

SELECTED ABSTRACTS

**POSTER
PRESENTATIONS**



**152nd Annual Meeting
AMERICAN OTOLOGICAL SOCIETY**

**May 3-5, 2019
JW Marriott Austin
Austin, TX**

POSTERS WILL BE VIEWED ON FRIDAY & SATURDAY
ORAL PRESENTATIONS ARE SATURDAY & SUNDAY

Reducing Postoperative Call Volume through Verbal Preoperative Education

Alexander Chern, MD; Marc L. Bennett, MD

Objective: To improve patient satisfaction and understanding of what to expect after chronic ear surgery and reduce call volume to an otology clinic at an academic tertiary referral center

Study Design: Quality improvement initiative

Setting: A single academic tertiary referral center

Patients: One hundred and ten patients who underwent chronic ear surgery in March to May 2018

Intervention: Preoperative counseling over the phone 1 week prior to surgery

Main Outcome Measures: Patient call volume to the clinic within a 2-week postoperative window, patient understanding and satisfaction of perioperative course

Results: There was a significant increase in patient satisfaction (6.4% increase, 9.8 intervention vs. 8.9 no intervention, $p=0.0032$) and in patient understanding of what to expect after surgery (8% increase, 9.5 intervention vs. 8.9 no intervention, $p=0.0275$). There was a significant decrease in mean number of calls per patient to the clinic (57.5% decrease, 0.31 intervention vs. 0.72 no intervention, $p=0.0105$) and in percentage of patients who made any number of calls to the clinic (20% intervention vs. 46%, no intervention, $p=0.00438$). Intervention group had less variation in number of calls per patient (i.e., smaller variance, $VAR=0.47$) compared to the no intervention group ($VAR=0.87$).

Conclusions: Verbal preoperative counseling over the phone was effective in significantly reducing unnecessary call volume to the clinic and in improving patient satisfaction and overall understanding of what to expect after surgery.

Define Professional Practice Gap & Educational Need: Otolaryngologists receive an overwhelming number of phone calls. Any methods to reduce calls and achieve better outcomes are beneficial to all.

Learning Objective: Attendees will appreciate quality improvement strategies to attain patient satisfaction and understanding, as well as reduce clinic call volume.

Desired Result: Attendees will implement the discussed quality improvement strategies in their own practice to improve patient satisfaction and understanding, optimize clinical workflow, and ultimately facilitate quality patient care.

Level of Evidence: Does not apply - This study is a quality improvement initiative.

IRB: Exempt

Hearing Loss's Incidence and Impact on Employment in the United States

Kian Tehranchi BS; Anita Jeyakumar, MD, MS

Background: Research is limited on recent estimates of the incidence of hearing loss (HL) in the US and its impact upon wages and labor force participation. Such estimates are important for demonstrating the cost-effectiveness of interventions.

Objective: To determine the incidence of HL as well as differences in wages and labor force participation rates between individuals with and without HL.

Methods: Data reflecting 1% of the U.S population from the public use microdata sample (PUMS) of the 2011-2016 American Community Survey (ACS) was analyzed. Incidence rates were determined by calculating changes in the proportion of individuals with HL in sequential age groups year-to-year from 2011-2016. Average self-reported wages and labor force participation rates were compared between individuals with and without HL between 2012-2016.

Results: HL incidence rates were 13.4, 0.4, 3.8, 18.1, and 117.1 per 10,000 people among 0-2, 3-17, 18-44, 45-64, and 65+ year-olds, respectively. HL 18-44, 45-64 and 65+ year-olds participated in the labor force at 86%, 81%, and 61% of the rate of hearing individuals. HL 18-44, 45-64 and 65+ year-olds earned 78%, 73% and 72% of the wages earned by non-HL individuals.

Conclusions: Calculated HL incidence and labor force participation rates were higher than previously published in literature analyzing 1991 census data. The changes may be due to the methodology used in this study but may also reflect improvements in diagnosis, access to technology and the implementation of the Americans with Disabilities Act (ADA) of 1990.

Define Professional Practice Gap & Educational Need: Research is limited on recent estimates of the incidence of hearing loss in the US and its impact upon wages and labor force participation.

Learning Objective: Learners will have increased knowledge on recent estimates on the incidence of hearing loss and the impact of this hearing loss upon patient's income and participation in the labor force.

Desired Result: Attendees will be able to apply this knowledge on recent estimates of the incidence and economic impact of hearing loss in future research aimed at demonstrating the cost effectiveness of potential future interventions

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

IRB: Exempt

1. Virginia Tech Carilion School of Medicine
2. Akron Children's Hospital

Precurved Electrode Insertion Techniques Affect Final Electrode Position in Temporal Bones

*William G. Morrel, MD; Nauman F. Manzoor, MD; Ashley M. Nassiri, MD, MBA
Benoit M. Dawant, PhD; Jack H. Noble, PhD; Robert F. Labadie, MD, PhD*

Hypothesis: Alterations to the recommended insertion technique for precurved cochlear implant (CI) electrode arrays (EA) inserted using an external sheath (Cochlear 532) will affect final intracochlear electrode position.

Background: Little objective data exists regarding optimal insertion technique for precurved EAs.

Methods: Insertions were performed using various depths, sheath positions, and insertion trajectories to explore the range of impact on final EA position. Subsequently, a series of insertions was performed in three fresh, never frozen temporal bone specimens using (i) “standard” insertion to the base insertion depth, (ii) slight “over-insertion” and subsequent “pull-back” to the base insertion depth, and (iii) insertion to a specimen-customized, “optimal depth” predicted from preoperative imaging. CT scans were acquired with the external sheath inserted without an EA and for EAs inserted using techniques i, ii, and iii.

Results: Inducing tip fold-over was difficult and required positioning the tip of the sheath at the round window. One scalar translocation occurred and was successfully corrected by removal and reinsertion. The sheath constrained insertion to a trajectory coplanar with cochlea’s basal turn. Compared to (i) “standard” insertion, both (ii) “over-insertion with pull-back” and (iii) “optimal depth” reduced average distance between electrode contacts and the modiolar wall by 13.6% and 16.4%, respectively, with minimal change in angular insertion depth (+1.8% and -2.5%).

Conclusions: Better perimodiolar positioning is possible with slight over-insertion and pull-back of the electrode to an optimal depth calculated from preoperative imaging.

Define Professional Practice Gap & Educational Need: Lack of consistent insertion technique among practitioners; Lack of objective data regarding ideal insertion technique

Learning Objective: Identify techniques to improve precurved cochlear implant electrode positioning

Desired Result: Utilize ideal insertion technique for precurved cochlear implant electrode placement

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

IRB: Exempt

Outcomes of Primary Pediatric Stapedotomy

*Joshua C. Page, MD (primary); Victoria Gau, MD (presenter); Matthew Bridges, BA
Joshua Jervis-Bardy, MD, PhD; DeAnne King, MD, PhD
John L. Dornhoffer, MD*

Objective: To review a single surgeon experience with pediatric stapedotomy for juvenile otosclerosis (JO), congenital stapes fixation (CSF) and tympanosclerosis.

Study Design: Retrospective chart review.

Setting: Tertiary referral center.

Patients: 63 pediatric patients (4-20 years of age) undergoing 72 stapedotomies from 2001 to 2017.

Main Outcome Measures: Hearing result based on preoperative, first postoperative and best postoperative PTA-ABG. Age, sex, diagnosis, procedure performed, prosthesis, footplate graft and ossicular anomalies were considered.

Results: There were 63 kids (72 ears) who underwent stapedotomy with an average post-operative audiogram out to 2.78 years. Final post-operative air-bone gap for tympanosclerosis was significantly worse than for other indications (29.8 dB [\pm 10.8 dB]) ($p=.020$). Significant improvement was seen for congenital stapes fixation (CSF) (20.0 dB [\pm 11.5 dB]) and juvenile otosclerosis (JO) (22.8 dB [\pm 14.9 dB]).

