, April 29-30. Oral presentations are Saturday & Sunday, April 30-May 1.

Vestibular Vertigo and Healthcare Utilization: Data from the 2016 National Health Interview Survey

Jacob C. Matthews, BS; Yuri Agrawal, MD MPH; Eric X. Wei, MD

Objective: We sought to characterize whether individuals with vestibular vertigo were more likely to utilize various healthcare resources.

Study Design: Cross-sectional study

Setting: Noninstitutionalized households in the United States

Patients: 32,047 adults completed the 2016 NHIS Balance Supplement.

Interventions: None

Main Outcome Measures: We examined several measures of healthcare utilization including number of nights in the hospital in the last 12 months, healthcare use 10 or more times in the past 12 months, number of visits to a healthcare professional in the last 2 weeks, and use of specific healthcare resources in the last 12 months.

Results: After controlling for demographics, socioeconomic factors, and medical comorbidities (including cardiovascular risk factors, hearing and vision issues, and cancer)**,** participants with vestibular vertigo had significantly increased odds of receiving healthcare 10 or more times in the last 12 months (OR 2.22, 95% CI 1.99, 2.48), a rate comparable to individuals with cancer (OR 2.29; 95% CI 2.03, 2.59). Individuals with vestibular vertigo spent on average 0.67 more days in the hospital per year (95% CI 0.37, 0.97) and were significantly more likely to visit several provider groups including general doctors, specialist doctors, mental health professionals, eye doctors, physical and occupational therapists, family doctors, and the ER/ED.

Conclusions: These findings demonstrate that individuals with vestibular vertigo have significantly higher rates of healthcare utilization in multiple domains including inpatient, outpatient, rehabilitative, and ER/ED settings. Further work is needed to characterize when and why individuals with vertigo tap into specific healthcare resources to better counsel these patients and help them navigate the healthcare system.

***Professional Practice Gap & Educational Need:** Lack of contemporary knowledge of how individuals with vestibular vertigo utilize healthcare resources in the U.S.

***Learning Objective:** Attendees will learn how individuals with vestibular vertigo are more likely to utilize healthcare resources in different domains including inpatient, outpatient, rehabilitative, and emergency room settings.

***Desired Result:** Attendees will gain a better understanding of how individuals with vestibular vertigo interact with the healthcare system and integrate this knowledge in counseling patients.

***Level of Evidence -** Level IV – Historical cohort and case-control studies

***Indicate IRB or IACUC:** Exempt

ANS 2022 POSTER H002

Evidence for Conscious Cortical Control of Balance in Individuals with Unilateral Sensorineural Hearing Loss

Jennifer Kelly, DPT; Maura Cosetti, MD; Daphna Harel; Brittani Morris, DPT
Sarah Mischianti SPT; Bryan Hujsak DPT; Anat Lubetsky, PhD

Objective: To identify the mechanism governing postural responses in individuals with Unilateral Sensorineural Hearing Loss (USNHL) and those with Unilateral Vestibular Hypofunction (UVH). Analyzing the frequency distribution of postural sway via Power Spectral Density (PSD) may shed light on the contribution of each sensory system to standing balance.

Study Design: Cross-sectional

Setting: Laboratory

Patients: USNHL (n=9, mean age 48, range [22, 82]), UVH (n=12, 62 [23, 78]), and 21 healthy controls (52, [28, 80]).

Interventions: Postural sway measurements during manipulation of auditory, visual and somatosensory cues within a virtual 3-wall display of stars projected from a virtual reality headset with headphones.

Main Outcome Measures: PSD (cm^2) from anterior-posterior postural sway data in 4 segments of frequencies: (Hz): Low [0, 0.25], Mid [0.25, 0.5], Mid-high [0.5, 1], high [1, 3].

Results: The vestibular group was significantly higher than controls on the static scene on all segments. UVH patients also showed greater increase when standing on foam for PSD 1, 3 and 4 and greater increase with moving visuals for PSD 2. The USNHL group was not different than controls on PSD 2, 3, 4 but they had significantly higher PSD 1 on the static scene, yet did not increase with the visuals like controls did.

Conclusions: While balance problems related to vestibular hypofunction are known to stem from difficulty in sensory integration, increased slow feedback loops response at baseline with minimal changes in response to perturbations suggests that people with USNHL employ a compensatory strategy of conscious cortical control of balance.

***Professional Practice Gap & Educational Need:**
Recent literature has demonstrated a correlation between hearing loss and increased risk of falls, balance instability and other fall-risk assessments**.** However, the mechanisms underlying the relationship between and hearing loss and balance dysfunction remain unknown. Greater insight into the postural strategies of those with unilateral hearing loss could expand our understanding of this relationship and influence our treatment paradigms.

***Learning Objective:** To identify whether the mechanism governing postural responses is similar between those with USNHL and those with unilateral vestibular hypofunction and shed light on the contribution of each sensory system to standing balance.

***Desired Result:** Improved understanding of the impact of USNHL and vestibular hypofunction on balance and postural stability

***Level of Evidence -** III

***Indicate IRB or IACUC :** Mount Sinai IRB # 18-00431

Defining the Need for MRI Screening in Vestibular Schwannoma: A Deep Learning-Based Analysis of Clinical and Audiometric Data in Vestibular Schwannoma Patients

Sarah Kortebein, MD; Shoujun Gu, PhD; Elizabeth Zhao, BA; Kathy Dai, BS
Kristal Riska, PhD AuD; Michael Hoa, MD; David Kaylie, MD

Objective: To find a more objective method of assessing which patients should be screened for a vestibular schwannoma (VS) with magnetic resonance imaging (MRI) using a deep-learning algorithm to assess clinical and audiometric data.

Study Design: Retrospective review

Setting: Tertiary referral center, academic hospital.

Patients: 1,192 adults (166 with a VS) who received an audiogram between January 2015 and January 2020 at Duke University Health Center.

Interventions: Clinical and audiometric data was collected for patients with and without VS confirmed by MRI. These data were analyzed data using a deep learning-based analysis to determine if the need for MRI screening could be determined more objectively with adequate sensitivity and specificity.

Main Outcome Measures: Ability to predict patients which have a VS based on audiometric and clinical variables

Results: Patients with VS showed slightly elevated but not statistically significant mean thresholds compared to those without. Tinnitus, gradual hearing loss, and ear fullness were more common in patients with VS. Of these only tinnitus was statistically significant. Several machine learning algorithms were used to incorporate and model all of the collected clinical and audiometric data, but none were able to distinguish ears with and without confirmed VS. When tumor size was taken into account the analysis was still unable to distinguish a difference.

Conclusions: Using audiometric and clinical data, deep learning-based analyses failed to produce an adequately sensitive and specific model for the detection of patients with VS. This suggests that a specific pattern of audiometric asymmetry and clinical symptoms may not necessarily be predictive of the presence/absence of VS.

***Professional Practice Gap & Educational Need:** This study would either take the onus off of physicians to decide on when to screen a patient for a VS or prove that there is not an adequate way to use audiometric and clinical data to more specifically decide which patients to screen with MRI in order to save money and resources.

***Learning Objective:** To understand whether a deep learning-based algorithm is capable of predicting which patients have a vestibular schwannoma

***Desired Result:** An objective method to more sensitively and specifically determine which patients have a vestibular schwannoma using clinical and audiometric data

***Level of Evidence –** Level III

***Indicate IRB or IACUC:** Approved, Pro00104949, Duke University Hospital

Hearing Loss is Associated with Smaller Social Networks in U.S. Hispanic Adults

Maeher R. Grewal, BS; Justin S. Golub MD, MS

Objective: Hearing loss (HL) is a risk factor for social isolation, which may predispose to dementia and depression. The association between HL and socialization has been primarily characterized in Caucasians. We aimed to explore this relationship in U.S. Hispanics.

Study Design: Cross-sectional epidemiological study

Setting: Hispanic Community Health Study (HCHS)

Participants: Hispanics age 18-76 years

Interventions and Main Outcome Measures: Multivariable linear regressions controlling for age, gender, and education were conducted to analyze the association between HL (measured by 4-frequency pure tone average) and socialization. Socialization was measured by a modified social network index (SNI), which assessed the number of close relatives with whom a participant had regular communication (at least once every 2 weeks). The ratio (SNI-R) between the SNI and total number of living close relatives was also calculated.

Results: 13,551 participants had audiometric and SNI data; average age was 46 years (SD=13.9 years). Of participants who reported at least one living relative, average SNI was 7.05 (range=0-18, SD=3.23). For every 10 decibel (dB) worsening in HL, SNI decreased by 0.25 (95% CI = -0.31, -0.18; $p<0.0001$) controlling for age, gender, and education. Thus, someone with moderate HL (40 dB) would communicate regularly with 1 fewer close relative than someone with no HL (0 dB). For every 10 dB worsening in HL, SNI-R decreased by 0.005 (95% CI= -0.009, -0.003; $p<0.0005$), controlling for age, gender, and education.

Conclusions: HL is associated with significantly smaller social networks in the U.S. Hispanic adult population

***Professional Practice Gap & Educational Need:** HL is associated with social isolation, which may, in turn, predispose patients to comorbidities such as dementia and depression. These relationships have primarily been studied in Caucasian populations, which prohibits generalization to other race/ethnic groups.

***Learning Objective**: HL is associated with smaller social networks in US Hispanic adults.

***Desired Result:** The relationship between HL and lower socialization appears to span multiple race/ethnic groups, including Hispanics. Providers should consider these findings in discussions regarding HL treatment.

***Level of Evidence -** IV

***Indicate IRB or IACUC:** Exempt

ANS 2022 POSTER H005

Assessing Barriers to Cochlear Implantation

Andrew R. Mangan, BS; Kyle P. Davis, MD; Robert Saadi, MD
Deanne King, MD; C. Lane Anzalone, MD; John L. Dornhoffer, MD

Objective: Evaluate barriers patients face that deter them from following through with cochlear implantation.

Study Design: Phone Survey.

Setting: Tertiary referral center.

Patients: Fourteen patients who qualified for a cochlear implant (CI) but did not follow up for implantation.

Main Outcome Measures: Assessment of factors that had the greatest impact, rated on a scale of 1 to 10 (10 being the most impactful), on their decision to defer a CI.

Results: 139 patients were evaluated for CI eligibility between January 2019 and July 2020. Thirty-four (24.5%) of these patients qualified for a CI but did not follow up for implantation. Two patients died prior to the start of this study, leaving 32 eligible patients. Response rate of the survey was 43.8% (14/32). Average age of respondents was 68.3 years (range 33 to 89) and a majority were male (9/14). General medical health (mean rating 5.5) and fear of losing residual hearing (5.4) rated the highest among the patients, followed by: time requirement and travel distance (3.8), cost and financial concerns (3.5), feels like current hearing is "good enough" (3.1), lack of family or social support (2.1), trust (or lack of trust) in the implant team (2.0), COVID pandemic (1.7), and attitude of others towards implants (1.3). Males rated cost and financial concerns higher than females (4.9 vs. 1.0; p=0.07).

Conclusions: Fear of losing residual hearing is a major concern for patients. Spending greater time educating patients about the success and failure rates of cochlear implantation may reduce patient hesitancy with implantation.

***Professional Practice Gap & Educational Need:** Patient perceived barriers to cochlear implantation.

***Learning Objective:** Factors that have the greatest impact on patients deferring a cochlear implant.

***Desired Result:** Understand areas in which we can invest time and resources to lessen the barriers people feel keep them from receiving a cochlear implant.

***Level of Evidence -** Level V.

***Indicate IRB or IACUC :** Approval for this study was obtained from the University of Arkansas for Medical Sciences IRB (#261590).

The Impact of Frailty on Older Adults Undergoing Cochlear Implantation: A Prospective Single-Center Study

Emily Kay-Rivest, MD, MSc; David R Friedmann, MD, MSc, Sean O. McMenomey, MD
Daniel Jethanamest, MD, MSc, J. Thomas Roland Jr., MD, Susan Waltzman, PhD

Objective: To determine the impact of frailty on cochlear implant outcomes in post-lingually deafened older adults.

Study Design: Prospective cohort study.

Setting: Tertiary referral center.

Patients: Adults over the age of 65.

Interventions: Frailty was assessed using Fried's Frailty Phenotype, a validated metric that includes grip strength, gait speed, self-reported exhaustion, unintentional weight loss and levels of physical activity. Demographic information, a comorbidity index and preoperative auditory testing were recorded.

Main Outcome Measures: The primary outcome was the relationship of frailty to adverse peri- and postoperative events. Secondary outcomes included improvement in speech perception scores at three months and at one-year.

Results: Fifty post-lingually deafened older adults were enrolled, with a mean age of 76.9 (SD: 7.1, range 65 to 94). Four patients (8%) were classified as frail, nine (18%) as pre-frail and the remainder as non-frail (74%). There were no major complications in any groups. Two (4%) patients required overnight admission, neither of whom were frail. Neither frail nor pre-frail patients had extended hospital stays or need for postoperative vestibular therapy. Among frail patients, median preoperative CNC word score in the implanted ear was 2% (range 0-8%), which increased to 16% on 3-month follow-up. Pre-frail and non-frail patients had a median preoperative word score of 8% (range 0-52%), which increased to 51% (range 23-84%) postoperatively. Median device use time in frail, pre-frail and non-frail individuals were 9.2, 12.1 and 11.8 hours daily respectively.

Conclusions: Frailty did not predict postoperative adverse events after CI surgery. The frailty phenotype may impact early speech perception scores, but longer term follow up will address whether frailty results in poorer long-term hearing outcomes.

***Professional Practice Gap & Educational Need:** Frailty is thought to affect between 10-15% of community-dwelling older adults. It is well-documented that frailty can significantly impact surgical outcomes of older adults and is distinct from age and multi-morbidities. Frail patients have an increased risk of falls, delirium and death after surgery. In the United States, over half of patients with severe to profound hearing loss are over the age of 65. Given that a growing number of older adults may benefit from cochlear implants, understanding the factors that can impact outcomes, including frailty, is important.

***Learning Objective:** The learning objective is to determine the prevalence of the frailty phenotype among our older adult cochlear implant candidates and understand its association with outcomes.

***Desired Result:** Elderly patients are a growing portion of our population. Understanding factors that can improve outcomes may help us tailor our approach to their treatment, whether it is choosing the appropriate type of anesthesia, preemptive vestibular training, or more intensive postoperative auditory rehabilitation.

***Level of Evidence -** Level III

***Indicate IRB or IACUC:** NYU School of Medicine Institutional Review Board i20-02050.

Na/K-ATPase in the Human Saccule

Michael P Avillion, MD; Ivan A Lopez, PhD
Hirooki Matsui, MD; Gail Ishiyama MD; Akira Ishiyama, MD

Hypothesis: There is a difference in expression of Na^+, K^+-ATPase (Na/K-ATPase) in the saccule of human patients with otologic disease compared to those without otologic disease.

Background: We have recently characterized changes in the expression of Na/K-ATPase in the normal and pathological cochlea, however, no studies have determined the distribution Na/K-ATPase in the human saccule. The present study utilizes archival temporal bones to study the expression Na/K-ATPase in the human saccule.