Conclusion: Our data suggest, that in our clinic, stapedotomy is safe to perform in children. While we achieved desirable results for JO and CSF, patients with tympanosclerosis did not achieve a statistically better hearing outcome. Tympanosclerosis deserves special consideration and may be better served with a staged procedure or amplification in lieu of surgical intervention.

Define Professional Practice Gap & Educational Need: Inconsistencies in the management of pediatric stapes surgery from a technical standpoint; Disagreement regarding the management of tympanosclerosis causing stapes fixation

Learning Objective: To report our experience with pediatric stapedotomy done for congenital stapes fixation (CSF), juvenile otosclerosis (JO) and tympanosclerosis; To discuss our stapedotomy technique and management considerations; To discuss management strategies and algorithm for tympanosclerosis

Desired Result: Surgeons will better understand the nuances related to operating on pediatric CSF, JO and tympanosclerosis; Surgeons will reconsider the appropriate algorithm for managing tympanosclerosis

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB: Approved

**Surgical Intervention for Acute Mastoiditis:
10 Years' Experience of a Tertiary Children Hospital**

*Sagit Stern Shavit, MD; David Ulanovski, MD; Lirit Levi, MD
Meirav Sokolov, MD; Eyal Raveh, MD*

Objective: To evaluate the clinical course of children with acute mastoiditis (AM) who required surgical intervention.

Study Design: Historical cohort, case-control study.

Setting: The database of a tertiary children hospital was reviewed for children who underwent surgery for AM.

Main Outcome Measure: Course of disease and patients' characteristics were compared with non-operated mastoiditis.

Results: Between 2008-2017, 570 children were admitted with AM, 82 children (14%) underwent surgery and were compared with control of 167 non-operated children. Surgery included cortical mastoidectomy, 38% had also removal of bony plate over the epidural space for drainage. Operated children presented with prolonged fever, pre-admission diagnosis of AOM, discharge and sub-periosteal abscess. Their average temperature, WBC, neutrophil count and CRP were significantly higher (39.15vs37.9, 19.96Kvs16.5K, 67%vs55.8%, 17vs8.8, $p=0.0001$). The most common pathogens in the operated mastoiditis were Fusobacterium (50%), Gr.A streptococcus and H.influenza. CT scan was required in 98% compared with 2% in non-operated. Sub-periosteal abscess, sinus vein thrombosis and epidural abscess were diagnosed in 95%, 35% and 38%. Operated children were treated for average of 20 days compared with 5.6 days ($p=0.0001$). A significant increase in the total number of surgeries for mastoiditis and surgeries due to Fusobacterium was seen between the first and the second half of the cohort ($p=0.0083$, $p=0.0001$).

Conclusion: In children with AM presenting with sub-periosteal abscess, high fever, leukocytosis and high CRP levels, an early CT and surgical intervention is frequently required. Increase in complicated AM requiring surgery is attributed to an increase in Fusobacterium infection.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge exist regarding the need for surgical interference for acute mastoiditis.

Learning Objective: The aim of our study is to describe our practice of a large cohort of children with acute mastoiditis and to compare clinical course and patients characteristics between the children who required operation and the medically managed. Our second objective is to identify annual trends and patterns in the operated mastoiditis population.

Desired Result: Our results will improve physicians ability to identify severe cases that will require surgery as opposed to children that may benefit from conservative treatment only.

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

IRB: Approved

NO EDITS TO MISSPELLINGS

National 30-day Readmission and Hospitalization Patterns in Acute Mastoiditis

*Zachary G. Schwam, MD; Rocco Ferrandino, MD; Vivian Z. Kaul, MD
Maura K. Cosetti, MD; George B. Wanna, MD*

Objectives: To determine the risk factors for unanticipated readmission and prolonged index admission after hospitalization for acute mastoiditis.

Study design: Retrospective cohort study.

Setting: National database.

Patients: Patients with a primary diagnosis of acute mastoiditis (International Classification of Disease-9th edition codes 383.00, 383.01, 383.02) were identified in the Nationwide Readmissions Database (2013-2014).

Interventions: None.

Main outcome measures: readmission rate, length of stay.

Results: There were 4,295 cases identified; 31.9% were patients <18 years. The 30-day readmission rate was 17.0%, and 7.9% of patients had a prolonged length of stay (LOS) of >8 days. On index admission, 26.5% underwent myringotomy and 21.7% underwent mastoidectomy or petrous apicotomy. Primary readmission diagnosis was mastoiditis in 16.0% of cases. Independent risk factors for readmission included Charlson score of 1 (odds ratio [OR] 1.91, p<.001) and living out of state (OR 3.74, p<.001), while undergoing mastoidectomy was associated with lower readmission rates (OR 0.13, p<.001). Factors independently associated with prolonged LOS in multivariate models included mastoidectomy (OR 2.46, p<.001) and disposition to a facility (OR 3.08), while private insurance (OR 0.44, p=.004) was associated with shorter LOS.

Conclusions: While readmission and prolonged LOS are rather common in the sampled cases of acute mastoiditis, few were documented as having undergone surgical intervention for this disease. Patient comorbidities and demographic variables are independently associated with both unintended readmission and prolonged length of stay.

Define Professional Practice Gap & Educational Need:

1. Lack of awareness of national treatment trends for mastoiditis.
2. Lack of awareness in independent risk factors for readmission following hospitalization for mastoiditis.
3. Lack of awareness in independent risk factors for prolonged hospitalization for mastoiditis.

Learning Objective:

1. To describe national treatment patterns for mastoiditis as found in a large national dataset.
2. To identify independent risk factors for unintended readmission and prolonged length of stay in patients with acute mastoiditis.

Desired Result: Attendees will use the independent risk factors identified in our dataset to inform the hospitalizations of their own patients; they will correlate the identified risk factors with their own patients' hospital courses and possibly attempt to target interventionable ones.

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

IRB: Exempt

T-tubes Through Cartilage Tympanoplasty: Is it Worth the Perforation Risk?

*Joshua Cody Page, MD (primary); Anna Celeste Gibson, BS (presenter)
Joshua Jervis-Bardy, MD, PhD; John L. Dornhoffer, MD*

Objective: To review a single surgeon experience with utilizing a T-tube placed through cartilage tympanoplasty for long-term ventilation of the chronic ear with regard to feasibility and risk for perforation

Study Design: Retrospective chart review.

Setting: Tertiary referral center.

Patients: 100 patients (4-71 years of age) who underwent either total island cartilage or posterior palisade cartilage tympanoplasties with T-tube placement from 1998 to 2016.

Main Outcome Measures: Long-term outcome of each T-tube was recorded with respect to retention rate and tympanic membrane status following either tube removal or extrusion. Audiometric data, age, sex, diagnosis and procedure performed were also recorded.

Results: There were 100 patients included: 50 who underwent total island cartilage tympanoplasty with tube placed through cartilage and 50 with only a posterior island graft with tube through native tympanic membrane, as a comparison. Sixty-eight T-tubes were placed in the total island group with 4 (5.9%) residual perforations following removal. Sixty-nine T-tubes were placed in the posterior graft group with 6 residual perforations (8.7%).

Conclusion: Our data suggest, that in our clinic, T-tube placement through cartilage tympanoplasty is worthwhile to provide long-term ventilation to the middle ear and portends no higher risk for residual perforation than tubes placed through native tympanic membrane.

Define Professional Practice Gap & Educational Need: Lack of knowledge on the long-term result following t-tube removal in setting of cartilage tympanoplasty

Learning Objective: We sought to determine if t-tube use through cartilage tympanoplasty increased the risk of perforation versus t-tube through native TM in similar ears.