Methods: Archival celloidin formalin fixed 20-micron thick sections of the vestibule from patients diagnosed with sensorineural hearing loss (SNHL) (n=12), Meniere's disease (MD) (n=4), otosclerosis (n=6), and normal hearing and balance (n=4) were analyzed. Sections containing the saccular macula were immunoreacted with mouse monoclonal antibodies against Na/K-ATPase alpha-1 subunit. Digital images were acquired using a high-resolution light and laser confocal microscope.

Results: In the normative human saccule, robust Na/K-ATPase immunoreactivity (IR) was present in nerve fibers and calyces that surround type I vestibular hair cells and nerve terminals. The basolateral membrane of extramacular saccular epithelium was also Na/K-ATPase-IR. Comparison between normal and pathological specimens showed that specimens from patients with SNHL, had a significant reduction in Na/K-ATPase-IR and specimens from patients diagnosed with Meniere's disease and otosclerosis exhibited a reduced Na/K-ATPase-IR.

Conclusions: . The decrease of Na/K-ATPase-IR in the saccule from patients with otopathologies suggests its critical role in inner ear homeostasis and pathologic alterations in SNHL.

Professional Practice Gap & Educational Need: The identification of proteins involved in ionic, osmotic and potential gradients like Na/K-ATPase in the inner ear would be helpful to explain inner ear pathologies.

Learning Objective: To describe the changes in Na/K-ATPase expression in the human saccule when the cochlea is affected by different types of hearing loss.

Desired Result: Identifying changes in presence and distribution of Na/K-ATPase can help elucidate the connection between hearing loss and saccule function.

Level of Evidence: Level IV

Indicate IRB or IACUC: #10-001449, UCLA, January 2021

A Five-Year Update on the Profile of Adults Undergoing Cochlear Implant Evaluation and Surgery – Are We Doing Better?

Ankita Patro, MD, MS; Nathan R. Lindquist, MD; Jourdan T. Holder, AuD, PhD
René Gifford, PhD; Elizabeth Perkins, MD

Objective: Characterize the influence of expanding indications on the profile of adults undergoing cochlear implantation (CI) at a high volume CI center.

Study Design: Retrospective review.

Setting: Tertiary referral center.

Patients: 774 adults undergoing CI evaluation from 2015-2020.

Main Outcome Measures: Demographics, preoperative audiometry and speech recognition (CNC and AzBio) scores.

Results: Of 741 (95.7%) patients qualifying for implantation, 642 (86.6%) pursued surgery. Mean age at evaluation was 65.4 years; 53.2% were male; 88.2% were white. Average distance to our center was 107 miles. The majority (61.4%) had public insurance (e.g. Medicare, Medicaid), followed by private (38.2%) and military (0.4%). Mean CNC, AzBio, and pure-tone averages for the ear to be implanted were 13%, 17%, and 77 dB HL, respectively. 479 patients (64.6%) met Hybrid/EAS criteria, and 438 (56.6%) had aidable hearing in the better hearing ear for a bimodal hearing configuration. Age (OR 0.96; 95% CI 0.93–0.92) and white race (OR 7.01; 95% CI 3.25–15.12) predicted CI candidacy. Likelihood of surgery increased for white (OR 8.94; 95% CI 5.57–14.34) and married (OR 2.12; 95% CI 1.45–3.09) patients and decreased for those with public insurance (OR 0.34; 95% CI 0.22–0.51).

Conclusions: Despite expansions in criteria, speech understanding at CI evaluation remains extremely low. Compared to 2013-2015, a larger percentage met Hybrid/EAS criteria (25.4% vs. 64.6%), and a smaller percentage had bimodal hearing (72.1% vs. 56.6%). Younger age and white race predicted candidacy while white, married patients with private insurance were more likely to pursue surgery.

Define Professional Practice Gap & Educational Need: There has not been a large, comprehensive assessment of both demographic and auditory profiles of patients undergoing CI evaluation and surgery. Greater awareness of disadvantaged groups can help increase access to CI care.

Learning Objective: To characterize the demographic and auditory profiles as well as to identify predictive factors of adult patients who underwent CI workup and surgery.

Desired Result: This information can help improve referral patterns for CI evaluation as well as patient counseling for surgery so that every patient who qualifies has the opportunity to benefit from this technology.

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

Indicate IRB or IACUC: IRB Exempt (211355, Vanderbilt University).

Machine Learning for Automated Calculation of Acoustic Neuroma Volumes

Nathan D. Cass MD; Nathan R. Lindquist MD; Qibang Zhu; Hao Li
Ipek Oguz PhD; Kareem O. Tawfik MD

Hypothesis: Machine learning-derived algorithms are capable of automated calculation of acoustic neuroma tumor volumes without operator input.

Background: Volumetric measurements are more sensitive than diametric measurements for detection of tumor growth in acoustic neuroma, and vital for patient counseling and management decisions. Yet, manually measuring volume is logistically challenging and time-consuming to perform, as well as subjective and difficult to reproduce. We created a machine learning algorithm to calculate acoustic neuroma volumes without operator input.

Methods: We developed a deep learning framework fusing transformers and convolutional neural networks to segment acoustic neuromas. The algorithm was trained and validated on an external, publicly available dataset consisting of medium and large tumors ([178 – 9598mm^3]). Testing of the algorithm was performed with additional subjects from the dataset.

Results: The algorithm yielded 87% overlap (Dice score) with manually segmented tumors on the test subjects.

Conclusions: Sophisticated machine learning algorithms can delineate tumors with an accuracy of 87% overlap with manual segmentations, without operator input, on images matching the acquisition protocols of the training dataset. Previously published intra- and inter-rater reliability studies for manual volumetric measurements demonstrate errors of up to 20% with repeated measurements; thus, our algorithm exceeds established norms for accuracy in volumetric assessment. This technology has promise for wide clinical applicability and time savings. Generalizing our algorithms to a diverse set of tumor sizes, MRI sequences, and acquisition protocols via data augmentation and image harmonization techniques remains as future work.

Define Professional Practice Gap & Educational Need: Tumor volumetrics are vital for patient counseling and management decisions, but logistically difficult and time-consuming to perform. This study introduces a sophisticated machine learning algorithm to address this need.

Learning Objective: Understand current advancements in machine learning for automated segmentation and thus tumor volumes in patients with acoustic neuroma.

Desired Result: As we provide attendees with a better understanding of current applications of machine learning algorithms to neurotology, we hope to inspire them to explore the possibilities of this intersection within their own institutions.

Level of Evidence: IV

Indicate IRB or IACUC: IRB Approved (#210996, Vanderbilt University Medical Center)

Quantification of Internal Auditory Canal Visualization Using Endoscopes

Nathan D. Cass MD; Hannah G. Mason BS; Mohammad M.R. Khan, MS
Jack H. Noble PhD; Kareem O. Tawfik MD

Hypothesis: Angled endoscopes have been postulated to increase visualization of the internal auditory canal (IAC); however, few studies have quantified extent of IAC visualization using endoscopes of varying angles.

Background: Preservation of the bony labyrinth in middle fossa (MF) hearing preservation acoustic neuroma surgery may limit visualization of the lateral IAC. We sought to determine the extent to which IAC visualization is increased with endoscopes in these situations.

Methods: CT scans were acquired before and after two cadaveric MF bony drillouts. An atlas-based method was used to localize the IAC in the pre-procedure CT, then registered with the post-procedure CT using standard image registration methods. Virtual microscope and endoscope positions and angle of approach were determined in a 3D rendering environment. Using ray-casting techniques, the percentage of IAC surface area visible (unobscured by bony structures) with microscope and 0˚, 30˚, and 45˚ endoscopes was calculated.

Results: For cadaver 1, microscope led to visible IAC surface areas of 72%, while 0˚, 30˚, and 45˚ endoscopes visualized 58, 79, and 84%, respectively. For cadaver 2, microscope led to visible surface areas of 67%, while the same endoscopes visualized 66, 84, and 84%, respectively.

Conclusions: Using a microscope yields similar proportions of visible IAC surface area to a 0˚ endoscope in MF bony drillouts. Increased visualization of the IAC is possible with more angled endoscopes. Using angled endoscopes may facilitate improved tumor dissection in the lateral IAC with neural and vascular preservation in acoustic neuroma surgery aimed at hearing preservation.

Define Professional Practice Gap & Educational Need: Neurotologists recognize that visualization of the lateral IAC is challenging in hearing preservation acoustic neuroma surgery, and may benefit from learning about techniques that might render this task safer.

Learning Objective: Attendees should understand the possible advantages of endoscopes for lateral IAC visualization in hearing preservation acoustic neuroma surgery.

Desired Result: As we all learn more about advances in techniques to assist in hearing preservation for patients with acoustic neuroma, we hope that the neurotology community would join us in evaluating outcomes to see whether these techniques actually improve care for our patients with this disorder.

Level of Evidence: V

Indicate IRB or IACUC: IRB Exempt (Vanderbilt University Medical Center)

ANS 2022 POSTER H011

Development of In Vitro Model for Ototoxic Demyelinating Injury and Rehabilitation

Michelle K. Hong, BS; Kristen A. Echanique, MD
Larry F. Hoffman, PhD; Ashley E. Kita, MD

Background: Recent evidence indicates that compromise to Schwann cells ensheathing inner ear afferent neurons results in inner ear dysfunction mimicking drug-induced ototoxicity. Cisplatin and aminoglycosides are widely prescribed but known to cause ototoxicity. While both drugs have been shown to induce peripheral nerve demyelination, demyelination of spiral or Scarpa's ganglion neurons has not been extensively studied. There is a need for a model for ototoxic demyelination to screen medications for injurious or protective potential in Schwann cells.

Hypothesis: An in vitro model of Schwann cells can be used to evaluate the potential of cisplatin and gentamicin to compromise their viability, thereby identifying risk factors for demyelination.

Methods: Rat Schwann RT4-D6P2T cells were seeded on 96-well plates 18-24 hours prior to treatment with cisplatin or gentamicin. Cell viability was evaluated 24 hours after treatment with the MTT cell proliferation assay.

Results: Dose-response curves were created using 4-parameter log logistic regression models. LC50 doses for cisplatin and gentamicin were 29.6μM (p=1.606E-11) and 2.0mM (p=1.035E-10) respectively, reflecting an approximate 64 fold difference.

Conclusions: Our RT4-D6P2T toxicity assay provides a high-throughput in vitro model for exploring Schwann cell sensitivity to ototoxins suggestive of demyelinating pathology. We demonstrated dose-dependent reductions in cell viability from cisplatin and gentamicin with significantly greater sensitivity to cisplatin. This suggests that cisplatin exhibits a greater potential than gentamicin for compromising Schwann cells and that cisplatin may cause demyelination-induced afferent neuron hypofunction in the inner ear. This assay is also well-positioned to screen for protective agents to preserve afferent neuron function during chemotherapy.

***Professional Practice Gap & Educational Need:** There is a need for a high-throughput method of testing pharmacologic agents to rehabilitate or prevent ototoxic injury from widely prescribed drugs such as gentamicin and cisplatin.

***Learning Objective:** To highlight demyelination as a potential mechanism for cisplatin ototoxicity and an important pathway to consider for rehabilitation. To develop a high-throughput method of screening multiple pharmacologic agents for rehabilitation benefit.

***Desired Result:** To identify a rehabilitation agent for ototoxic demyelination in vitro and further study this agent as a drug of choice for mitigating ototoxicity in a clinical setting

***Level of Evidence –** N/A

***Indicate IRB or IACUC :** Exempt

Combined Arterial and Venous Phase Computed Tomographic Findings in Patients with Pulsatile Tinnitus

Eric J. Formeister, MD, MS; Grace Xiao, BS
Ferdinand Hui, MD; Yuri Agrawal, MD; James Clark, MD
John P. Carey; Daniel Q. Sun, MD

Objective: To describe the demographic, clinical and radiologic findings in a consecutive series of patients presenting to otolaryngologists with a chief complaint of pulsatile tinnitus (PT).

Study Design: Retrospective review of 157 patients undergoing a novel combined arterial/venous phase computed tomographic (CT) imaging study.

Setting: Tertiary Referral Center

Patients: Adult patients referred to neurotology faculty for evaluation of PT between 2016 and 2020.

Interventions: CT arteriography/venography study.

Main Outcome Measures: Prevalence of venous or arterial pathology, clinicodemographic characteristics.

Results: One-hundred and fifty-seven adults (avg. age, 52 years; 79.6% female) were evaluated. A history of migraine headaches was common (19.7%). The average BMI was 30.0 (S.D., 6.8), and 17.2% of subjects had a diagnosis of obstructive sleep apnea. Idiopathic intracranial hypertension was diagnosed by elevated opening pressure on lumbar puncture in 14.0%. Comorbid depression and anxiety were common (25.5% and 26.1%, respectively).

Overall, abnormalities were found in 78.9% of scans, with bilateral transverse sinus stenosis (TSS) seen in 38.9% and unilateral TSS found in 20.4%. Fifteen subjects (9.6%) had evidence of osseous etiologies, including superior canal dehiscence or thinning in 8.9% and sigmoid sinus dehiscence in one subject. There were 3 dural arteriovenous fistulae identified. Unilateral PT was ipsilateral to the side of TSS in 84.4% of subjects with unilateral TSS.

Conclusions: In a large consecutive series of patients with PT referred for CT venography/arteriography, transverse sinus stenosis was the most common finding at 59%. Venous etiologies for PT should be suspected when patients are referred to neurotologists for evaluation.

***Professional Practice Gap & Educational Need:** Pulsatile tinnitus (PT) is a common referral to otologists and neurotologists and can indicate serious underlying pathology. However, there is wide practice variation in the diagnostic imaging modalities suggested for adequate workup. A single screening study for PT that can simultaneously assess arterial, venous, and skull base anomaly etiologies of PT may offer higher diagnostic accuracy and lower healthcare costs.

***Learning Objective:** To describe venous etiologies for PT demonstrated on a novel arterial/venous phase computed tomography protocol.

***Desired Result:** To demonstrate the importance of assessing for venous etiologies of PT in patients presenting to otology/neurotology practices.

***Level of Evidence –** Level III

***Indicate IRB or IACUC :** The following study was approved by the Johns Hopkins University Institutional Review Board (IRB Number 00231197).

Gender-Based Differences in Operating Room Ergonomics and Musculoskeletal Pain among Otolaryngology Trainees

Eric J. Formeister, MD, MS; Lekha Yesantharao, BS
John Pentikis, PhD; John P. Carey, MD; Deepa J. Galaiya, MD

Objectives: (1) To assess perception of operating room (OR) ergonomics and musculoskeletal (MSK) pain related to operating; and (2) To describe gender bias in size/adjustability of standard operating room tables and chairs.

Study Design: Survey study of otolaryngology trainees at a university medical center.

Main Outcome Measures: (1) Responses to a comprehensive ergonomics survey; and (2) Percentage of males and females accommodated by standard operating room equipment.

Results: Twenty-three trainees (43% female, avg. age, 30.9 years) completed the survey. The most common sites of MSK pain experienced included the neck (91%), lower back (87%), shoulders (74%), and upper back (65%). Sixty-one percent experienced neck pain at least 8 days per month, and 53% attributed MSK pain directly to operating. All female respondents reported neck pain, compared to 83% of male respondents. Forty-percent of female respondents experienced upper back pain more than 8 days per month, compared to 17% of male respondents. Overall, 0% reported pain or discomfort to supervisors, and 0% requested time off or breaks from operating. The majority (81%) of respondents were completely unfamiliar with ergonomics principles.

Based on population normative data, a substantially smaller proportion of females are ergonomically accommodated when seated compared to males when using standard otolaryngology stools on 3 measures (lowest seat pan height, 3% of females accommodated versus 54% males; seat pan depth, 85% versus 95%; and elbow rest height, 31% versus 38%).

Conclusions: MSK pain is almost universal among otolaryngology trainees, with more than half attributing pain directly to surgical training. Standard operating room equipment is less accommodating to the average female stature and thus may differentially disadvantage female trainees in otolaryngology.

***Professional Practice Gap & Educational Need:** Work-related musculoskeletal disorders are common in surgical specialties. This study characterizes this issue among otolaryngology trainees and provides insight into differences in ergonomic risk with respect to gender.

***Learning Objective:** (1)The audience will understand the prevalence of MSK pain in otolaryngology trainees and ergonomic differences with respect to gender; and (2) The audience will recognize that standard otolaryngology equipment is poorly optimized for surgeons with smaller stature.

***Desired Result:** Increasing awareness of ergonomic issues in otolaryngologic surgery.

***Level of Evidence -** IV

***Indicate IRB or IACUC :**
This study was approved by the Johns Hopkins Institutional Review Board (IRB number 00289314).

Evaluation of Navigation Deficits in Patients with Bilateral Vestibular Loss using a Novel Virtual Reality Spatial Navigation Task

Maimuna Ahmad, BS; Susan King, BS; Sacha Panic, PhD
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Objective: To determine whether performance in a virtual reality spatial navigation (VRSN) task is poorer in patients with bilateral vestibular loss (BVL) compared to healthy controls and assess the correlation between patient-reported outcomes measures (PROMs) and visuospatial navigation.

Study Design: Cross-sectional study.

Setting: Academic medical center.

Patients: Nineteen age-matched subjects: fourteen BVL and five control subjects.

Interventions: Subjects completed questionnaires to assess the severity of vestibular and cognitive impairment, including the Dizziness Handicap Inventory (DHI) and Cognitive Function - Quality of Life in Neurological Disorders (CF-Neuro-QOL). Subjects performed a VRSN ("complete-the-triangle") task while wearing a VR headset. Two versions were performed: 1) ambulatory, in which subjects navigated on a platform, providing the brain with visual, vestibular, and proprioceptive cues; 2) stationary, in which subjects navigated virtually using a gamepad controller without head or body movement, providing the brain with only visual information.

Main Outcome Measures: Survey scores and VRSN task performance (mean and standard deviation (SD) of angular and linear error, with mean characterizing accuracy and SD characterizing precision).

Results: Male BVL subjects demonstrated improved accuracy with reduced mean linear error ($V=39;p<0.05$) and precision with reduced SD of angular and distance error ($V=35;p<0.1$ and $V=38;p<0.05$, respectively) on the stationary task compared to the ambulatory task. Female BVL and control subjects performed similarly on both tasks. DHI and Neuro-QOL scores negatively correlated with VSRN task performance in BVL subjects ($r=-0.74;p=-0.02$ and $r=-0.79;p=0.02$, respectively).

Conclusions: Unlike healthy controls, BVL subjects perform better on stationary tasks than ambulatory tasks, suggesting that spatial orientation is degraded when aberrant vestibular inputs are provided to the brain.

Professional Practice Gap & Educational Need: 1) Lack of in-depth characterization of previously reported visuospatial navigation deficits in patients with bilateral vestibular loss, specifically in the comparison of tasks that utilize the peripheral vestibular system (e.g. head turning and ambulation) and tasks that do not require activation of the peripheral vestibular system. 2) Paucity of information relating subjective cognitive complaints using patient reported outcome measures (PROMs) to performance on visuospatial navigation tasks.

Learning Objective: 1) Attendees will obtain an improved understanding of the effect of bilateral vestibular loss on path integration and spatial navigation. 2) Attendees will gain a greater appreciation for the role of patient reported outcome measures (PROMs) in quantifying subjective complaints of cognitive impairment.

Desired Result: A greater understanding of visuospatial navigation deficits in patients with bilateral vestibular loss and an improved appreciation of the method in which patient reported outcome measures (PROMs) can aid physicians in assessing and quantifying cognitive deficits.

Level of Evidence - III

IRB: IRB 2019P000438, Massachusetts Eye and Ear

Auditory Brainstem Implant (ABI) Outcomes in Tumor and Non-Tumor Patients: A Systematic Review and Meta-Analysis

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Objective: To compare auditory and non-auditory outcomes between auditory brainstem implant (ABI) users with tumor and non-tumor etiologies.

Data Sources: A systematic search was performed in Pubmed, Embase, and Web of Science Core Collection from 1990-2021. The search methodology was limited to studies published in English.

Study selection: Included studies had five or more patients reporting ABI outcomes due to tumor (neurofibromatosis type-2 (NF-2), sporadic vestibular Schwannomas) or non-tumor etiologies (cochlear malformations/ossification, trauma).

Data extraction: Forty-one studies were included and underwent full-text review. Data were extracted for 1083 ABI recipients (75% tumor recipients, 25% non-tumor recipients). Most recipients were post-lingually deafened (60% adult subjects). Seven studies directly compared auditory performance in tumor and non-tumor recipients. Study quality was assessed using the Newcastle-Ottawa scale.

Data synthesis: A random effects model was used to compare speech recognition scores due to high study heterogeneity (92-67%). Non-tumor patients performed significantly ($p<0.05$) better than tumor patients, with a standardized mean difference (SMD) for open-set sentence recognition of 1.65 (95% CI, 2.04-1.26) and a SMD for word recognition score of 0.75 (95% CI, 1.47-0.03) resulting in a medium-large effect size. No differences were seen in the categories of auditory performance (CAP) scale. The most common side effects were head tingling and vertigo for tumor versus non-tumor subjects, respectively. The mean weighted average of active electrodes was significantly different ($p<0.05$) across ABI device manufacturers.

Conclusions: Overall, non-tumor ABI subjects demonstrated superior auditory perception compared to tumor subjects. This performance difference could be considered for expanding ABI candidacy criteria to non-tumor etiologies in the United States.

***Professional Practice Gap & Educational Need:** There is no consensus about the difference in performance between tumor and non-tumor ABI users. The lack of enough evidence demonstrating auditory outcomes in this diverse patient population leads to a reduction in number of recipients. Physicians should be able to inform potential ABI candidates about their possible auditory performance.

***Learning Objective:** Determine the clinical indications and difference in auditory performance between tumor and non-tumor ABI patients.

***Desired Result:** Attendees should be able to differentiate the auditory outcomes in ABI patients with tumors and without tumors.

***Level of Evidence** – Level II

***Indicate IRB or IACUC:** Exempt

Long-term Audiometric Outcomes following attempted Hearing Preservation in Vestibular Schwannoma

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Samuel L. Barnett, MD; Jacob B. Hunter, MD

Objective: Assess success and durability of audiological outcomes among different treatment modalities intended for hearing preservation in the management of vestibular schwannoma.

Study Design: Retrospective review.

Setting: Tertiary skull base center

Patients: Sporadic adult vestibular schwannoma patients with class C hearing or better at the time of intervention.

Interventions: Gamma knife radiation, middle cranial fossa or retrosigmoid approaches

Main Outcome Measures: Pure tone audiometry, speech discrimination scores.

Results: Of the 107 patients treated with Gamma-knife, 32 (29.9%) had serviceable hearing at last follow-up, compared to 42 (40.8%) that underwent retrosigmoid (N=10) and middle cranial fossa (N=32) approaches (p=0.11). One surgical and 34 (31.8%) radiated patients subsequently experienced loss of residual hearing despite initial preservation (p<.001), at a mean 5.15 ± 9.4 years following radiation. Among those with initially preserved hearing, twenty radiated and fifteen surgical patients had follow-up ≥5 years.
There was no difference in mean tumor size (p=0.75) or distribution of pre-treatment hearing classes (p=0.66) between surgical and radiated groups. Mean age was higher among radiated patients (60.48 ± 11.21 years vs. 44.87 ± 13.25 years, p<0.01).

Conclusions: Neither surgery nor radiation conferred a higher likelihood for hearing preservation. When successful however, surgical approaches offered more durable hearing outcomes.

***Professional Practice Gap & Educational Need:** Long-term audiometric data outcomes following hearing preservation treatment approaches is needed to inform clinical decision making and guide patient expectations.

***Learning Objective:** Evaluate the long-term hearing results among patients undergoing following hearing preservation treatment modalities.

***Desired Result:** To share the audiologic outcomes among a large cohort of surgical and radiated patients with sporadic vestibular schwannoma treated at a single academic skullbase center.

***Level of Evidence -** IV

***Indicate IRB or IACUC :** STU 112016-040, UT Southwestern Medical Center

ANS 2022 POSTER H017

Trends in Spontaneous CSF Leak Repair in the United States 2009-2015

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Rick F. Nelson, MD, PhD

Objective: To determine national rates of spontaneous cerebrospinal fluid (sCSF) leaks, how these rates have changed over time, and to determine the association with risk factors

Study Design: Retrospective review from 2009-2015

Setting: Vizient Clinical Database of 141 academic institutions in the United States that reported all CSF leak repairs from all years of the study.

Patients: Patients who underwent craniotomy for sCSF leak repair in hospitals included in the Vizient Clinical Database.

Main Outcome Measures: National rates of craniotomy for sCSF leak repair each quarter and single and multivariable linear regression comparing these quarterly rates over time along with covariables, which were included as percentage of total patients per quarter.

Results: The rate of sCSF leak repairs per quarter increased by over 50% from 2009 to 2015 (β=2.4, $p<0.001$). Obstructive sleep apnea (OSA) and diabetes were associated with higher rates of sCSF leak repairs in multivariable regression (β=2.5, p=0.008; β=2.4, p=.02, respectively). Obesity was associated with higher repair rates in single-predictor regression [(β=3.8, $p<0.001$) and was not included in multivariable analysis due to collinearity with time (i.e. progressive quarters)]. Black patients were overrepresented in the CSF leak repair cohort compared to expected population rates (22% vs. 13%).

Conclusions: In this nation-wide study of adults in the United States**,** the rate of sCSF leak repairs continues to nearly double every decade since 2002. Co-morbid conditions like obesity, diabetes, and OSA are associated with increased risk of sCSF leak repairs. The temporally shifted rise in sCSF leaks mirrors the rise in US obesity, which began in the 1980s.

***Professional Practice Gap & Educational Need:** Understanding of change in sCSF leak repair rates over time, which may affect practice patterns, trainee exposure to cases, and patient counseling regarding treatment and prevention.

***Learning Objective:** The incidence of sCSF leak repairs continues to increase. Black patients may be disproportionately affected by need for sCSF leak repairs. While obesity itself is not predictive of need for sCSF leak repair, increased BMI may still be associated with this need.

***Desired Result: s**CSF leak rates continue to increase. Otolaryngologists should have a high index of suspicion for spontaneous sCSF leaks and be well-equipped to repair sCSF leaks when they occur.

***Level of Evidence -** IV

***Indicate IRB or IACUC:** Exempt

Improved Facial Nerve Preservation with Inferior Long Axis Dissection of Large VS Tumors

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Rick F. Nelson, MD, PhD

Objective: To determine the facial nerve (FN) outcomes and degree of resection in large vestibular schwannomas (VS) using the inferior long axis dissection of the tumor/FN interface in the cisternal segment.

Study Design: Retrospective case series of patients who underwent inferior long axis approach for VS dissection from 2017-2021.

Setting: Tertiary medical center

Patients: Patients who underwent resection of large VS (>2.0 cm measured along the petrous ridge).

Main Outcome Measures: Levels of intraoperative FN stimulation; rates of good post-operative FN outcomes (House-Brackmann 1-2); and rates of surgical resection defined at 1-month postoperative MRI [gross total resection (GTR), near-total resection (NTR), defined as residual tumor volume of <0.5 cm^3), and subtotal resection (STR)].

Results: 29 patients had an average [SD] VS tumor size of 3.3 [0.9] cm. FN stimulation at 0.05 mAmp with >100µV was achieved in 97% of cases. GTR or NTR was achieved in 83% of cases. Good FN outcomes were observed in 78% of cases immediately post-op and at 1-month follow-up, in 76% of cases at 1-year follow-up for patients who were followed for a full year, and in 81% of patients at last follow-up.

Conclusions: The inferior long-axis technique allows for optimal visualization and dissection of the thinnest portion of the FN leading to both high rates of facial nerve preservation and high degree of tumor resection. Further research is needed to systematically compare this technique to standard medial-to-lateral (or lateral-to-medial) techniques.

***Professional Practice Gap & Educational Need:** While GTR/NTR results in lower rates of tumor re-growth, STR is associated with better FN outcomes. The inferior long axis technique to FN dissection is designed to remove more tumor while placing less strain on the facial nerve through identification of a plain that allows for improved tumor dissection with reduced traction on the splayed fibers of the facial nerve.

***Learning Objective:** The inferior long axis technique may improve GTR/NTR rates while reducing FN deficits postoperatively

***Desired Result:** Inferior long axis technique should be further studied to compare outcomes to more standard techniques of FN dissection.

***Level of Evidence -** IV

***Indicate IRB or IACUC :** Indiana University School of Medicine IRB #1806000302

Endolymphatic Hydrops in the Setting of Vestibular Schwannoma: A Temporal Bone Study

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Akira Ishiyama, MD; Yu-Tung Wong, MD

Hypothesis: Vestibular schwannoma (VS) may be associated with endolymphatic hydrops (EH). EH may account for symptomatology in a subset of patients with VS.

Backround: Presenting symptoms of VS and EH overlap and MRI evaluation of the membranous labyrinth in some patients with VS demonstrates EH. The aim of the current study is to evaluate whether EH is present in temporal bones of patients with VS.

Methods: The NIDCD and House Temporal Bone Laboratory at UCLA Eccles database was queried for the diagnosis of "acoustic neuroma". Exclusion criteria included concomitant ear disease and surgery. Temporal bones were analyzed for EH of the basal, middle and apical turns and vestibule. Pre-mortem audiometric and clinical data were gathered.

Results: Of 43 human temporal bones with VS, 6 met inclusion criteria. All temporal bones demonstrated VS that was undisturbed by surgery. 3/6 demonstrated EH of at least one cochlear turn as well as vestibular hydrops. Three patients had severe to profound hearing loss. One patient carried a diagnosis of Meniere's Disease.

Conclusions: EH is demonstrated in the setting of VS in human temporal bones. EH may be one mechanism of hearing loss and dizziness in patients with VS.