Desired Result: We hope to show our experience that t-tube use through cartilage tympanoplasty can be valuable for long-term ventilation in the chronic ear without increased risk for residual perforation following removal.

Level of Evidence - LEVEL V - Case series, studies with no controls

IRB: Approved

Round Window and Facial Recess Packing Alter Cochlear Implant Electrode Distance to the Modiolus in the Basal Turn using a Cadaveric Model

*Matthew M. Dedmon, MD, PhD; Robert J. Yawn, MD
Brendan P. O'Connell, MD; Yiyuan Zhao, PhD
Robert T. Dwyer, AuD; Alejandro Rivas, MD*

Hypothesis: Packing of the round window and facial recess during cochlear implantation may alter intracochlear electrode position with respect to the modiolus.

Background: Electrode position inside the cochlea has significant consequences for implant performance. While many surgical aspects affecting electrode position have been studied, little is known about the effects of extracochlear packing on intracochlear electrode position.

Methods: One attending cochlear implant surgeon performed electrode round window insertions using 5 human cadaveric temporal bones. Two perimodiolar electrodes (Cochlear[®] Slim Modiolar 532[™] (CI532) and Advanced Bionics[®] HiFocus[™] Mid-Scala (MS)) and one lateral wall electrode (Cochlear[®] Slim Straight 522[™] (CI522)) were used. Cadaveric muscle was used to pack the round window and facial recess for each insertion under the following conditions: 1) inferior to the electrode, 2) superior, and 3) both inferior and superior. Pre- and post-insertion computed tomography scans were analyzed with image processing software to compute distances between electrode contacts and the modiolus.

Results: Packing superior to CI532 resulted in decreased distances from the modiolus in the basal turn compared to inferior packing ($0.39\pm 0.09\text{mm}$ vs. $0.63\pm 0.16\text{mm}$, respectively, $p<0.001$). A similar effect was seen for CI522 when comparing superior ($0.69\pm 0.53\text{mm}$) vs. inferior ($0.95\pm 0.38\text{mm}$) packing ($p=0.04$). No statistical differences were observed for MS, or for any electrode in the mid/apical turns.

Conclusions: Round window and facial recess packing alter electrode distance to the modiolus in the basal turn using a cadaveric model. The effect was most pronounced with CI532, and appears to be device-dependent.

Define Professional Practice Gap & Educational Need: Lack of knowledge of the effects of round window and facial recess packing on the intracochlear position of cochlear implant electrodes.

Learning Objective: Demonstrate that round window and facial recess packing can change the proximity of a cochlear implant electrode to the modiolus in a cadaveric temporal bone model.

Desired Result: Understand that extracochlear packing may alter cochlear implant electrode location in the basal turn region of the cochlea.

Level of evidence does not apply because: anatomic study

IRB: Exempt

Distinct Temporal Bone Dissection Scales Demonstrate Equivalence in Distinguishing Trainee Performance

*Shubhi Singh MD; Justyn Pisa AuD
Bertrum Unger MD; Jordan Hochman MD*

Hypothesis: Different temporal bone dissection scales will independently distinguish resident surgeon performance by graduate year with each illustrating strong inter and intra rater reliability.

Background: Increasing emphasis on patient safety creates the need for quality assessment of fundamental surgical skills. Existing summative temporal bone rating scales are laborious and contain fundamental inconsistencies and redundancies. Evaluator fatigue is a concern.

Two new scales are compared to evaluate their construct validity prior to implementation in training.

Methods: Resident surgeons attending a National Otolaryngology Conference completed a mastoidectomy with posterior tympanotomy on identical 3D printed temporal bone models. Four blinded Neurotologists evaluated the drilled specimens using the CanadaWest (CW) and Iowa Temporal Bone Assessment Tool (ITBAT), with scoring repeated after a six week interval.

Results: Nineteen residents from nine postgraduate programs participated. Assessment was clustered into junior (Post Graduate Year or PGY 1, 2), intermediate (PGY 3) and senior resident (PGY 4, 5) cohorts. ANOVA analysis found significant differences between cohort performance ($p < 0.05$) for both scales in consideration of PGY and subjective account of temporal bone surgical experience. Cohen's Kappa found strong inter-rater reliability with scores of 0.790 (ITBAT) and 0.858 (CW) respectively. The ITBAT illustrated a marginal intra rater score of 0.289, compared to [0.711] for the CW scale. The CW had a significantly lower average time to completion of 42.7 (+/- 16.8) seconds compared to 105.6 (+/- 38.9) seconds ($p = 0.005$).

Conclusion: Both the ITBAT and CW Scales demonstrate construct validity and consistency in performance and consideration should be given to judicious use in training.

Define Professional Practice Gap & Educational Need: The literature supporting the employment of scales in surgical trainee evaluation is deficient. A more comprehensive evaluation of these instruments is required before use in competency-based education or the accreditation process.

Learning Objective: At this end of this presentation, attendees will appreciate the need for and the process in the genesis of a summative temporal bone grading schema. At the end of this presentation, attendees will become familiar with several of the different temporal bone dissection scales that have supporting literature and gain an appreciation of possible strengths and concerns.

Desired Result: The attendee will be presented with viable grading scales for temporal bone drilling which can be applied to resident physician training. The evidence presented will help the attendee decipher the best scale for their trainees based on consistency of assessment and duration to completion of scale.

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

IRB: Exempt

**Density of Macrophage Immunostained with Anti Iba1+ antibody
in the Vestibular Endorgans after Cochlear Implantation in the Human**

Tadao Okayasu, MD, PhD; Jennifer T. O'Malley, BA; Joseph B. Nadol, Jr., MD

Hypothesis: Cochlear implantation may result in an increase in the density of macrophage in vestibular endorgans in the human.

Background: Vestibular symptoms are a common complication of cochlear implantation. In a previous study we demonstrated histological evidence of a foreign body response caused by silicon and platinum in the human following cochlear implantation. The objective of the current study was to seek evidence of a possible immune response in vestibular neuroepithelium after cochlear implantation.

Methods: The density of macrophages immunostained with anti-Iba1⁺ antibody in the vestibular endorgans (lateral and posterior semicircular canal, utricle and saccule) in ten human subjects who had undergone unilateral cochlear implantation was studied by light microscopy. The densities of macrophages in the neuroepithelium, subepithelial stroma, and dendrites process in the substromal area in four vestibular endorgans in implanted and unimplanted ears were compared. The distributions of phenotypes of macrophages (amoeboid, ramified and transitional) were also compared.

Results: The densities of macrophage in implanted ears in four endorgans were significantly greater than that in unimplanted ears except in subepithelial stroma of the utricle and posterior semicircular canal. In contrast in the neuroepithelium, the stromal distribution of amoeboid macrophages in unimplanted ears was significantly greater than in implanted ears.

Conclusion: Increase in the density of macrophages at four vestibular endorgans after implantation was demonstrated in human. The transition among phenotype of macrophages suggested possible migration of amoeboid macrophages from the subepithelial stroma into the neuroepithelium.

Define Professional Practice Gap & Educational Need: Hypothesis: Cochlear implantation may result in an increase in the density of macrophage in vestibular endorgans in the human.

Learning Objective: The objective of the current study was to seek evidence of a possible immune response in vestibular neuroepithelium after cochlear implantation.

Desired Result: Increase in the density of macrophages at four vestibular endorgans after implantation was demonstrated in human.

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

IRB: Approved

Hearing Preservation with the Use of Flex20 and Flex24 Electrodes in Patients with Partial Deafness

*Piotr H. Skarzynski, PhD, MD, MS; Henryk Skarzynski, PhD, MD
Beata Dziendziel MS; Joanna J. Rajchel BS
Elzbieta Gos PhD; Artur Lorens, PhD*

Objective: To evaluate the impact of electrode length on hearing preservation (HP) in Partial Deafness Treatment Electrical Complement (PDT-EC) subjects.