Professional Practice Gap & Educational Need: The underlying mechanisms of symptoms of VS may be multifactorial. The association of EH in some patients with VS would modify our clinical approach to management.

Learning Objective: To discover if EH may be associated with VS.

Desired Result: To broaden understanding of pathophysiologic mechanisms in patients with VS.

Level of Evidence: Level IV

IRB Approved: UCLA IRB#10-001449

Post-Operative Evaluation of CT Imaging Following Cochlear Implantation

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Objective: Use automatic segmentation to determine the position of cochlear implant (CI) electrodes that produces the best audiologic outcomes for the patient. We also compare automatic segmentation to manual measurements. We hypothesize that electrodes within the scala tympani (ST) without translocation into the scala vestibuli (SV) will result in better audiologic outcomes.

Study Design: Retrospective chart review.

Setting: Tertiary referral center.

Patients: Patients implanted from 2015-2019 with imaging and post-operative AzBio or Consonant-vowel Nucleus-consonant (CNC) testing. Patients were excluded if pre or perilingual at the time of implantation (<18 years of age), non-English speaking, had a cognitive disorder or a cochlear malformation.

Interventions: Retrospective analysis of CT scans.

Main Outcome Measures: Post-operative speech perception testing and detection of translocation via automated and manual methods.

Results: 47 patients met inclusion criteria, 15 had a dislocation. When controlling for cochlear implant usage and the pre-operative AzBio score, patients with a dislocation had a significantly lower CNC score and AzBio score 6-months post-operation compared to patients without a dislocation. The number of dislocated electrodes was significantly associated with CNC score post-operation among patients with a dislocation. 42 of 47 manual evaluations did not suggest there was a dislocation, 32 of these evaluations were correct, while all 5 of the evaluations suggesting a dislocation were correct, providing evidence that manual evaluations are predictive of dislocations ($p = 0.002$).

Conclusions: Placement of CIs within the ST without translocation to the SV leads to improved audiologic outcomes. Additionally, manual evaluation of temporal bone CT shows promise for identification of electrode position for prediction of audiologic outcomes.

***Professional Practice Gap & Educational Need:**
1. Lack of consensus on factors affecting CI hearing outcomes 2. Lack of an available method to evaluate position of CI electrodes in a non-research setting.

***Learning Objective:**
1. To recognize that our data provides additional support for the hypothesis that position of CI electrode impacts audiologic outcomes 2. To raise awareness that CI electrode position can be measured to a satisfactory degree by physicians using post-operative CT scans, while automated segmentation remains the standard for research purposes.

***Desired Result:**
For physicians to recognize the importance of CI electrode position and the availability of methods to identify when patients are at risk for worse audiologic outcomes.

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

***Indicate IRB or IACUC :** Approved 9/26/2018 - 2018H0394 - Assessment of Electrode Placement and Audiologic Outcomes in Cochlear Implantation.

Bone-Island Craniotomy Technique for the Placement of Bonebridge Active Transcutaneous Bone Conduction Implants

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Objective: Current techniques for placement of the Bonebridge active transcutaneous bone conduction implant require drilling of a precisely size bone bed for the device fixation points to make appropriate contact, which is often difficult even when lifts are used. In this study we describe the surgical technique and outcomes of a novel bone-island craniotomy technique which simplifies the procedure and precludes the necessity for lifts in securing the device.

Study Design: Prospective case series

Setting: Tertiary care academic medical center

Patients: Fourteen patients who underwent surgery for placement of 15 Bonebridge active transcutaneous bone conduction implants. Twelve for conductive or mixed hearing loss with maximum bone conduction threshold of 45 dB HL between 500 and 3000 Hz on the operative side, and three for single sided deafness with contralateral maximum air conduction threshold of 60 dB HL.

Interventions: Surgical placement of the Bonebridge active transcutaneous device with a novel bone island craniotomy technique.

Main Outcome Measures: Functional gain in air conduction thresholds, frequency of need for lifts, minor and major complications

Results: For patients with conductive or mixed hearing loss, the mean functional gain in air conduction pure tone average with the device compared to the unaided condition was 31.2 dB HL (SD 8.3). Lifts were not needed in any case to secure the device. There was 1 minor complication requiring a second procedure due to wound infection in a patient who had received radiation. There were no major complications. There was no device loss or failure.

Conclusions: A bone island craniotomy technique eliminates the need for lifts and is a simple, safe, and effective method for placement of the Bonebridge active transcutaneous bone conduction implant.

Define Professional Practice Gap & Educational Need:
Current techniques for placement of the Bonebridge bone conduction implant require drilling of a bone bed such that the device fixation points make appropriate contact at the edges, which is often difficult even when lifts are used to assist in achieving proper fit and fixation. A novel bone-island craniotomy technique simplifies the process and avoids the needs for lifts, but its safety and efficacy have not been studied.

Learning Objective: Evaluate the safety and efficacy of a novel bone-island craniotomy technique for placement of the Bonebridge bone conduction implant.

Desired Result: Attendees will be able to perform Bonebridge surgery with a bone-island craniotomy technique and understand the benefits, risks, and outcomes with this technique.

Level of Evidence – Level III

Indicate IRB or IACUC : Approval per Rutgers Robert Wood Johnson Medical School IRB, Protocol# 2021001732

ANS 2022 POSTER H022

Social Determinants of Health in the Management of Vestibular Schwannoma

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Shannon Fayson, MD; Renee Banakis, MD, AuD; Emily Stucken, MD

Objective: To evaluate the influence of racial disparities and social determinants of health in vestibular schwannoma (VS) management

Study Design: Retrospective review

Setting: Tertiary academic center

Patients: 556 adults (>18) with VS diagnosed between 1/1/2010 to 12/31/2019

Interventions: VS evaluation and management, clinical decision making

Main Outcome Measures: Initial treatment recommendation, actual treatment pursued, hearing class

Results: Of the 556 patients analyzed, 47% were female and 53% were male. 87% identified as white, 3.4 % as black, 3.4% as Asian, and 6% were of other or unknown races. Only 3.2% identified as Hispanic or Latinx. Surgical resection was recommended as a treatment option for 57.2% of patients. On multivariate logistic regression, race (p 0.04), age (p <0.001), marital status (p 0.001), insurance type (p 0.004), and tumor size (p <0.001) were correlated with a recommendation of surgery. Ethnicity (p 0.49), hearing class (p 0.74), and Charlson Comorbidity Index (CCI) score (p 0.14) were not associated with a recommendation of surgery. Ultimately 37.7% of patients in this cohort underwent surgery within one year of diagnosis. Tumor size (p <0.001), CCI (p 0.01), and hearing class (p 0.41) were correlated with surgical intervention. Race (p 0.44), ethnicity (p 0.29), marital status (p 0.50) and insurance type (p 0.89) were not associated with undergoing surgical intervention.

Conclusions: Social determinants of health and racial disparities may influence the evaluation and management of patients with VS. Multi-institutional analysis and evaluation of area deprivation index is ongoing.

Define Professional Practice Gap & Educational Need: Racial disparities and social determinants of health are known to impact diagnosis and disease management in many medical disciplines. There has been very little investigation into the impact this has on VS management. Prior studies have suggested that racial disparities may impact whether patients are treated with surgical excision. Further investigation is warranted to identify and acknowledge opportunities for the delivery of more equitable medical care.

Learning Objective: Social determinants of health including race may influence initial treatment recommendations for VS management and ultimate treatment pursued

Desired Result: Identify and acknowledge the influence of racial disparities and social determinants of health in the management of VS

Level of Evidence - Level V

Indicate IRB or IACUC : HUM00191920; 6/2/2021

Generation and Initial Validation of the Hearing Health Utilities Index

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Objective: Utility is a single-number summary of health-related quality of life used as an outcome measure in clinical trials and cost-effectiveness analyses. Existing utility measures do not detect important hearing changes and underestimate the benefit of hearing treatments including bilateral cochlear implantation. The Health Utilities Index, Mark 3 was re-designed to address this limitation. Here we debut the Hearing Health Utilities Index (HUI-Hearing) and describe its content validation.

Study Design: Cognitive interviews, focus groups, modified Delphi

Setting: Tertiary center

Subjects: Stratified sample of adults (age ≥18 years) with hearing loss, their communication partners, and clinical and measurement experts.

Interventions: Hour-long, transcribed semi-structured interviews with patients who completed HUI-Hearing. Focus groups including patients and their communication partners. Modified Delphi process involving clinical and measurement experts.

Main Outcome Measures: (1) Saturation, defined by no emergence of novel themes during interviews/focus groups. (2) Consensus in modified Delphi

Results: Focus groups included 40 subjects in 8 groups. Cognitive debriefing included 10 subjects with hearing ranging from normal to profound loss and broad demographics and treatment experiences. The modified Delphi included 4 audiologists, 4 otologist/neurotologists, and 2 health economists. Adjustments were made to the preliminary HUI-Hearing in response to identified issues with clarity, interpretation, response time, and range of functioning described.
The final HUI-Hearing classifies hearing status according to 7 domains: speech recognition, environmental sounds, localization, listening effort, tinnitus, music appreciation, and assistive hearing devices. It describes 25,920 unique hearing states.

Conclusions: HUI-Hearing is a comprehensive hearing status classification system with excellent granularity and face validity that will facilitate appropriate health resource allocation for hearing treatments.

***Professional Practice Gap & Educational Need:** Health utility is often calculated using generic instruments applicable to all health conditions that lack granularity for detection of clinically important differences in specific conditions like hearing loss. Until now, no hearing-specific utility instrument has been available.

***Learning Objective:** Understand the composition of health utility instruments, steps involved in their derivation, and appreciate the limitations of generic utility instruments in hearing loss

***Desired Result:** Knowledge of available alternatives to generic health utility instruments, including the HUI-Hearing, for estimating health utility in patients with hearing loss.

***Level of Evidence –** V

***Indicate IRB:** Sunnybrook REB, Project Identification Number 114-2018

Identifying Ideal Candidates with Vestibular Schwannoma for the Middle Cranial Fossa Approach

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Alexander D. Claussen, MD; Marin A. Mcdonald, MD
Marc Schwartz, MD; Rick A. Friedman, MD, PhD

Objective: Identify characteristics associated with ideal outcomes after middle cranial fossa (MCF) approach for vestibular schwannomas (VS).

Study Design: Case-control

Setting: Tertiary care hospital

Patients: Adults with VS and serviceable hearing

Interventions: MCF approach between 2017 and 2021

Main Outcome Measures: Ideal outcomes were defined as preserved AAO class A or B hearing, House-Brackmann (HB) Grade I facial function, and gross total resection; each without complications or length of stay >4 days. A perfect outcome was defined by the combination of all ideal outcomes.

Results: Of the 83 patients included, hearing was preserved in 58(70%), HB Grade I in 58(70%), with gross total resection in all cases. Perfect outcome was observed in 41 and was associated with better median pre-operative pure tone average (10dB vs. 17dB; $p<0.01$) and word recognition (100% vs. 64%, $p<0.01$). Transverse tumor dimension was smaller in the perfect outcome group (median 8.1 vs. 9.2 mm, $p=0.034$). The position of the tumor within the internal auditory canal (IAC) was measured relative to the mid-pole of the IAC as ratios of distances to the anterior vs. posterior, and superior vs. inferior tumor borders. Perfect outcome was associated with more posteriorly-based tumors (median anterior:posterior component ratio 1.00 vs. 1.04, $p<0.01$).

Conclusions:
Preoperative hearing, tumor size, and relative position of the tumor within the IAC could be important features to consider in the selection of candidates for MCF approach. Further analysis including machine-learning feature selection techniques will be applied to identify independent predictors from more than 100 other clinical and radiographic characteristics and will be presented with the final abstract.

***Professional Practice Gap & Educational Need:** Small sporadic vestibular schwannomas may often be reasonably managed with observation, stereotactic radiosurgery, or microsurgical resection. Identification of patients most likely to experience ideal surgical outcomes may facilitate decision making and counselling.

***Learning Objective:** To identify clinical and radiographic characteristics that are available at preoperative consultation after routine investigations that may be associated with ideal surgical outcomes.

***Desired Result:** Facilitate counselling for small sporadic vestibular schwannomas and improve selection of candidates for middle fossa approach to vestibular schwannomas.

***Level of Evidence -** Level III

***Indicate IRB:** #180978, University of California San Diego

Instrumented Insoles for Assessment of Gait in Vestibular Schwannoma Patients

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Objective: Imbalance and gait disturbances are common in vestibular schwannoma (VS) patients and can result in significant morbidity. Here, we use custom-engineered instrumented insoles to evaluate the gait and balance of patients diagnosed with VS; we then compare our results to published metrics from the general population. We aim to validate instrumented insoles as a means of personalized gait assessment in VS patients.

Study Design: Prospective clinical study.

Setting: Otology, neurosurgery, and radiation oncology clinics at a tertiary referral center.

Patients: Inclusion criterion: diagnosis of VS without prior treatment. Exclusion criteria: > 80 years of age, significant neurological disorder with gait dysfunction.

Interventions: Functional gait assessment (FGA), 2-minute walk test, and uneven surface walk test with diagnostic instrumented insoles.

Main Outcome Measures: Scores on standardized gait assessments; spatiotemporal gait parameters from instrumented insoles.

Results: FGA scores and insole data were obtained for 12 patients with untreated VS. The average FGA score was 25.9±4.3 vs. 26.1±4.0 in the general population. FGA scores were significantly correlated with metrics obtained from the two-minute walk test (2MW), including normalized stride length (NSL) ($r=0.86$, $p=0.01$), normalized stride velocity (NSV) ($r=0.83$, $p=0.02$), and swing period (SP) ($r=0.76$, $p=0.05$). Compared to the 2MW, on the uneven surface walk test (USW), patients had significantly decreased NSV (0.30 vs. 0.33, $p=0.03$) and SP (37.8% vs. 39.9%, $p=0.04$).

Conclusions: VS patients have significant gait disturbance on uneven surfaces that cannot be detected by standard assessment (FGA). Instrumented insoles have greater sensitivity for identifying gait dysfunction in VS patients and may be valuable in gait assessment before and after treatment.

***Professional Practice Gap & Educational Need:**
Diagnostic instrumented insoles allow for personalized assessment of gait and balance dysfunction. Precision medicine in the realm of gait and balance has not been widely explored in otology and neurotology clinics.

***Learning Objective:**
To understand the value of diagnostic instrumented insoles in personalized medicine.

***Desired Result:**
Greater interest and investment in personalized assessment methods for gait and balance dysfunction.