Study design: Retrospective case review.

Setting: Tertiary referral center.

Patients: The main eligibility criteria were: patient's age ≥ 18 years, preoperative hearing thresholds qualifying PDT-EC subjects and insufficient benefits with conventional hearing aids.

Interventions: All participants were subjected to minimally invasive cochlear implantation using the round window approach with the simultaneous administration of intravenous steroids. The patients were divided into two groups: one has received Flex20 electrode (16 patients) and the second group received the Flex24 electrode (15 patients).

Main Outcome Measure(s): Pure tone audiometry (125-8000 Hz) was performed preoperatively and at 1, 6, 12 and 24 months postoperatively. Hearing preservation (HP) was established using the HEARRING group formula (2013). Speech understanding was assessed preoperatively and at 12 and 24 months postoperatively.

Results: Mixed-design ANOVA with contrasts showed that long-term results in pure tone audiometry were similar for Flex20 and Flex24, although mean hearing thresholds were better for Flex20 in 500 Hz at 1 and 6 months follow-up than for Flex24. At least minimal HP was found in all Flex24 subjects and in 87.5% of Flex20 subjects. Postoperative speech understanding was significantly better after the operation and similar for both groups.

Conclusions: An excellent HP can be observed in PDT-EC patients while using the short flexible MED-EL electrodes. The length of the electrodes (Flex20 vs Flex24) does not affect the degree of HP in the long-term observation.

Define Professional Practice Gap & Educational Need: Although it is currently reported that the length of the electrode affects the hearing preservation, the methodological discrepancies of the studies published so far cause difficulties in drawing the final conclusions. There is lack of studies on hearing preservation with particular electrode types in specific groups of patients with partial deafness, using a well-established hearing preservation classification system.

Learning Objective: To evaluate the impact of electrode length on hearing preservation in homogenous group of patients with partial deafness, testing what electrode length can provide better hearing preservation.

Desired Result: Obtaining further arguments on what length of electrode can bring the best benefits to a demanding group of patients with normal hearing up to 1500 Hz.

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

IRB: Approved

Can Unaided Audiologic Testing Be Used as a Surrogate to Determine Cochlear Implant Candidacy?

Stephany J. Ngombu, BA; Aaron C. Moberly, MD

Objectives: The process to evaluate a patient for cochlear implant (CI) candidacy is time- and resource-consuming. Furthermore, without standardized criteria for whom to refer for CI candidacy evaluation, individuals who should receive testing are often overlooked. Our primary objective was to determine whether unaided pure tone audiograms and word recognition scores from adult patients with moderate-to-profound hearing loss would predict CI candidacy in the best-aided conditions during CI evaluation. Secondly, we sought to determine if older patient age would impact the relationship between preoperative unaided testing and CI candidacy in aided conditions.

Study Design: Retrospective series review

Setting: Tertiary care outpatient clinic

Patients: Medical charts of 800 adult patients referred for CI evaluation from July 1989 through June 2017 were reviewed. Patients were excluded for history of neurofibromatosis type 2 or known cognitive impairment.

Interventions: Diagnostic testing to determine CI candidacy

Main outcome measure(s): Unaided audiologic pure tone averages and word recognition scores were examined as predictors of CI candidacy in best-aided conditions.

Results: Preliminary logistic regression analyses demonstrate that unaided word recognition score in either ear significantly predicts whether a patient is or is not a CI candidate. Additional analyses will be performed to examine the effects of age on this relationship.

Conclusions: Unaided word recognition can predict CI candidacy in adults. Findings suggest that the CI evaluation process might be streamlined to focus on unaided audiologic findings to determine candidacy.

Define Professional Practice Gap & Educational Need: 1. Lack of contemporary knowledge regarding unaided audiological findings that predict cochlear implant candidacy.

Learning Objective: To recognize unaided audiological findings that predict a patient's cochlear implant candidacy under best-aided listening conditions.

Desired Result: Attendees will be better able to recognize patients in their practice who may benefit from cochlear implantation.

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

IRB: Approved

Potential Confounding Factors May Bias the Association between Configurations of the Vertebrobasilar Artery System and the Incidence of Idiopathic Sudden Sensorineural Hearing Loss and Canal Paresis

*Ayako Maruyama, MD; Yoshiyuki Kawashima, MD, PhD; Taro Fujikawa, MD, PhD
Taku Ito, MD, PhD; Takamori Takeda, MD; Takeshi Tsutsumi, MD, PhD*

Objective: To investigate the impact of configurations of the vertebrobasilar artery system on the incidence of idiopathic sudden sensorineural hearing loss (ISSNHL) and canal paresis (CP).

Study Design: Retrospective case review.

Setting: Tertiary referral center.

Patients: One hundred and fifty consecutive patients diagnosed with ISSNHL and 111 patients with unilateral CP of uncertain cause between January 2011 and December 2015. The unaffected side of 123 patients with Bell's palsy or acoustic tumor served as control.

Interventions: All patients underwent magnetic resonance cisternography. CP was diagnosed with caloric testing.

Main Outcome Measures: 1) Branching patterns of the anterior/posterior inferior cerebellar artery (AICA/PICA) in the cerebellopontine angle area. 2) The direction and degree of the basilar artery (BA) curvature. 3) Vertebral artery (VA) dominance.

Results: The incidence of vascular loops of the AICA/PICA entering the internal acoustic canal and tortuous BA was significantly higher in patients with ISSNHL and CP on both the affected and healthy sides than in controls ($p < 0.05$). The incidence of asymmetric VA was significantly higher in CP patients than in controls ($p = 0.0033$), while no significant difference in the incidence was observed between ISSNHL patients and controls ($p = 0.2363$). Remarkably, we found no correlation in the laterality between the affected ear and any configurations of arteries ($p > 0.05$).

Conclusions: Our results indicate that vascular configurations of the vertebrobasilar system do not directly cause ISSNHL and CP. Instead, they suggest the presence of confounding factors that influence the vascular configurations and the development of ISSNHL and CP.

Define Professional Practice Gap & Educational Need: The etiology of SSNHL remains unclear. Among the proposed etiologies, one of the most compelling theories is vascular impairment. Several researchers have recently proposed the hypothesis that the presence of irregular vertebrobasilar artery and its branches increase the risk of SSNHL; however, whether or not the irregular vessels themselves can trigger SSNHL is unclear.

Learning Objective: The learning objective of this study is to confirm the recently proposed hypothesis regarding the etiology of SSNHL and clarify the impact of vascular configurations of the vertebrobasilar system on the development of ISSNHL and unexplained CP.

Desired Result: (How will attendees APPLY the knowledge they learned from the presentation): Attendees will better understand the clinical importance of performing magnetic resonance cisternography in patients with SSNHL and unexplained CP. The incidence of vascular loops of the AICA/PICA entering the internal acoustic canal and tortuous BA may suggest the presence of confounding factors, such as arterial sclerosis.

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

IRB: Approved

Comparison of HF Mid-scala and Helix CI Electrode Performance

Arne Ernst, MD, PhD; Rolf Battmer, PhD

Different types of cochlear implant electrodes have been developed to improve speech understanding and to provide a better performance of the cochlea-neural interface. It is therefore the aim of the present study to compare the performance of the HF mid-scala electrode (MS) and the Helix (HX) electrode (both from Advanced Bionics, Valencia, CA) which have different intracochlear positions.