***Level of Evidence:** Level II

***Indicate IRB or IACUC:**Columbia University Irving Medical Center, IRB #AAAT5366 (approved 3/11/2021)

ANS 2022 POSTER H026

Predicting Incomplete Microsurgical Resection of Sporadic Vestibular Schwannoma

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Objective: Develop a predictive model for incomplete microsurgical resection of sporadic vestibular schwannoma (VS)

Study Design: Retrospective cohort

Setting: Tertiary referral center

Patients: Patients with sporadic VS

Interventions: Microsurgery with preoperative intent of gross total resection (GTR)

Main Outcome Measures: Incomplete resection

Results: Among 603 patients, 101 (17%) had intracanalicular tumors and 502 (83%) had tumors with cerebellopontine angle (CPA) extension. For patients with CPA tumors, 331 (66%) underwent reported GTR and 171 (34%) underwent reported near total/subtotal resection (NTR/STR). Multivariable modeling identified older age at surgery, larger linear tumor size, and absence of a fundal fluid cap as predictive of NTR/STR ($p<0.001$). From this model one can estimate that a 20-year-old with a tumor that has <10 mm of CPA extension and a fundal fluid cap has a predicted probability of NTR/STR of 1%, while a 70-year-old with a tumor that has ≥30 mm of CPA extension and no fundal fluid cap has a predicted probability of NTR/STR of 91%. Among the 171 patients who underwent a NTR/STR, 24 (14%) required secondary treatment at the time of last follow-up.

Conclusions: Predictive factors for incomplete microsurgical resection of VS include older age at surgery, larger linear tumor size, and the absence of a fundal fluid cap. These factors can be used to estimate the likelihood of NTR/STR, aiding in preoperative discussions regarding future surveillance and risk of secondary treatment as well as clinical decision-making.

***Professional Practice Gap & Educational Need:** Optimal management of small- to medium-sized vestibular schwannoma remains debated. A predictive model for likelihood of gross total resection and subsequent cure can aid in this clinical decision-making.

***Learning Objective:** Identify risk factors for incomplete microsurgical resection and apply these in a predictive model to aid in patient counseling.

***Desired Result:** To provide clinicians with an additional tool in clinical decision-making and patient counseling when all management options of vestibular schwannoma are available.

***Level of Evidence -** IV

***Indicate IRB or IACUC:** Mayo Clinic IRB Protocol #16-007363

The Natural History of Primary Inner Ear Schwannomas: Outcomes of Long-Term Follow-Up

Zain Khera, BA, Emily Kay-Rivest, MD, J. Thomas Roland Jr, MD
David R. Friedmann, MD, MSc, Sean McMenomey, MD
Daniel Jethanamest, MD, MSc

Objective: To describe the natural history of primary inner ear schwannomas over a long follow up period.

Study Design: Retrospective case series.

Setting: Tertiary referral center.

Patients: Patients with primary inner ear schwannomas (PIES), with serial audiometric and radiologic follow up were included.

Interventions: None.

Main Outcome Measures: Patterns of hearing loss, rate of hearing decline, presence of vestibular symptoms, and rate of tumor growth.

Results: A total of 12 patients with 13 tumors were identified. The mean duration of follow up was 7.0 years (median 7.5 years, range 1.75 to 11.3 years). Tumor locations were described as per the Kennedy classification and 46% were intracochlear, 15% intravestibular, 23% transmodiolar and 15% intravestibular-cochlear. There were no cases of tumors breaking through the otic capsule. Among patients with serviceable hearing (AAO Class A or B) at the time of presentation, the median time to decline to a non-serviceable hearing level was 55 months (range 21 to 117 months). The hearing loss was sudden in 33% of patients, progressive in 58% and fluctuating in 8%. No patients had intractable vertigo; however, two required vestibular physiotherapy. On the first MRI, the mean largest tumor dimension was 3.1 mm (SD: 1.3 mm) and the mean largest dimension on most recent MRI was 4.4 mm (SD: 1.1 mm). Two tumors exhibited no growth over a follow up of 11.3 and 2.8 years respectively. For the remaining tumors, the mean rate of growth was 0.29 mm per year followed. Two patients underwent a CI with simultaneous tumor resection and had favorable outcomes.

Conclusions: Long-term follow up suggests that a conservative approach, with possible hearing rehabilitation at the time of deterioration, is a safe management strategy for PIES.

***Professional Practice Gap & Educational Need:** 1. There are no formal guidelines on how aggressively PIES should be managed. A better understanding of the natural history of PIES will help inform treatment decisions and the safety of observation. 2. The current literature on the natural history of PIES has relatively short follow-up times.

***Learning Objective:** To better understand the progression, growth rates, and time-to-hearing loss related to PIES.

***Desired Result:** To guide the attendee in their treatment approaches and further their knowledge of the natural history of PIES so they can better inform patients of their prognosis.

***Level of Evidence –** Level V: Case series, studies with no controls

***Indicate IRB or IACUC :** NYU School of Medicine Institutional Review Board, s21-00257 (03/10/21)

Does Compliance or Cost Regulate Effectiveness of Phone Applications for Tinnitus Relief?

Richard Adamovich-Zeitlin, BS; Maja Svrakic, MD

Objective: To evaluate compliance with and effectiveness of notched sound therapy (NST) administered through a mobile application in improving symptoms of patients suffering from chronic tinnitus.

Study Design: Prospective randomized control trial

Setting: Tertiary referral center

Patients: Adult patients with tinnitus

Interventions: A free subscription to notched sound therapy (NST) mobile app (AudioNotch), or standard of care (SOC)

Main Outcome Measures: Frequency and duration of therapy use, change from baseline in the Tinnitus Handicap Inventory (THI)

Results: There was a clinically relevant mean decrease in THI from baseline in the NST group compared with SOC. Only 35% of patients with the free mobile app, and 25% of the patients without the free mobile app used NST for 3 months post enrollment. Of the patients using NST, 30% used it for the prescribed 2 hours per day.

Conclusions: Mobile application administration of notched sound therapy (NST) is effective in improving subjective symptoms of tinnitus after at least 3 months of therapy. Cost was not a determinant on use of therapy and very few patients were able to comply with 2 hours of listening time. Despite these limitations, any use of therapy decreases symptoms and should therefore be used as a standard in treating patient with tinnitus.

***Professional Practice Gap & Educational Need:** Despite high prevalence of tinnitus and a perceived impact on quality of life, few studies address the effectiveness of easily accessible apps for treatment of tinnitus and even less is known about the effect of cost of and compliance to tinnitus sound therapy.

***Learning Objective:** To identify the early clinical results of at-home, mobile app delivered notched sound therapy in the treatment of chronic tinnitus.

***Desired Result:** To increase the clinician's knowledge of the effectiveness and feasibility of mobile application administration of notched sound therapy for the treatment of tinnitus.

***Level of Evidence –** Level II

***Indicate IRB or IACUC :** North Shore LIJ IRB, protocol number 17-0537

Image Guided Cochlear Implant Programming: A Systematic Review and Meta-analysis

Alex W. Yang, BA; Katie F. Lee, BS; Michael Noller, MD; Nora Watson, PhD
Elicia M. Pillion, AuD; Charles A. Riley, MD; Anthony M. Tolisano, MD

Objective: To review studies that have implemented clinical image guided cochlear implant programing (IGCIP) and to evaluate its effect on cochlear implant (CI) performance.

Data Sources: PubMed, Embase, and Google Scholar were searched for publications through August 1st, 2021 without date or language restrictions.

Study Selection: Included studies prospectively compared intra-individual CI performance between an image-guided experimental map and a patient's preferred traditional map. Non-English, cadaveric, and studies where imaging did not directly inform programming were excluded.

Data Extraction: Eight studies were identified for review, and four reported comparable audiological testing and follow-up times appropriate for meta-analysis. Demographic, speech, spectral modulation, pitch accuracy, and quality of life (QOL) survey data were collected. Aggregate data was used when individual data was unavailable.

Data Synthesis: Audiological test outcomes were evaluated as standardized mean difference (SMD) [95% confidence interval] using random-effects meta-analysis with raw score standardization. Improvements in speech and QOL measures using the IGCIP map demonstrated nominal effect sizes: CNC words: 0.15 [-0.12, 0.41]; AzBio quiet: 0.09 [-0.05, 0.22]; AzBio +10 dB SNR: 0.14 [-0.01, 0.30]; BKB-SIN: -0.08 [-0.36, 0.21]; Abbreviated Profile of Hearing Aid Benefit (APHAB): -0.14 [-0.28, 0.00]; Speech Spatial and Qualities of Hearing Scale (SSQ): 0.14 [-0.02, 0.30]. Nevertheless, 79% of patients allowed to keep their IGCIP map opted for continued use after the investigational period.

Conclusions: IGCIP has potential to precisely guide CI programming. Nominal effect sizes for currently employed objective outcome measures may fail to fully identify benefits given discordance with the percentage of patients who prefer to maintain their IGCIP map.

***Professional Practice Gap & Educational Need:** Image guided cochlear implant programming remains a novel but heterogenous concept that has not been easily described.

***Learning Objective:** To describe the several approaches to image guided cochlear implant programming and to measure its clinical potential objectively.

***Desired Result:** Physicians will have an improved understanding of image guided cochlear implant programming and how it is relevant to modern day precision medicine.

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

***Indicate IRB or IACUC:** Exempt.

ANS 2022 POSTER H030

Matched Cohort Study of Radiographic Superior Semicircular Canal Dehiscence and Tegmen Dehiscence and Obstructive Sleep Apnea

Adam C. Kaufman, MD, PhD; Noor Ali, BS; Shayna Cooperman, BA; Jennifer C. Alyono, MD

Objective: Report the frequency of radiographic superior semicircular canal dehiscence (SSCD) and tegmen dehiscence in patients with and without obstructive sleep apnea(OSA).

Study Design: Retrospective matched cohort study

Setting: Tertiary care center

Patients: Adults with OSA and fine cut CT scans including the temporal bone were matched to patients without OSA by age, gender, and type of CT(protocol, scanner type, slice thickness). Ears with otologic surgery or temporal bone tumors were excluded.

Main Outcome Measures: Prevalence of SSCD and tegmen dehiscence assessed by two independent reviewers.

Results: The average BMI of the OSA patients was 29.3 kg/m^2 with an average AHI of 36.5. The control group had an average BMI of 26.3 kg/m^2. 34/352(9.7%) temporal bones in the OSA cohort had SSCD vs 37/352(10.5%) of controls($p>0.05$). 7(25.6% of those with SSCD) OSA patients had bilateral SSCD vs 8(27.6% of those with SSCD) controls ($p>0.05$). The majority(87.3%) of dehiscences involved the temporal lobe with the remaining involving the superior petrosal sinus or both. 90/352(25.6%) of OSA ears had a tegmen dehiscence vs 95/352(27.0%) of controls ($p>0.05$). Neither group had a laterality preference for SSCD or tegmen dehiscence.

Conclusions: The prevalence of radiographic SSCD and tegmen dehiscences in OSA patients does not significantly differ from age and gender matched controls. This is in contrast to prior case-control studies finding patients with symptomatic SSCD to have higher rates of OSA. This may suggest the effect size of OSA on SSCD prevalence may be limited despite OSA being a risk factor for elevated intracranial pressure.

***Define Professional Practice Gap & Educational Need:**
Although previous studies have shown that patients with symptomatic SSCD have a higher rate of OSA, the reverse relationship does not hold true. Patients with OSA did not have an elevated rate SSCD compared to a control population. This study emphasizes the need for further research in understanding the risk factors for SSCD.

***Learning Objective:**
Radiographic SSCD is seen no more frequently in the OSA patient population than the general population.
SSCD or skullbase dehiscences do not preferentially occur on one side in either the OSA or general patient population.

***Desired Result:** The increased intracranial pressure seen in patients with OSA is not enough to induce SSCD at rates higher than the general population. These dehiscences are often asymptomatic and therefore do not need an intervention.

Level of Evidence - IV

Indicate IRB or IACUC : Assessed by IRB as non-human subjects research, Stanford University

Quality of Life Impact of Cochlear Implantation for Single Sided Deafness: Assessing the Interrelationship of Objective and Subjective Measures

Matthew Ryan, MD; Joshua G.W. Bernstein, PhD; Elicia M. Pillion, AuD
Coral E. Dirks, AuD, PhD; Nora Watson, PhD; Anthony M. Tolisano, MD

Objective: Cochlear implants (CIs) for single-sided deafness (SSD) and asymmetric hearing loss (AHL) provide objective spatial speech-understanding in noise (SIN) and sound-localization (SL) and subjective quality-of-life (QOL) benefits. How patients weigh objective benefits in subjective QOL responses is unknown. This study examined the pre- and post-operative time course for a patient-reported QOL outcome measure validated for CI patients (CI-QOL) and its relationship to changes in spatial-hearing and standard monaural-CI speech-in-quiet (SIQ) outcomes in a standardized clinical SSD-CI protocol.

Study Design: Retrospective cohort study

Setting: Tertiary-care military medical center

Patients: 22 SSD and 2 AHL adults

Interventions: Unilateral CI

Main Outcome Measures: CI-QOL score, CI-alone SIQ score (CNC), binaural SIN threshold, binaural SL error

Results: At post-activation Visit 1 (mean 1.9 months post-implantation), 17/24 (71%) had clinically beneficial (>3-point) CI-QOL improvement from pre-preoperative. Longitudinal results (n=10) showed mean post-operative CI-QOL improvement peaked at Visit 1 (10.0 points), decreasing through Visit 4 (7.3 points, mean 8.9 months). Speech-understanding improvement increased dramatically over the same period (SIQ: 28-52%; SIN: 7.4-12.2 dB) while SL improvement was steady (6.8-7.4 degrees). For those with data for all four outcomes (n=16), there was moderate positive correlation between QOL and SIQ improvements ($r=0.52$, $p=0.04$) and a strong positive correlation between SIN and SIQ improvements ($r=0.65$, $p<0.01$) at the latest timepoint tested.

Conclusions: QOL improvements reflect speech-understanding performance but likely also other untested objective or subjective factors. Different subjective- and objective-benefit time courses suggest clinical conclusions will be most valid after all measures asymptote. CI-alone SIQ is technically and logistically more feasible and can stand in for binaural SIN assessment.

***Professional Practice Gap & Educational Need:** To examine the QOL impact of CI for SSD patients with a validated instrument and to identify pre or post-operative metrics which may predict QOL benefit.

***Learning Objective:** CI for SSD patients leads to a clinically impactful improvement in QOL. QOL improvement is closely related to improvement in the patient's ability to understand speech.

***Desired Result:** Attendees will be able to better counsel patients regarding magnitude and timing of QOL improvement that can be expected from CI for SSD or AHL. Attendees will be able to focus on post-implant audiometric parameters which best impact their patient's QOL.

***Level of Evidence -** III

***Indicate IRB or IACUC :** Approval obtained through the Department of Research Programs at Walter Reed National Military Medical Center (IRB# WRNMMC-2020-0290). The contents of this publication are the sole responsibility of the author(s) and do not necessarily reflect the views, opinions or policies of Uniformed Services University of the Health Sciences (USUHS), the Department of Defense (DoD), the Departments of the Army, Navy, or Air Force. Mention of trade names, commercial products, or organizations does not imply endorsement by the U.S. Government.