In our prospective, non-randomized series, 51 patients (28 female, 23 male, average age 62 yr at implantation) with similar duration of deafness were included. The MS group (n = 29) and the HX group (n = 22) were age- and gender matched and compared with respect to the most comfortable listening levels (M), impedances, monosyllables in quiet (Freiburger test) and a sentence test (OLSA) in adaptive noise at 3, 6 and 12 months. Group medians were compared using the Mann-Whitney U test ($p \leq 0.05$) and a general linear model (GLM) and univariate analysis were conducted to assess multifactorial interaction on main outcome which were monosyllables and speech-in-noise data for the 6 and 12-months' follow-up.

Median scores for the monosyllables in quiet for the MS group were significantly better than the HX group at each test interval ($p \leq 0.05$). Speech perception in quiet also significantly improved from 3 to 12 months for both groups ($p \leq 0.01$). There was no significant difference between the groups for speech in noise. Impedances were significantly lower for the MS group at 12 months ($p \leq 0.05$) except at the basal end and M levels were generally higher.

The MS group has better median performance for monosyllables in quiet than the HX group at each test interval although performance in noise was similar. For speech-in-noise, the MS group appeared to reach optimum performance quicker than the HX group. Impedance were lower in the MS group, other than at the most basal end and confirm the hypothesis that the MS as an array aimed at neither touching the modiulus nor the lateral wall when being placed in scala tympani has a more lateral position than the HX which contributed to this different performance.

Define Professional Practice Gap & Educational Need: Cochlear implant Technology has been improved over time largely by modifying electrode size/shape with the aim of atraumaticity in Insertion and, thus, preserving residual Hearing. This series is aimed at comparing two different electrodes of one manufacturer with respect to performance over a 12-months' period.

Learning Objective: The learning objective of this study to produce awareness among the surgeons that Performance data differ significantly between These two electrodes, even if personal attitudes lead to some preferences because of the handling.

Desired Result: The results of this study support that the mid scala electrode gives better audiological results in a 12-months' period than the Helix one.

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

IRB: Approved

Evaluation of a Wireless CROS Device with the NAIDA Q90 Speech Processor

Arne Ernst, MD, PhD; Rolf Battmer, PhD

It is the aim of the present study to investigate hearing aid technology feature and their impact in uni/bilateral CI and bimodal device users.

In our prospective, non-randomized series, 30 patients (16 female, 14 male, average age 49 yr) were investigated at baseline and 1 / 3 months after re-fitting. Ten patients each (3 groups) were recruited: unilateral CI users (A), bilateral CI users (B) and bimodal CI users with one CI and a contralateral hearing aid (C). At baseline, their performance with a conventional T mic was measured with a sentence test (OLSA) in noise and localization was tested (ONE - SO/N60/120/180) or (TWO -S0/N30/60/180). After refitting with UltraZoom (A), they were re-tested. Group B was given Ultra & StereoZoom mics and group C was fitted with a contralateral Phonak Naida Link hearing aid (HA) and loudness balancing. Controls were normal hearing subjects.

There was a significant advantage for Ultra/StereoZoom for all groups. The largest advantage (StereoZoom) was in group (B) and a significant advantage for StereoZoom over UltraZoom in group C ($p \leq 0.001$). Group B performed as well as controls in both lateralization setups and group C as well as in setup ONE. There was a significant benefit of 1.8 dB (sentence test) for ClearVoice over UltraZoom in group (A).

Ultra/StereoZoom microphone technology at the speech processor level provided a clinically and statistically significant benefit over the T mic and helps to improve CI performance significantly, particularly in those specific patient populations.

Define Professional Practice Gap & Educational Need: Cochlears implants were deeply influenced by modern hearing technology features (zoom/directional microphones, acoustic Input Streaming) from the hearing aid Industry. This is of great importance for patients with bimodal, unilateral, but to some extent also for bilateral CI users, particularly in noise and for spatial hearing. The impact of those Features should be systematically investigated to better counsel our patients and to better understand the Ratio of this approach.

Learning Objective: The learning objective of this study is to better understand that modern hearing aid features as combined or incorporated into CI technology can offer our patients an additional Benefit which leads to a hearing performance that comes close to normal Hearing controls.

Desired Result: The results of this study support the hypothesis that state-of-the-art hearing Technologies improve the Performance of CIs.

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

IRB: Exempt

Use of Google Trends to Evaluate for Geographical or Seasonal Variation in Search Terms for Benign Paroxysmal Positional Vertigo

*Josh R. Sen, BA; Alex J.F. Tampio, MD; Shaelyn M. Cavanaugh, MPH
Brian D. Nicholas, MD*

Objective(s): Google Trends is an increasingly used tool in the healthcare field, but its use in the field of otolaryngology has been limited to date. To assess its viability as a research tool, we examined search frequencies for terms related to benign paroxysmal positional vertigo (BPPV). By comparing frequencies between cities at different latitudes and throughout seasons, we assessed if suspected associations are reflected in online data.

Study Design: Retrospective database analysis.

Methods: Google Trends search frequency data from 5 U.S. cities for terms related to BPPV were obtained and compared. In addition, monthly averages were compared to detect seasonal variation. Data was analyzed in SPSS through ANOVA analysis.

Results: Latitude affected the search frequency for terms related to BPPV – averages between cities were almost always statistically different. However, there was not always a consistent trend with change in latitude. Comparison of monthly averages showed that individual search terms appear to demonstrate seasonal fluctuations.

Conclusion(s): BPPV related search term frequencies demonstrate differences among varying latitudes, but not always in a consistent trend. This may be reflective of previously published data suggesting that sunlight exposure and vitamin D levels may play a role in the pathogenesis of BPPV. There were seasonal variations among search terms for BPPV. This may suggest that Google Trends or other big data tools may be beneficial when comparing search frequencies in a categorical manner as a proxy for relative disease incidence.

Define Professional Practice Gap & Educational Need: Knowledge of Google Trends applicability and viability within the field of otolaryngology is limited.

Learning Objective: We will explore the benefits and limitations of Google Trends as a research tool within the field of otolaryngology.

Desired Result: Increasing physician awareness of Google Trends as a research tool specifically for the field of otolaryngology.

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - Exempt

Utility of the EAONO/JOS Staging System to Predict Cholesteatoma Recidivism after Canal-Wall-Up Tympanomastoidectomy

Simon I. Angeli, MD; David Shahal, MD; Bjorn Herman, MD

Objective: Evaluate the utility of the classification and staging system for acquired cholesteatoma proposed jointly by the European Academy of Otolaryngology and Neuro-otology and the Japan Otological Society (EAONO/JOS) to predict recurrent or residual disease.

Study design: Retrospective cohort.

Setting: Tertiary referral center.

Patients: Adults and children with acquired cholesteatoma.

Interventions: Primary and planned-second look tympanomastoidectomy.

Main outcome measure: Occurrence of recurrent and/or residual cholesteatoma during planned second-look tympanomastoidectomy. The independent variables were age, gender, size of canal defect, mucosa status, and cholesteatoma classification (pars flaccida and/or tensa), stage (I-IV), and site involvement (STAM: S1 supratubal recess, S2 sinus tympani, T tympanic cavity, A attic, M mastoid).

Results: There were 12 (9.6%) cases of cholesteatoma recidivism: recurrent cholesteatoma in five cases, residual cholesteatoma in six cases, and one additional patient with both recurrent and residual disease. Residual cholesteatoma was noted more frequently in children than in adults (Fisher's exact test, 2-tail, $p=0.041$, $RR=7.89$ [95% CI 0.98, 63.6]). Supratubal recess (S1) disease was associated with recurrent cholesteatoma ($p=0.0384$, RR of 5.944 [95% CI: 1.299, 27.191]) as well as with recidivism ($p=0.014$, RR 4.24 [95%CI: 1.511, 11.933]). Among other staging and clinical factors, only the presence of a large canal defects showed an association with residual disease.