The Effect of Delayed Intervention Prior to Microsurgical Resection of Vestibular Schwannoma

Omid Moshtaghi, MS, MD; Peter R. Dixon, MD; Alexander D. Claussen, MD
Pasha Mehranpour, BS; Kareem O. Tawfik, MD
Marc Schwartz, MD; Rick A. Friedman, MD, PhD

Objective: Identify outcomes associated with length of observation in patients who underwent microsurgical resection of vestibular schwannomas (VS).

Study Design: Retrospective single institution cohort study spanning November 2017 to July 2021.

Setting: Tertiary care hospital.

Patients: Sporadic VS surgically treated.

Interventions: Observation window greater (delayed intervention) or less (quick intervention) than 3 months defined by time from first available MRI to date of surgery.

Main Outcome Measures: Pre- and post-operative audiometric performance, objective mobility and balance metrics, tumor maximum linear dimension.

Results: Of the 492 patients who met inclusion criteria, 307 waited longer than 3 months ("delayed intervention group") with a median observation time of 354 days, while 185 underwent surgery within 3 months of the first available MRI (median 59 days). Median tumor size was larger in the delayed intervention group (20mm vs. 18mm, p=0.016). Pre-operative word recognition score (WRS) was worse in the delayed intervention group (92% vs. 84% , p=0.02). No statistically significant difference in AAO hearing classification or pure tone average was noted between the two groups. On post-operative mobility and balance metrics, the delayed intervention group scored poorly compared to quick intervention group both on the 10 Meter Walk Test (median 1.47 vs.1.58 minutes; p=0.003) and 2 Minute Walk Test (132 vs. 145 meters; p<0.01), respectively. No statistically significant difference was observed on other metrics including the dynamic gait index, functional gait assessment.

Conclusions: Patients who underwent delayed intervention of a tumor for greater than 3 months prior to surgery (median 354 days) demonstrated worse pre-operative WRS and post-operative functional mobility despite presenting at a younger age with a smaller tumor size.

***Professional Practice Gap & Educational Need:** This study better defines the potential risks associated with delay in tumor intervention beyond 3 months after initial diagnostic MRI.

***Learning Objective:** To evaluate differences in pre-operative clinical outcomes in those who elected to delay their tumor resection for at least 3 months after initial diagnostic MRI.

***Desired Result:** To better council patients who elect to undergo delayed intervention at time of diagnosis and later pursue surgical intervention.

***Level of Evidence -** Level IV

***Indicate IRB:** #180978, University of California San Diego

Audiometric and Surgical Outcomes of a Novel Bone-Conduction Hearing Aid

Alexandra E. Quimby, MD, MPH; Jino Park, BS; Michael J. Ruckenstein, MD, MSc

Objective: To report the audiometric outcomes of a series of patients having undergone implantation of a novel transcutaneous osseointegrated hearing device via a minimally invasive surgical approach.

Study Design: Retrospective case series.

Setting: Single academic tertiary referral center.

Patients: Adults (≥ 18 years) who have undergone transcutaneous osseointegrated implant placement (Osia®) between December 1, 2019 and August 1, 2021 with audiometric data available prior to and following device activation and a minimum of 4 weeks follow-up.

Interventions: Transcutaneous osseointegrated bone-conduction device implantation.

Main Outcome Measures: Change in pure tone average (PTA) after implantation. Secondary outcomes include average operative time and complications.

Results: 22 patients underwent implantation of the transcutaneous osseointegrated device via the minimally invasive surgical approach and had complete follow-up, forming the largest series of patients in the published literature. The most common indication for implantation was unilateral conductive hearing loss with a mastoid cavity. The mean operative time was 60.4 minutes (range, 26-117). The mean pre-implantation air conduction (AC) PTA was 61dB, and mean post-implantation was 27.6dB. The mean change in PTA was 34.3dB, which achieved statistical significance ($t=8.406$, $p<0.0001$). Some complication was suffered by 50% of patients, the most common of which were pain (23%) and device-related complications (excluding failure; eg buzzing, magnet displacement) (23%).

Conclusions: A minimally invasive surgical approach is feasible for the implantation of this novel transcuatneous osseointegrated hearing device. It provides a safe and effective means of hearing rehabilitation in individuals with unilateral or bilateral conductive or mixed hearing losses. Further prospective study is warranted in order to fully elucidate long-term outcomes.

***Professional Practice Gap & Educational Need:** Few studies of small numbers of patients have examined audiometric and safety outcomes of this novel transcutaneous osseointegrated device since its approval. Further data on larger numbers of patients is necessary in order to better assess outcomes following implantation of the device.

***Learning Objective:** Gain knowledge of the audiometric outcomes and common complications experienced by patients who have undergone implantation of the device.

***Desired Result:** The knowledge gained adds to that from existing literature by means of demonstrating outcomes in a larger series of patients than those previously reported on.

***Level of Evidence –** V

***Indicate IRB or IACUC :** University of Pennsylvania, IRB exempt, protocol no 849747.

ANS 2022 POSTER H034

Association between Thyroid Stimulating Hormone Level and Bell's Palsy

Avishai Stahl, MD; T. Hornik, PhD; B. Nageris, MD

Objective: Association between dysregulated thyroid hormone function and Bell's palsy has not been investigated. Our hypothesis is that dysregulated thyroid hormone function is associated with Bell's palsy.

Study Design: Retrospective cohort comparison study.

Setting: Electronic medical record database of Clalit Health Services (CHS). CHS is an Israeli payer-provider integrated health care system, serving >4.5 million members, which includes 54% of the Israeli population.

Patients: Older than 18 years old patients with Bell's palsy during 2000-2019.

Interventions: A total of 2807 patients with Bell's palsy who had Thyroid stimulating hormone (TSH) blood level prior to the palsy were matched (1:2) for age and sex with 5614 controls who had TSH blood level with no history of bell's palsy.

Main Outcome Measures: TSH level.

Results: A total of 12,628 patients with bell's palsy were found after retrospective review of the CHS database, from 2000–2019. Of which, 2807 met the inclusion criteria. Mean age was 57.9 years, and 58.4% were female. There was a significantly higher percentage of low TSH < 0.55 milli-international units per liter (mIU/L) in the Bell's Palsy group compared to controls (5.9% vs 3.7%, p< 0.001). The rate of pregnant women was similar between the bell's palsy group and control group (3% vs. 2.2%, respectively; p=0.081), as was the rate of purchasing thyroid hormone drugs (5% vs. 4.2%, respectively; p= 0.212). The Bell's palsy group had higher BMI, and more patients with diabetes mellitus, hypertension and prior cerebrovascular accident. Therefore, when we performed a binary logistic regression model to determine the risk of developing Bell's Palsy, we included the confounder variables into the model, together with the independent variable TSH (divided into 5 groups: low- <0.55 mIU/L; 0.55-1.96 mIU/L; 1.96-3.37 mIU/L; 3.37-4.78 mIU/L; high - >4.78 mIU/L). In logistic regression, TSH was found to be an independent predictor for Bell's Palsy (p=0.014). Low TSH increased the odds for Bell's Palsy compared to the other four TSH groups, [< 0.55 mIU/L] vs. [0.55-1.96 mIU/L] OR 1.44, CI (1.10-1.89), p=0.007; [1.96-3.37 mIU/L] OR 1.58 CI (1.20-2.08), p=0.001; [3.37-4.78 mIU/L] OR 1.44 CI (1.44-1.95), p=0.019; [>4.78 mIU/L]= OR 1.64 CI (1.20-2.25), p=0.002.

Conclusions: TSH <0.55 mIU/L is associated with Bell's Palsy.

Define Professional Practice Gap & Educational Need: The etiology of Bell's palsy is unknown. We hope to expand the knowledge regarding the etiology of Bell's palsy by looking for an association between thyroid hormone level and Bell's palsy.

Learning Objective: Explore the epidemiologic association between dysregulated thyroid hormone function and Bell's palsy.

Desired Result: Clinicians will consider examining thyroid hormone function for Bell's Palsy patients; thus increasing the possibility of early diagnosis of hyperthyroidism. In addition, balance dysregulated thyroid hormone function may improve bell's palsy prognosis, but further study is required.

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

Indicate IRB or IACUC: RRM-003-20. Approved.

The Efficacy of CT Angiography in Assessing Vascular Injury in Patients with Temporal Bone Fracture

Erin Harvey, MD; Eileen Peterson, BS; Mana Espahbodi, MD; Ahmed Beydoun, MD
David R. Friedland, MD, PhD; Jazzmyne A. Adams, MPH; Jake Luo, PhD

Objective: To determine the utility of computed tomography angiography (CTA) to assess vascular injury following temporal bone fracture.

Study Design: Retrospective cohort study.

Setting: Tertiary academic hospital.

Patients: Trauma patients with radiographic temporal bone fracture undergoing subsequent CTA head.

Interventions: Patients with temporal bone fracture were characterized with respect to demographics, mechanism of injury, otologic/neurologic morbidities, fracture location, and neurosurgical intervention. CTAs were evaluated for carotid involvement, intracranial hemorrhage, and other skull base fractures.

Main Outcome Measures: Pearson's regression analysis and one-way ANOVA to identify variables correlating with positive CTA (CTA+). Secondary analyses were performed for predictors of facial paralysis, CSF leak and hearing loss.

Results: Among 228 temporal bone fractures, 11.8% had subsequent CTA+. CTA+ findings were noted in 20% of those with carotid canal involvement. Patients with CTA+ were significantly younger (33.8±12.6 vs 43.7±17.7, $p=0.005$) and more likely to have otic capsule involving ($p=0.0002$), bilateral ($p=0.0008$), mixed-type temporal bone fractures ($p=0.004$). Motor vehicle collisions ($n=28$) were more commonly associated with CTA+ findings, while no blunt assault patient ($n=12$) had CTA+ ($p=0.04$). Cranial hemorrhage, need for neurosurgical intervention, expiration from injury, facial nerve paralysis, and extra-temporal skull base fractures did not correlate with CTA+. Facial paresis correlated with otic capsule involving fractures ($p=0.001$), initial GCS ($p<0.0001$), and concomitant hearing loss ($p<0.0001$).

Conclusions: Vascular injury on CTA following temporal bone fracture correlates with younger age, more extensive fracture patterns and higher speed mechanisms of injury. These factors may inform more judicious use of high-cost radiographic assessments.

***Professional Practice Gap & Educational Need:** CTA is commonly ordered following temporal bone fracture with concern for carotid involvement. There is lack of evidence as to factors likely to predict positive findings resulting in high-cost and low-yield healthcare delivery.

***Learning Objective:** To recognize the multifactorial nature of temporal bone injury with carotid canal involvement and correlation with CTA+.

***Desired Result:** For physicians to be more cost-effective by considering clinical and demographic factors prior to ordering CTA for temporal bone fracture**.**

***Level of Evidence -** IV

***Indicate IRB or IACUC :** IRB# 1538127

Impact of Demographics and Clinical Features on Initial Treatment Decision Making in Vestibular Schwannoma

Erin Harvey, MD; Katarina Stark, BS; David R. Friedland, MD, PhD
Jazzmyne A. Adams; Michael S. Harris, MD; Ling Tong MS; Jake Luo PhD

Objective: To identify demographic and clinical features impacting decision making for vestibular schwannoma treatment.

Study Design: Retrospective chart review.

Setting: Tertiary care academic medical center.

Patients: Patients diagnosed with vestibular schwannoma between 2009 and 2019

Interventions: Initial treatment decisions of 197 patients with vestibular schwannoma were analyzed with respect to socioeconomic factors, tumor size, hearing status, treating surgeon, and final treatment course. Multivariate logistic regression was used to develop a model for predicting treatment pathway.

Main Outcome Measures: Initial treatment pathway for vestibular schwannoma.

Results: Among 197 patients, 93 (47%) were initially treated with observation, 60 (30%) with Gamma Knife and 44 (22%) with surgical resection. Age univariately had no statistically significant impact on initial pathway but those undergoing surgery trended toward a younger demographic (49.1y (sur) vs 57.2y (obs) vs 59.0y (GK)). Males were more likely to elect observation than females ($p=0.04$). Patients opting for observation were more likely to have a lower Koos classification ($p<0.001$) and have better tumor-ear hearing ($p=0.03$). Only 34.4% of patients living outside the local geographic region elected observation compared with 53.0% living locally ($p=0.055$). Interestingly, surgeon correlated with initial treatment ($p=0.03$) but did not maintain significance when adjusting for hearing level or tumor size. A multiple linear regression model found age, maximum tumor diameter, and Koos class to predict initial treatment ($p<0.0001$, $r^2=0.42$).

Conclusions: Treatment pathway decision making for vestibular schwannoma is impacted by demographic factors such as age, sex, and geographic proximity to the medical center. Clinical features including hearing level and tumor size also impacted treatment decision making.

***Professional Practice Gap & Educational Need:** Various options are available for vestibular schwannoma treatment. It is unclear what demographic and clinical factors contribute to patient decision making among these options.

***Learning Objective:** To recognize the influence of sex, age, and proximity to the medical center in treatment pathway decision making; to recognize the impact of hearing level and tumor size on treatment pathway decisions.

***Desired Result:** For physicians to recognize and consider demographic factors, along with clinical features, in shared decision making with vestibular schwannoma patients.

***Level of Evidence -** IV

***Indicate IRB or IACUC :** IRB# 1538127

ANS 2022 POSTER H037

Presbycusis and Hearing Preservation in Observed Acoustic Neuromas

Julia R. Brennan, MD; Shreyas G. Krishnapurna, BS; Nathan R. Lindquist, MD
Nicole Kloosterman, BS; Nathan D. Cass, MD
David S. Haynes, MD; Kareem O. Tawfik, MD

Objective: We reviewed a cohort of patients with untreated sporadic AN and examined the relationship between high-frequency hearing loss (HFHL) in the non-AN ear and long-term hearing outcomes in the AN-affected ear. We hypothesized that progression of HFHL is associated with accelerated hearing decline in sporadic AN.

Study Design: Retrospective cohort study.

Setting: Tertiary center.

Patients: 109 patients with sporadic AN diagnosed from 1999-2015 with ≥5 years of observation (average 7.3yr). 64 had AAO-HNS Class A/B hearing at presentation and were included in analysis.

Interventions: Audiometry, observation of AN.

Main Outcome Measures: Four-frequency pure tone average (PTA) and word recognition scores (WRS) in the AN-affected ear. Decline in high-frequency PTA (HFPTA [average of thresholds at 4000, 6000, and 8000 Hz]) was defined as ≥10 dB over the study period. Decline in WRS was defined as ≥10%.

Results: Compared to those without, patients with progressive HFHL in the non-AN ear demonstrated a higher rate (84% vs 50%, p=0.0039) of decline in speech understanding in the AN ear. However, the same group showed no difference (64% vs 46%, p=0.1679) in decline in PTA of the AN ear.

Conclusions: Patients with observed AN who experience progressive HFHL in the non-AN ear are more likely to experience significant declines in speech understanding (but not PTA) in the AN-affected ear over time. This observation suggests that a personal or family history of presbycusis could increase the risk of loss of serviceable hearing in ears affected by sporadic AN.

***Professional Practice Gap & Educational Need:** The trajectory of neurosensory decline in acoustic neuromas remains unpredictable. This study provides increased data for clinical guidance and decision making in patients presenting with acoustic neuromas.

***Learning Objective:** For patients diagnosed with acoustic neuromas

1. Provide insight into the relationship between sensorineural hearing loss and hearing outcomes in the tumor ear for patients undergoing observation, and
2. Understand implications for counselling and clinical guidance on expected audiometric decline.

***Desired Result:** This study provides increased data surrounding underlying cochlear health as it relates to long-term outcomes in patients with observed acoustic neuromas.

***Level of Evidence -** Level IV

***Indicate IRB or IACUC :** IRB #110839

Frailty Predicts Increased Length of Hospital Stay after Middle Cranial Fossa Approach for Encephalocele or Cerebrospinal Fluid Leak

Steven D. Curry, MD, MPH; Jonathan L. Hatch, MD; Daniel L. Surdell, MD
Andrew P. Gard, MD; Geoffrey Casazza, MD

Objective: The modified 5-item frailty index (mFI-5) is a concise, comorbidity-based risk stratification tool that has been shown to predict adverse outcomes after surgery. The goal of this study was to understand the frailty of patients undergoing surgery for temporal encephalocele or cerebrospinal fluid (CSF) leak and the utility of mFI-5 for predicting increased post-operative outcomes.

Study Design: Retrospective cohort.

Setting: Single tertiary care academic medical center.

Patients: Adults with temporal encephalocele or CSF leak who underwent middle cranial fossa (MCF) approach craniotomies with or without mastoidectomy from January 2018 through August 2021 were included. Patients who underwent additional surgeries or extended surgical approaches were excluded.

Interventions: The mFI-5 was calculated for all patients. Demographic and clinical data were obtained from the medical record.

Main Outcome Measures: Length of hospital and ICU stay (LOS).

Results: 35 patients underwent 39 MCF approach craniotomies for temporal encephalocele or CSF leak, including 3 revision cases and 1 patient with sequential bilateral operations. Mean age was 53.8 ± 11.4 years, and 65.7% were female. There were 13 patients with a mFI-5 of 0 (34.3%), 9 with mFI-5 of 1 (25.7%), 11 with mFI-5 of 2 (31.4%), and 3 with mFI-5 of 3 (8.6%). In the regression analysis, mFI-5 was significantly associated with increased hospital LOS ($p=0.002$) but not increased ICU LOS ($p=0.06$). Multiple regression analysis of factors in the mFI-5 index showed that hypertension requiring medication ($p=0.04$) and history of pneumonia or COPD ($p=0.02$) were independently associated with increased hospital LOS. No comorbidity was associated with increased ICU LOS.

Conclusions: Increasing frailty is associated with increased length of hospital stay among patients undergoing MCF approach for treatment of temporal encephalocele or CSF leak.

Professional Practice Gap & Educational Need: Surgical treatment with craniotomy has a risk of complications that can be debilitating to patients and costly to the health care system. Understanding who is at greater risk for post-operative complications can provide an impetus for medical optimization and improve patient counseling.

Learning Objective: To understand the utility of mFI-5 in risk stratification of patients for increased length of stay and post-operative complications after MCF approach craniotomy for temporal encephalocele or CSF leak.

Desired Result: Better understanding of the role of frailty in patients undergoing surgery for temporal encephalocele or CSF leak.

Level of Evidence: Level IV

IRB: Approved, UNMC IRB #412-19-EX.

An Elusive Diagnosis: Delays in Treatment and Opportunities for Improvement in Temporal Encephalocele and CSF leak

Steven D. Curry, MD, MPH; Colin McCorkle, MD
Jonathan L. Hatch, MD; Geoffrey Casazza, MD

Objective: Symptoms of temporal encephalocele or cerebrospinal fluid (CSF) leak causing middle ear effusion or otorrhea can be non-specific and mistaken for other common diagnoses, leading to delays in diagnosis, failed treatments, and a risk of meningitis. This study sought to investigate the association between symptomatology and time to definitive surgical management.

Study Design: Retrospective cohort.

Setting: Single tertiary care academic medical center.

Patients: Adults treated for temporal encephalocele or CSF leak via a middle cranial fossa (MCF) approach. Revision cases were excluded.

Interventions: Chart review was performed to identify pertinent symptoms at presentation. Four patients who had symptoms for "several/many years" were coded as having symptoms for 3 years for quantitative analysis. Multivariable analysis was performed to identify the association between symptoms and time to surgical management.

Main Outcome Measures: Otologic and related symptoms present prior to MCF. Length of time between symptom onset and surgical treatment.

Results: 35 patients had symptoms present 23.6 ± 25.7 months (range: 1 month to 12 years) prior to surgery. The most common symptoms were subjective hearing loss in the affected ear (77%) and aural fullness (74.3%). Otorrhea was present in 57.1%, and 42.9% had a history of myringotomy with or without tube insertion. Meningitis occurred in 5 patients (14.3%). Only otalgia was statistically significantly associated with decreased time between symptoms onset and surgery ($p=0.03$).

Conclusions: Encephalocele and CSF leak were most commonly associated with aural fullness and hearing loss. Medical treatment for presumed Eustachian tube dysfunction or myringotomy and subsequent CSF otorrhea were commonly observed. Patients had symptoms for an average of about 2 years prior to surgical management.

Professional Practice Gap & Educational Need: Temporal encephalocele or middle ear effusion due to CSF leak can present with non-specific otologic symptoms including aural fullness and conductive hearing loss. This can result in a lengthy period of time before the correct diagnosis is made, and having CSF otorrhea puts the patient at risk of ascending infection and meningitis.

Learning Objective: To understand the presentation of temporal encephalocele of CSF leak and the need for consideration in the differential diagnosis of common otologic symptoms.

Desired Result: Increased recognition of encephalocele and CSF leak in the differential diagnosis of common symptoms including aural fullness, conductive hearing loss, and middle ear effusion, as well as appreciation of the need for improvement in diagnosis of these entities to avoid unnecessary treatment delays and added risks to patients.

Level of Evidence: Level IV

Indicate IRB or IACUC: Approved, UNMC IRB #412-19-EX.

ANS 2022 POSTER H040

Vitamin D Supplementation for Benign Paroxysmal Positional Vertigo: A Systematic Review

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David Schramm, MD, SM; Lisa Caulley, MD, MPH
Georgios Kontorinis, MD, MSc

Objective: Benign Paroxysmal Positional Vertigo (BPPV) is commonly attributed to displaced otoconia. These have been shown to have biomineralization close to that of bone, and Vitamin D deficiency has been associated with BPPV. We aim to systematically review the available literature on Vitamin D supplementation and BPPV intensity and recurrence in adults.

Data sources: PubMed, MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), Current Controlled Trials, and ClinicalTrials.gov

Study selection: We systematically reviewed the available literature from 1947 to April 2020. The study protocol was registered in the PROSPERO database (Trial Registration: CRD42020183195).

Data extraction: A total of 179 abstracts were identified and screened by two independent reviewers. Based on inclusion and exclusion criteria, six studies were selected and subjected to a quality assessment.

Data synthesis: In one randomized clinical trial (RCT), Vitamin D supplementation was found to reduce annual recurrence rate of vertigo in patient with BPPV and subnormal serum Vitamin D levels compared to placebo (odds ratio [OR] 0.69, 95% Confidence Interval [CI]: 0.54, 0.90). Non-randomized clinical trials demonstrated the possibility of a null effect in the random effects model (OR 0.08, CI [0.00, 1.56]). The RCT considered as low risk of bias. All of the non-randomized studies were assessed as serious risk of bias.

Conclusions: The intervention studies identified consistently demonstrated a decrease in BPPV recurrence with supplementation of Vitamin D in patients with subnormal Vitamin D levels. Although there is a paucity of high-quality studies, the present literature does highlight a role for optimization of Vitamin D levels in patients with BPPV.

***Professional Practice Gap & Educational Need:** It has been shown that serum Vitamin D levels are significantly lower in individuals with BPPV, and that Vitamin D deficiency is an independent risk factor for BPPV. Indeed, some small studies have shown that Vitamin D supplementation are associated with a reduction in the recurrence of BPPV. However, many fail achieve statistical significance to demonstrate causation, and very few clinicians routinely measure and supplement Vitamin D despite its potential benefits.

***Learning Objective:** 1) To appreciate the relationship between Vitamin D deficiency and BPPV; 2) To understand Vitamin D supplementation in reducing the recurrence of BPPV.

***Desired Result:** In reviewing the evidence demonstrating significant effect of Vitamin D therapy to reduce frequency of BPPV episodes and improve quality of life, clinicians may consider investigating for and treating Vitamin D deficiency in patients with BPPV.

***Level of Evidence –** Level II

***Indicate IRB or IACUC:** Exempt

Incidence and Management of Traumatic Facial Paralysis, an Administrative Database Study

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Objective: Report the incidence and treatment of facial nerve palsy after skull base fracture.

Study Design: Single-group cohort study

Setting: IBM MarketScan Commercial and Medicare Supplemental Databases (2006-2019)

Patients: Human subjects with skull base fracture, per International Classification of Diseases, 9th and 10th Revisions diagnosis codes.

Main Outcome Measures: Incidence and median time to facial nerve palsy diagnosis and treatment (corticosteroids, antivirals, botulinum toxin, facial nerve decompression, facial reanimation) within 30 days of skull base fracture; demographics; medical comorbidities; associated injuries (loss of consciousness, hearing loss, vertigo, tympanic membrane rupture, cerebrospinal fluid leak).

Results: The incidence of facial nerve palsy within 30 days of skull base trauma was 1.0% (738/72,273 patients). Facial nerve palsy was associated with significantly higher rates (proportion difference, 95% confidence interval) of hearing loss (26%, 22-29%), tympanic membrane rupture (5.4%, 0.8-3.6%), cerebrospinal fluid leak (6.4%, 4.5-8.3%), loss of consciousness (24.3%, 20.7-27.9%), and medical comorbidity (14%, 10.4-17.6%). The median time to diagnosis of facial nerve palsy was 6 days; only 22.9% (169 patients) were diagnosed within 1 day of skull base fracture. Patients with loss of consciousness or medical comorbidity had longer median time to facial nerve palsy diagnosis. Corticosteroids were the most common treatment, but only occurred in less than 1/3 of patients. Only 8 patients underwent facial nerve decompression within the first 21 days after injury.

Conclusions: Facial nerve palsy after skull base fracture is associated with higher comorbidity and the diagnosis is often delayed. Few patients were treated for traumatic facial nerve palsy and there are inconsistencies in the types and timing of treatments.

***Professional Practice Gap & Educational Need:** The two clinical factors governing management of facial nerve palsy in the setting of skull base trauma are: 1) timing and 2) severity of facial nerve palsy. Often the presence and severity of facial nerve palsy cannot be assessed due to other clinical factors, such as critically illness or altered consciousness. Evidence-based guidelines for management of facial nerve palsy after trauma are lacking.

***Learning Objective:**
1. To measure the 30-day incidence and median time to diagnosis of facial nerve palsy among patients with a diagnosis of skull base fracture.
2. To describe medical and surgical management of patients with traumatic facial nerve palsy.

***Desired Result:** Attendees will have a better understanding of the inconsistences in current practices regarding traumatic facial nerve palsy. This work will support efforts to create guidelines based on the best available evidence for management of traumatic facial nerve palsy.

***Level of Evidence –.** Level V, Case series, studies with no controls

***Indicate IRB or IACUC :** Exempt

Impact of Obesity on Postoperative Complications After Lateral Skull Base Tumor Resection: A Systematic Review

Kelly Bridgham, BS; Meryam Shikara, MD
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Objective: To determine the relationship between obesity and postoperative outcomes following lateral skull base tumor resection

Data Sources: PubMed, Embase, CINAHL, and Cochrane CENTRAL databases were searched using a comprehensive keyword strategy in accordance with PRISMA guidelines.

Study Selection: Included studies assessed the relationship between obesity and outcomes following lateral skull base tumor removal, including postoperative complications such as CSF leak, readmission and reoperation rates, and/or length of stay. Studies with ≤5 patients, duplicate patient populations, or insufficient data were excluded.

Data Extraction: Two independent investigators reviewed each study for inclusion. A third reviewer served as a tie-breaker for any conflicts. Extracted data includes patient demographics, tumor pathology, surgical approach, and postoperative outcomes including incidence of CSF leak and other postoperative complications, length of stay, and readmission and reoperation rates.

Data Synthesis: Studies were categorized based on outcome measurement (CSF leak, readmission rates, reoperation rates, and/or length of stay). Descriptive statistics were used for data analysis.

Conclusions: 15 studies met final inclusion criteria. Nine studies evaluated the relationship between obesity and CSF leaks. Four studies found a significant increase in post-operative CSF leak in obese patients compared to non-obese controls. The remaining studies trended towards an increased incidence of CSF leak in the obese population however did not reach statistical significance. One out of seven studies found that obesity increased post-operative length of stay, and one out of five studies found that obesity increased reoperation rates following tumor resection. Based on the results, obesity does not appear to increase length of stay, readmission, or reoperation rates after lateral skull base tumor resection. The relationship between obesity and post-operative CSF leak however warrants further analysis.

Define Professional Practice Gap & Educational Need: 1. Inconsistencies in the literature regarding the relationship between obesity and postoperative CSF leak after lateral skull base tumor removal. 2. Lack of knowledge with regards to how obesity affects postoperative outcomes, including length of stay, readmission, and reoperation.

Learning Objective: 1. To evaluate and synthesize the existing literature on the obese population and lateral skull base tumors 2. Describe the difference in outcomes after lateral skull base tumor resection based on obesity status

Desired Result: 1. Attendees will be able to discuss the role of obesity status in postoperative outcomes after lateral skull base tumor removal.

Level of Evidence: Level III

Indicate IRB or IACUC: Exempt

Proposal of a Scoring System for Discriminating Skull Base Osteomyelitis from Malignancies

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Objective: Skull base osteomyelitis (SBO) sometimes causes bone destructions and cranial nerve palsies, which is often misdiagnosed as malignancies such as nasopharyngeal cancer (NPC) and external auditory canal cancer (EACC) by CT/MRI. Since treatments for SBO and malignancies are different, histological evaluations are necessary for diagnosing both conditions. However, pre-treatment assessments on the differential diagnosis for SBO would be important for earlier starting the appropriate antibiotic therapies. Moreover, inappropriate specimen or false-negative biopsy in EACC-suspected patients that sometimes occurs in clinical settings would make confusion when diagnosing SBO. In this study, we proposed and validated a scoring system for discriminating SBO from NPC/EACC.

Study Design: Retrospective

Setting: University Hospital

Patients: Fourteen patients with SBO, twenty-five with NPC, and nineteen with EACC.

Main Outcome Measures: A scoring system (full score, 8 points) consisted of various characteristics which may be useful for diagnosing SBO was proposed. Eight scoring items included age (≥65), immunocompromised status, severe pain, otorrhea, cranial nerve palsy, C-reactive protein levels (≥1 mg/dL), petrous bone destruction, and no deformity of nasopharyngeal mucosal surface on CT.