Conclusion: Young age and large ear canal defects were associated with residual disease and S1 disease was associated with recurrence. While the EAONO/JOS classification and staging system for cholesteatoma facilitates description of the type and extent of disease, its prognostic value is still not proven.

Define Professional Practice Gap & Educational Need: There is lack of a universally accepted staging system for acquired cholesteatoma that provides prognostic and outcome information

Learning Objective: After completing this activity, participants will learn the new staging system for acquired cholesteatoma proposed jointly by the European Academy of Otolaryngology and Neuro-otology and the Japan Otological Society (EAONO/JOS), and its value to predict recurrent or residual disease after canal-wall-up tympanomastoidectomy

Desired Result: Attendees will learn to apply a newly proposed staging system to describe the extent of cholesteatoma involvement and obtain an understanding of its use in prognosis

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

IRB - Approved

A Protocol for Intra-operative Imaging of Cochlear Implantation

Stephanie J. Wong, MD; Alexis M. Strohl, MD; Benjamin T. Crane, MD, PhD

Objectives: Correct electrode placement is a challenge of cochlear implant surgery, which occurs because electrode position cannot be directly visualized. This work aims to 1) Develop a protocol for a practical, quick, consistent, single view plain radiograph able to be used to confirm electrode position, 2) test its utility for identifying misplaced electrodes in cadaveric heads, 3) confirm its utility on patients.

Study design: Study in specimens and clinical case series.

Setting: Tertiary academic hospital

Patients: Cadaveric heads, and patients undergoing cochlear implantation

Intervention(s): An intra-operative imaging protocol was developed specifying patient head position, machine and film position, and exposure. It was tested using intentionally misplaced electrodes in cadaveric specimens. This technique is used to confirm proper cochlear implantation in patients, during initial and revision surgery.

Main outcome measure(s): Ability to accurately identify electrode insertion based on radiographic images

Results: After adjusting radiographic exposure to account for the embalming process of the cadaveric heads, this new protocol was confirmed to be able to identify incorrect placement. This was also successfully used to confirm proper placement of cochlear implants in both adult and pediatric patients. The protocol allowed verification of the electrode position prior to awaking the patient. Cases of tip fold over, slide back after full insertion, and incorrect insertion were identified and corrected on the operating table.

Conclusions: Following a standardized radiographic protocol for cochlear implantation is a quick and easy method for checking electrode position.

Define Professional Practice Gap & Educational Need: The inconsistent and/or suboptimal use of imaging to confirm electrode placement for patients undergoing cochlear implantation.

Learning Objective: 1) Appreciate the value for consistent and practical intra-operative imaging to confirm correct cochlear implantation, 2) better understand a protocol specifying patient head position, machine and film position, and exposure, and 3) accurately identify electrode insertion based on radiographic images

Desired Result: 1) Reduce incidence of misplaced electrodes during cochlear implantation, and 2) To reduce the number of x-rays that are taken to get adequate visualization, thus decreasing radiation exposure and cost

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - IRB exemption was established for the use of imaging of the cadaveric heads and IRB approval was acquired from the University of Rochester's Research Subjects Review Board.

Cochlear Implantation in Labyrinthitis Ossificans: Long-term Outcomes

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Jourdan T. Holder, AuD; David S. Haynes, MD, MMHC
Matthew R. O'Malley, MD; Alejandro Rivas, MD

Objective: To describe long-term audiologic and surgical outcomes of cochlear implantation (CI) in the setting of labyrinthitis ossificans.

Study Design: Retrospective case review.

Setting: Tertiary referral center.

Patients: 13 ears in 11 patients with labyrinthitis ossificans who underwent CI from 2002-2017

Interventions: Rehabilitative (CI).

Outcome measures: Surgical outcomes, audiologic testing.

Results: Thirteen ears were included (61.5% female, 34.4 years) at the time of CI. Etiologies of labyrinthitis ossificans included meningitis (n=5), unknown (n=5), otosclerosis (n=1), chronic ear disease (n=1), and autoimmune-related (n=1). The median follow-up was 5.2 years (range, 1.3-12.2 years). Electrode insertion was achieved through cochleostomy (n=5), drilling of the basal turn (n=5), or round window approach (n=3). Electrode types included perimodiolar (n=8), lateral wall (n=4), and double array (n=1). Three cases resulted in incomplete insertion with 3-6 extracochlear electrodes. At last follow-up, 5 cases demonstrated improvement in speech understanding, 5 had no perceivable benefit, and 2 had improvement in sound awareness. Audiologic success was not correlated with duration of deafness (p=0.23), surgical approach (p=0.35), extent or etiology of ossification (p=0.6, p=0.2, respectively). One patient experienced a soft failure associated with a severe decline in performance 4 years postoperatively and was recommended to undergo CI replacement. Two patients underwent explantation for lack of benefit in the setting of facial stimulation (n=1) and pain (n=1).

Conclusions: CI in the setting of labyrinthitis ossificans may provide a significant audiologic benefit, however, the extent of benefit is highly variable and overall unpredictable. No specific markers of good performance were encountered.

Define Professional Practice Gap & Educational Need: Lack of knowledge regarding long-term outcomes in patients with labyrinthitis ossificans who undergo cochlear implantation.

Learning Objective: Present long-term surgical and audiologic outcomes for patients with labyrinthitis ossificans who undergo cochlear implantation.

Desired Result: Attendees will learn that in the long-term, over 50% of this patient population does have objective and subjective benefit from cochlear implantation, however, no preoperative findings are good predictors of long-term success. This information may be used in practice for clinical decision-making and patient counseling.

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - Approved

Scalar Location and Modiolar Proximity in Precurved Electrode Arrays Inserted using an External Sheath with Over-Insertion and Pull-Back Technique

Ashley M. Nassiri, MD, MBA; Robert J. Yawn, MD; Jourdan T. Holder, AuD
 Jack Noble, PhD; Robert F. Labadie, MD, PhD
 Marc L. Bennett, MD, MMHC; Alejandro Rivas, MD

Objectives: To determine intracochlear electrode position for precurved electrode array inserted using an external sheath and to determine the impact of slight over-insertion followed by pull-back upon final electrode position.

Study Design: Retrospective case review.

Setting: Tertiary referral center.

Patients: 38 ears (26 adult, 12 pediatric) undergoing cochlear implantation (CI) with precurved electrode array inserted using an external sheath.

Interventions: CI followed by computed tomography (CT).

Outcome measures: scalar location; average distance from electrode to modiolar, \bar{M} ; angular insertion depth

Results: Seventy-four ears were implanted with precurved electrode arrays inserted using an external sheath (from 2016-2018). Thirty-eight implants with post-implantation CT were included. One implant (2.6%) exhibited translocation at 124° with an angular insertion depth of 261°. The remaining 37 (97.4%) had all electrodes located entirely within scala tympani. One instance of tip fold-over using standard insertion technique was noted intraoperatively and resolved with repositioning. Overall $\bar{M} \pm$ standard deviation was 0.39±0.17mm with apical, middle, and basal electrode subgroups having \bar{M} of 0.2±0.12mm, 0.52±0.34mm, and 0.48±0.25mm, respectively. Slight over-insertion and pull-back, controlling for each performing surgeon, resulted in statistically significant lower \bar{M} (0.31mm) compared to those inserted using conventional technique (0.59mm, p=0.001) but was not associated with a significantly different angular insertion depth (p=0.11).

Conclusions: A new precurved electrode inserted using an external sheath had very low rates of translocation or tip fold-over. Slight over-insertion and subsequent pull-back improved electrode proximity to the modiolar.

Define Professional Practice Gap & Educational Need: Lack of knowledge regarding electrode positioning, modiolar distance, and angular insertion depth in a precurved electrode array inserted using an external sheath, as this information has practical applications in audiologic outcomes. Need for improved insertion technique that may maximize benefits of a precurved electrode.