Results: The average score for SBO (6.57) was significantly higher than that for NPC/EACC (2.55) ($p<0.01$). The area under the receiver operating characteristic curve was 0.99, showing very high accuracy. The cut-off value set at 5 points had the best combination of sensitivity (100%) and specificity (90.9%) to discriminate SBO from NPC/EACC.

Conclusions: The scoring system for discriminating SBO from NPC/EACC would be useful for an early starting the treatment for SBO.

***Professional Practice Gap & Educational Need:** Since it is difficult to distinguish SBO from malignancies, a scoring system that can be easily diagnosed is required.

***Learning Objective:** The readers can easily diagnose SBO from the scoring system.

***Desired Result:** The scoring system for screening SBO had high sensitivity and specificity.

***Level of Evidence -** Level V

***Indicate IRB or IACUC :** This study has been submitted to the Institutional Review Board of Niigata University Medical and Dental Hospital.

Use of a Novel Clinical Decision-Making Tool in Vestibular Schwannoma Treatment

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Shamim Nemati, PhD; Hamid R. Djalilian, MD; Rick A. Friedman, MD, PhD

Objective: To determine the utility of a personalized tool in the decision-making process for vestibular schwannoma (VS) patients.

Study Design: Proof-of-concept prospective study.

Setting: Academic skull base surgery program.

Patients: Patients with VS.

Interventions: A comprehensive clinical decision support (CDS) tool was constructed from retrospective patient-reported data obtained from patients within the Acoustic Neuroma Association from January to March 2017. Demographic, tumor characteristic, and treatment modality data, including associated side effects, were previously collected for 775 patients. These data were integrated in an interactive and personalized mobile tool.

Main Outcome Measures: A comparison of pre- and post-tool questionnaires assessing the process of deciding on treatment modality for VS using a Decisional Conflict Scale (DCS) and Satisfaction with Decision (SWD) scale was implemented.

Results: A pilot study of 3 patients with mean age 59.00 (±19.08) years and mean tumor size 7.00 mm have been analyzed. After using the tool, average confidence in decision improved from 81.33% (±8.08) to 84.67% (±5.03) confidence. Similarly, DCS score decreased from an average of 19.79 to 16.67 points (indicating decreased conflict). Post-tool decision satisfaction, indicated by SWD scale, demonstrated an average increase from 30 to 31. Notably, 100% of patients reported the tool added important information to previous consults and could facilitate better communication with their medical team. Additional data will be available for presentation at the meeting.

Conclusions: In this pilot study of 3 patients, all demonstrated an increase in confidence and decrease in conflict with decision-making following implementation of this personalized tool. Further data collection is ongoing and will be available at time of presentation.

Professional Practice Gap & Educational Need: Patient education and quality of life consideration is variable across VS patients and practitioners alike. Several studies have highlighted the role for improved communication through shared decision-making in this population. This study tests the utility of an informative, personalized, patient-facing tool as an adjunct in patient education regarding disadvantages and advantages of each treatment modality.

Learning Objective: To assess how sharing additional information regarding VS treatment through an interactive tool may improve patient autonomy and ability to participate in shared decision-making.

Desired Result: To provide evidence that individualized, interactive tools can improve patient education and communication. To determine what interventions strengthen the patient's role in shared decision-making. Further data is being actively collected to better understand the role of this interactive information when deciding on VS treatment.

Level of Evidence – Level II

IRB: UCSD IRB Project #180978XL; Approved on 9/14/2021

Cochlear Implantation in Patients with Known Cognitive Impairment: What are the Benefits?

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Objective: To evaluate the benefit of cochlear implantation (CI) in adults with preoperatively diagnosed cognitive impairment.

Study Design: Retrospective cohort study.

Setting: Tertiary-care academic center.

Patients: Adults undergoing CI with preexisting cognitive impairment.

Interventions: Cochlear implantation.

Main Outcome Measures: 1) Hearing improvement following CI; 2) Morbidity and mortality associated with surgery.

Results: Eight patients met inclusion criteria with mean age 77.8 years (SD 9.6 years) at time of implantation. Average preoperative MoCA cognitive score of 22.1 (SD 4.1, ≤25 demonstrates cognitive impairment). Average follow up was 26.8 months (SD 31.5 months). Two patients passed away at an average 58.0 months (SD 31.1 months) after surgery. Median preoperative pure tone average (PTA) was 88.9 dB HL (IQR 32.2 dB HL) compared to 33.8 dB HL (IQR 4.1 dB HL) postoperatively (p=0.012). Median preoperative speech testing score (AzBio/HINT) was 21% (IQR 24%) compared to 44% (IQR 21%) postoperatively (p=0.018). There were no observed surgical complications during the follow up period.

Conclusions: This study demonstrates that patients with cognitive impairment prior to CI can experience improved hearing, no increased risk of complications, and good longevity following CI. Further prospective studies are needed to further define the utility of CI in patients with impaired cognition.

***Professional Practice Gap & Educational Need:** We still do not know whether treating hearing loss will mitigate the risk of dementia, nor whether CI is beneficial to candidates with impaired cognition.

***Learning Objective:** To describe the benefits of CI in patients with preexisting cognitive impairment.

***Desired Result:** To provide guidance on the utility and benefits of CI in patients with known cognitive impairment.

***Level of Evidence -** V

***Indicate IRB or IACUC:** University of Utah IRB#00105049

Incidence of Surgical Complications and Postoperative CSF Leaks in Morbidly Obese Patients Undergoing Middle Cranial Fossa Approach for Spontaneous CSF Leak Repair

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Bruce J. Gantz, MD; Marlan R. Hansen, MD

Objective: Over the past few decades, spontaneous CSF (sCSF) leaks have increased in incidence, coinciding with a rise in obesity in the general population. We sought to determine the rate of surgical complications and postoperative CSF leaks in morbidly obese patients (BMI 40+) versus those with a BMI of 18.5-39.9 following MCF craniotomy for CSF leak repair.

Study Design: Retrospective chart review study.

Setting: Tertiary academic center.

Patients: All adults, n = 57 (21 patients with BMI 40+ vs. 36 patients with BMI 18.5-39.9), undergoing sCSF leak repair via a middle cranial fossa approach were evaluated.

Main Outcome Measures: Clinical records were reviewed for age, gender, BMI, comorbidities, complications at <30 days and between 30-60 days, and material used for CSF leak repair.

Results: 64 operative MCF repairs were performed for sCSF leaks on 57 patients (7 had bilateral CSF leaks). The average age was 60 years, and 45% were female. There were no postoperative complications in 78% (50 of 64) of cases. Twenty-two percent of adults with (BMI 18.5-39.9) and 21.7% of adults with (BMI 40+) had surgical complications. The percentage of postoperative CSF leaks in adults with (BMI 18.5-39.9) was 9.7% and 15% in adults with (BMI 40+). Differences in the rate of surgical complications and postoperative CSF leaks between both groups were not statistically significant (Chi-Square p-values = 0.6, 0.69, respectively).

Conclusions: Surgical complication rates and postoperative CSF leaks between undergoing MCF approach for sCSF leak repair were comparable.

Define Professional Practice Gap & Educational Need: There exists a strong correlation between obesity and spontaneous CSF leaks, as well as an increased incidence of CSF leaks in obese patients undergoing intracranial surgery. However, data evaluating the complication rate of MCF sCSF leak repair in the morbidly obese population (BMI 40+) is limited.

Learning Objective: To better understand the role of obesity in spontaneous CSF leaks, as well as its influence on rates of postoperative CSF leaks and surgical complications when undergoing intracranial surgery.

Desired Result: Given that obesity is suspected to play a role in an increased incidence of CSF leaks, we hope to clarify any CSF-related complications and adverse events associated with MCF procedures on morbidly obese patients.

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

Indicate IRB or IACUC : Exempt.

Management of the High Riding Jugular Bulb in Vestibular Schwannoma Surgery using 3-Dimensional Endoscopy and 3-Dimensional Computational Modeling

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Objective: We present a series of patients with a high riding jugular bulb (HRJB) who underwent vestibular schwannoma (VS) resection via retrosigmoid approach (RSA) assisted by 3-Dimensional (3D) computational modeling and 3D endoscopy and compare them to matched controls without a HRJB.

Study Design: Retrospective case-control series.

Setting: Academic center.

Patients: Five patients with VS and HRJB resected via RSA and matched controls without HRJB matched for tumor geometry and laterality.

Interventions: Tumor resection via RSA assisted by 3D endoscopy and 3D computational modeling using 3D Slicer.

Main Outcome Measures: Radiographic percentage of tumor resected, jugular bulb injury, cranial nerve deficits, craniotomy size.

Results: 3D modeling accurately rendered the HRJB in relation to the internal auditory canal (IAC) and coupled with 3D endoscopy provided depth perception for safe and complete resection at the fundus. Mean tumor resection was 99.1 ± 2.1%. Post-operative outcomes included facial paresis (2/5), vocal cord paresis (1/5), and no cases of iatrogenic breach or mobilization of the jugular bulb (0/5). Controls had similar completeness of tumor resection and craniotomy size.

Conclusions: The HRJB impedes visualization of the IAC fundus during RSA. Strategies include a large craniotomy for microscopic visual reach, a wide IAC drill out, or deliberate breach of the jugular bulb with downward transposition of the HRJB. However, these may be limited by inadequate surgical exposure, brisk bleeding, or increased risk of thrombus formation. We demonstrate thorough and safe resection of intracanalicular VS in the presence of a HRJB via RSA facilitated by 3D modeling and 3D endoscopy.

***Professional Practice Gap & Educational Need:** Vestibular schwannoma resection at the IAC via RSA is impeded by a high riding jugular bulb and current strategies in the literature are limited.

***Learning Objective:** Thorough and safe resection of intracanalicular vestibular schwannoma in the presence of a high riding jugular bulb via a retrosigmoid-suboccipital approach is facilitated by 3D endoscopy and 3D anatomic surgical modeling.

***Desired Result:** Thorough and safe vestibular schwannoma outcomes for all patients regardless of jugular bulb status.

***Level of Evidence -** IV

***Indicate IRB or IACUC:** Mass General Brigham IRB exempt: #2021P002699

ANS 2022 POSTER H048

ENoG Characteristics Demonstrate Subtle Neuronal Asynchrony in Patients with Vestibular Schwannoma

Mariel O. Watkins, MD; Renee M. Banakis, MD, AuD; Susan E. Ellsperman, MD
Steven A. Telian, MD; Paul R. Kileny, PhD

Objective: To evaluate preoperative facial electroneuronography (ENoG) for changes suggestive of neural asynchrony in patients with vestibular schwannoma (VS)

Study Design: Retrospective review

Setting: Academic tertiary referral center

Patients: 45 adults with a diagnosis of presumed VS underwent ENoG testing between January 2017 and 2020. Patients with Neurofibromatosis type 2 or non-VS causes of facial weakness were excluded.

Interventions: ENoG testing

Main Outcome Measures: ENoG response metrics (latency, duration, amplitude, half-peak width, area), post-operative facial function

Results: ENoG responses from the tumor versus non-tumor side demonstrated a significant increase in duration (2.42 vs. 2.22 ms; p 0.014), latency (5.72 vs. 5.58 ms; p 0.037), and half-peak width (1.09 vs. 0.98 ms; p 0.033). There was no significant difference in amplitude (1.34 vs 1.40 mV; p 0.165) or area (1.67 vs 1.41; p 0.0581). There was no significant relationship between tumor dimension and ENoG metrics. Correlation with intraoperative tumor findings and postoperative facial function will be reviewed.

Conclusions: There is subtle but significant evidence of neuronal asynchrony in preoperative ENoG for patients with VS. Correlation with intraoperative findings and postoperative facial function will be discussed.

***Professional Practice Gap & Educational Need:** The literature has yet to examine how changes in preoperative ENoG metrics may reveal subtle neuronal asynchrony even without significant differences between amplitude of the affected and non-affected sides.

***Learning Objectives:**
1. Identify ENoG characteristics that demonstrate subtle neuronal asynchrony.
2. Determine clinical utility of ENoG testing in characterizing neuronal asynchrony in patients with VS.

***Desired Result:** Attendees will recognize characteristic ENoG changes that indicate preoperative neuronal asynchrony of the facial nerve in patients with VS.

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

***Indicate IRB or IACUC:** Exempt 4/20/202, University of Michigan Protocol #HUM00195967

ANS 2022 POSTER H049

Surgical Outcomes for Resection of Medium to Large Vestibular Schwannomas: Retrosigmoid versus Translabyrinthine Approaches

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Pasha Mehranpour, BS; Jimmy Yu, BS; Marc Schwartz, MD
Rick A. Friedman, MD, PhD

Objective: To compare surgical outcomes between retrosigmoid (RS) or translabyrinthine (TL) approaches to resection of vestibular schwannomas (VS) greater than 2cm in those with serviceable hearing.

Study Design: Retrospective cohort study

Setting: Tertiary academic hospital

Patients: Patients with serviceable hearing (AAO Class A or B) undergoing RS (n=41) or TL (n=60) approach to resection of VS greater than 2cm.

Interventions: RS or TL approaches.

Main Outcome Measures: House-Brackmann (HB) score at discharge, cerebrospinal fluid (CSF) leak, extent of tumor resection, length of stay and adverse neurologic outcomes (hemorrhage, stroke, thrombosis, seizure, infection).

Results: At pre-operative baseline, the RS group had significantly ($p<0.05$) smaller mean tumor size (22mm) and higher rates of AAO Class A hearing (85%) compared to the TL group (28mm and 65%). There were no significant ($p>0.05$) differences in HB score at discharge (HB I/VI: RS: 85%; TL: 73%), CSF leak rate (RS: 4.9%; TL: 10%), length of stay (RS: 3.27 days; TL: 3.26 days) or adverse neurologic outcome (RS: 2.4%; TL: 1.7). between the approaches. Rates of gross total resection were significantly ($p=0.045$) higher in the RS group (85%) vs TL group (73%).

Conclusions: The RS and TL approaches to acoustic neuroma resection achieve similar surgical outcomes across several metrics. The smaller mean tumor size in the RS group may account for higher rates of HB I/VI facial function and gross total resection compared to the TL group. The RS approach to VS excision may provide a comparably safe and effective alternative to the TL approach for patients with serviceable hearing valuing hearing preservation with VS treatment.

***Professional Practice Gap & Educational Need:** This study compares surgical outcomes and overall safety of RS versus TL resection of medium to large tumors and provides evidence supporting the safe use of the RS approach for tumor resection comparable to the TL approach in those with serviceable hearing. This point is relevant for those patients with medium to large tumors wishing to pursue a microsurgical treatment of VS with the potential for preservation of residual acoustic hearing, as is afforded by the RS approach.

***Learning Objective:** To evaluate the differences in surgical outcomes between the RS and TL approaches to excision of medium to large VS.

***Desired Result:** Acquire adequate knowledge of differences and similarities in broad surgical outcomes between the RS and TL approaches to excision of medium to large VS in order to enhance patient counseling regarding treatment of VS.

***Level of Evidence –** Level IV

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