Learning Objective: To determine electrode positioning, modiolar distance, and angular insertion depth in a precurved electrode array inserted using an external sheath and to determine the impact of electrode over-insertion and pull-back technique on electrode location.

Desired Result: Attendees will learn that the precurved electrode array inserted using an external sheath has minimal rates of translocation and tip fold-over (rates are comparable to a lateral wall electrode), which are important for hearing preservation and audiologic outcomes. The over-insertion and pull-back technique offers improved modiolar proximity. Both these conclusions impact clinical decision-making in electrode selection for patients as well as surgical technique in the OR.

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - Approved

**Cochlear Implantation in Patients with Ménière's Disease:
Does Disease Activity Affect the Outcome?**

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Maroun T. Semaan, MD*

Objective: Ménière's disease (MD) is characterized by episodes of vertigo, tinnitus, and sensorineural hearing loss (SNHL). In the setting of bilateral deafness due to MD alone or contralateral pathology, cochlear implantation (CI) improves hearing. Active MD is characterized by fluctuating auditory symptoms and vertigo; whereas remittance of vertiginous symptoms and severe, permanent SNHL characterizes the non-active disease state. This study evaluates outcomes for MD patients compared to the general CI population and assesses if disease activity affects implant outcomes.

Study Design: Retrospective chart review.

Setting: Tertiary referral center.

Patients: 23 patients with MD that received CI (7 active, 16 non-active, and 1 unknown), and 23 age-matched controls.

Intervention(s): Cochlear implantation.

Main outcome measure(s): Pure Tone Audiometry (PTA), Word Recognition Scores (WRS), Sentence Recognition Scores (SRS), and Speech Reception Thresholds (SRT).

Results: Best-aided preoperative and postoperative audiometric data were compared per ear between MD patients and controls and stratified by disease status using descriptive statistics with mixed-effects modeling. Patients with MD derived significantly more benefit from CI than controls when comparing differences between preoperative and postoperative levels for WRS (12.2%, $p=0.0236$), SRS (12.8%, $p=0.0375$), and SRT (-14.4 dB, $p=0.0188$), but not PTA. Patients with active MD had significantly greater gains in SRS (23.5%, $p=0.0107$) than non-active MD patients.

Conclusions: CI provides greater gains in functional hearing for patients with MD compared to age-matched controls. Patients with active MD seem to perform better with respect to SRS following CI than patients with non-active status.

Define Professional Practice Gap & Educational Need: Inconsistencies of outcomes of cochlear implantation in patient's with Ménière's disease and whether disease activity affects the outcome.

Learning Objective: To learn Ménière's disease and characteristic symptoms, indications for cochlear implantation, explore the outcomes for MD patients compared to the general CI population and assesses if disease activity affects implant outcomes.

Desired Result: Better understand the indications of cochlear implantation in Ménière's disease and learn about outcomes depending on the activity of the disease.

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

IRB - Approved

Stryker Surgical Simulator: Temporal Bone Simulator Validation Study

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Andrea McGlynn, MS; Allen O. Mitchell, MD; Craig R. Folsom, MD*

Background: The Stryker Surgical Simulation (S3) is a hybrid, temporal bone simulator that uses both tactile and haptic feedback combined with a computer interface. We sought to validate S3 as an otolaryngology resident training tool for performing tympanomastoidectomies.

Methods: Fifteen residents and staff performed 5 basic cortical mastoidectomies. Subjective evaluation of the face validity and content validity was performed via pre and post questionnaires. Objective evaluation of content validity was assessed by blinded assessment of each temporal bone dissection specimen by a senior neurotologist.

Results: The residents had a longer drilling time on the first trial (43 vs. 28 minutes) but approached the staff group drilling time by the conclusion of the last trial. The mean staff Likert scale response for face validity was 4.5 compared to the trainee group mean response of 3.9 ($p = 0.22$). The mean staff response for content validity was 4.9 compared to the trainee group mean response of 4.3 ($p = 0.30$). The mean staff response for global assessment was 4.8 compared to the trainee group mean response of 5.0 ($p = 0.69$).

Conclusion: Both groups rated the simulator favorably on face validity, content validity and in all global assessment categories. Resident drillers showed progressively decreasing drilling times on serial trials, approaching staff performance times. Objective discrimination between experienced and novice participants was not achieved, likely due to low power. However, the data can be used to show the positive training merits of a hybrid simulator system using a temporal bone insert model.

Define Professional Practice Gap & Educational Need: 1. Shortage of validated, temporal bone simulation for resident training 2. Reduced surgical experience for resident surgeons in light of decreasing national cadaver availability

Learning Objective: The learner should acquire an improved understanding about need for validated surgical simulation, as well as an unique approach to qualitatively and quantitatively evaluate a novel surgical simulator.

Desired Result: The learner should be able to apply the principles of simulator validation to ensure residents are using only appropriate and accurate simulators in training.

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

IRB - Approved

Comparison of Materials Used for 3D-Printing Temporal Bone Models to Simulate Surgical Dissection

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Nicholas Moon, BA Sarah E. Mowry, MD*

Hypothesis: Identification of optimal materials for 3D printed temporal bones that closely mimic the experience of drilling native temporal bone has great potential application in skull base surgical training.

Background: 3D printed temporal bones have been created and validated as adequate models for surgical planning and trainee education. There are many different printers and materials available to create these models. To date there has not been a head to head comparison of these different materials with regard to the “best” materials to utilize for the models.

Methods: 3D printed temporal bones were constructed using 5 different materials and 4 printers. Evaluation of drilling of the different models by 4 skull base surgeons and 4 senior otolaryngology/ neurosurgery residents assessed the haptic experience of drilling and recreation of the temporal bone anatomy.

Results: Results demonstrate the photopolymer and polycarbonate models served as accurate simulators for cadaveric bone drilling, and both the photopolymer and Acrylic-White model most accurately recreate a model for cortical mastoidectomy. Although ABS closely replicates change in pitch during *in vivo* temporal bone surgery, it generates the most odor and least accurately replicates the anatomy of the mastoid, antrum, tegmen, and otic capsule. Acrylic-Blue performed poorly in simulation, likely due to its dark color and translucent appearance.

Conclusions: This work demonstrates that 3D printing temporal bones with different materials results in variable recreation of the temporal bone anatomy and drilling experience. Overall, the Photopolymer used in this work serves to recapitulate temporal bone drilling most accurately.

Define Professional Practice Gap & Educational Need: There currently exists a gap between current surgical trainee drilling methodologies and practical application of these practices. Temporal bone dissection using cadaver specimens has historically been a standard educational tool for teaching otologic surgery. However, access to cadaveric resources has increasingly become more difficult. To overcome this limitation, this work identifies different materials for application in 3D-printing temporal bones for use in surgical dissection training and surgical planning.

Learning Objective: Current literature describes the use of 3D-printed temporal bones for application in skull base surgical training. However, to date, there has not been a head to head comparison of these different materials with regard to the “best” materials to utilize for the models. Therefore, the overall goal of this research project is to investigate which 3D-printed model looks and drills most like a cadaveric bone. This study will result in exciting new data that will hopefully change skull base drilling training by providing a realistic dissection experience for established surgeons as well as otolaryngology and neurosurgery residents, without the need for costly cadaveric bones.

Desired Result: There are many different desktop printers and materials available to create temporal bone models. This work examines the ideal material to 3D-print temporal bones for surgical drilling. Different temporal bone constructs were printed using patient-specific 3D models based on computed tomography data which was digitalized and segmented using Mimics software. Therefore, attendees can 3D print patient-specific models using a desktop printer at their home institutions to create constructs for surgical dissection practice as well as enhanced preoperative planning. Practice drilling using a replica of a patient’s own temporal bone has the potential to improve intraoperative decisions and patient outcomes.

Level of evidence does not apply because: The work presented did not include patients clearly divided into trials. Each 3D printed construct was compared to all other constructs.

IRB - Approved

Comparison of Transcanal Endoscopic and Microscopic Improved Simple Underlay Myringoplasty

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Objective: Simple underlay myringoplasty using a microscope, which was first developed by Yuasa in 1989, is widely performed for repairing a tympanic membrane (TM) perforation, however closure rate by Yuasa's procedure is not so high. We hypothesized that TM perforation may not be completely repaired by simple underlay myringoplasty because of delayed wound healing of the TM epithelium in a dry environment and displacement of the graft from the TM perforation edge. Therefore, we modified conventional simple underlay myringoplasty. On the other hand, recently an endoscope is becoming more frequently used in middle ear surgery. Endoscopic ear surgery (EES) is suitable for simple underlay myringoplasty. The objectives of this study are to show the effectiveness of our improved simple underlay myringoplasty techniques, and to compare the results of endoscopic myringoplasty with that of microscopic myringoplasty.

Study design: Retrospective medical records review

Patients: Eighty four patients having TM perforation who underwent our improved underlay myringoplasty at Tenri Hospital

Methods: Patients were divided into 45 patients in microscopic ear surgery (MES) group and 39 patients in EES group. Closure rate of TM, hearing improvement and operation time were all assessed and compared between two groups.

Results: Closure rate in MES and EES group were 91.1% and 84.6%, respectively. Hearing improvement of MES and EES group were achieved 94.6% and 100%, respectively. Mean operation time of MES and EES group were 39.5±12.7 minutes and 44.0±16.3 minutes, respectively. These values were not significantly different.

Conclusion: Favorable outcomes were obtained using our improved simple underlay myringoplasty.

Define Professional Practice Gap & Educational Need: In this presentation, we modified conventional Yuasa's simple underlay myringoplasty because the rate of successful closure by conventional procedure is not so high. This concern is a professional practice gap. Therefore, this presentation is valuable for educational need of clinicians performing simple underlay myringoplasty.

Learning Objective: Low closure rate of a tympanic membrane perforation using conventional Yuasa's procedure is a problem to be solved. The learning objective in this presentation is useful for filling the identified practice gap.

Desired Result: In this study, favorable outcomes were obtained using our improved simple underlay myringoplasty. Therefore, Attendees will apply the knowledge gained from this presentation for better medical treatment of a tympanic membrane perforation.

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

IRB - Exempt

Educational Value of Endoscopic Versus Microscopic Ear Surgery

Sarah E. Maurrasse, MD; Adam J. Ciarleglio, PhD

Justin S. Golub, MD, MS

Objective: Despite recent enthusiasm for endoscopic ear surgery, studies comparing endoscopic and microscopic outcomes have largely shown equivalence. We hypothesize that endoscopic ear surgery will have superior educational value to microscopic ear surgery among medical students.

Study Design: Prospective survey

Setting: Tertiary care academic medical center

Intervention: A survey was anonymously completed by third- and fourth-year medical students immediately after they observed either endoscopic or microscopic ear surgery

Main Outcome Measures: 21 items on a Likert scale (1=worst, 5=best) spanning 4 domains: (1) view of specific anatomic structures, (2) ability to see area of interest, (3) video quality assessed by the validated Maryland Visual Comfort Scale, (4) perceived educational value

Methods: Unpaired T-tests were used to compare score differences between the endoscopic and microscopic groups, with a Benjamin-Hochberg adjustment for multiple comparisons. Individual items and domain means were compared.

Results: 32 surveys were completed (12 endoscopic, 20 microscopic). Across domains, the endoscope was superior to the microscope for perceived educational value (4.68 vs 3.95, raw $p=0.0009$, adjusted $p=0.004$). Across individual items, the endoscope was superior to the microscope for view of the ear canal (5.00 vs. 4.38, raw $p=0.003$, adjusted $p=0.03$), ability to clearly hear the attending's voice (4.75 vs. 3.85, raw $p=0.004$, adjusted $p=0.03$), and understanding surgical steps (4.75 vs 3.95, raw $p=0.0008$, adjusted $p=0.02$). The microscope was not superior for any items.

Conclusions: Endoscopic ear surgery was superior to microscopic ear surgery for several key educational items among medical students. This has implications for improving surgical training.

Define Professional Practice Gap & Educational Need: There is variation on the visualization tool that otolaryngologists use when performing ear surgery. This gap exists because measurable advantages of endoscopic versus microscopic techniques, including educational value, are unclear. Educational Needs: Attending physicians need to understand whether endoscopic or microscopic ear surgery have advantages for teaching students/trainees.

Learning Objective: To learn whether endoscopic or microscopic ear surgery has superior educational value across a span of domains.

Desired Result: The potentially superior educational value of endoscopic ear surgery should be considered when otolaryngologists are performing ear surgery with students/trainees present.

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

IRB: Approved

Prospective Evaluation of Opioid Consumption after Otologic Surgery

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Noor S. Ali, MD; Taha A. Jan, MD; Nikolas H. Blevins, MD

Objective: To prospectively evaluate opioid consumption following outpatient otologic surgery.

Study design: Prospective observational

Setting: Single tertiary referral center

Patients: Patients scheduled for otologic surgery who did not have a history of chronic opioid use were recruited between February and September 2018.

Interventions and Main Outcome Measures: All participants underwent otologic surgery and received postoperative opioid prescriptions per the surgeons' regular prescribing patterns. Opioid consumption was queried using telephone or in-person surveys administered between postoperative day 5 and 15. Patient demographics, surgical details, and opioid prescription patterns were abstracted from medical records. Opioid dispensation records were reviewed through the California Department of Justice.

Results: 43 patients with an average age of 50 ± 18 years were prescribed 65.4 ± 39.9 mg of morphine equivalents (ME) and consumed 32.8 ± 38.6 mg ME over the course of 2.6 ± 2.2 days postoperatively. Patients who received a postauricular incision (27/43 patients) were prescribed significantly more than those who underwent transcanal procedures (18/43 patients) (78.5 vs 47.9 mg ME; t-test, $p=0.01$), consumed significantly more (45.5 vs 15.8 mg ME; t-test $p=0.01$), and for a significantly longer duration (3.4 vs 1.6 days; t-test, $p=0.01$). Of the postauricular incisions, there was no significant difference in consumption between those who underwent mastoidectomy (14/27 patients) with those who did not (13/27 patients) (40.0 vs 52.0 mg ME; t-test, $p=0.05$).

Conclusions: Patients in our cohort consumed approximately half of the prescribed opioids. Those with postauricular incisions used significantly more than those with transcanal incisions. Postoperative opioid prescription recommendations should be tailored according to the extent of surgery.

Define Professional Practice Gap & Educational Need: 1. Lack of awareness of postoperative opioid needs and consumption patterns in patients following otologic surgery 2. Inconsistencies in prescribing patterns for opioids after otologic surgeries

Learning Objective: 1. To characterize opioid prescription, dispensation, and consumption patterns as it relates to otologic surgery

Desired Result: 1. Attendees should tailor their opioid prescription patterns according to extent of surgery 2. Attendees should appreciate how patients typically consume approximately half of the prescribed opioids after otologic surgery, which is consistent with consumption patterns in other types of surgery

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - Approval

Sensitivity of High-Resolution Computed Tomography in Otosclerosis Patients Undergoing Primary Stapedectomy

*Anne K. Maxwell, MD; Mohamed Hosam, MD
Adam Master, MD; William H. Slattery, III, MD*

Objective: To determine the incidence of abnormal otospongiotic or otosclerotic findings on high-resolution computed tomography (HRCT) as read by local radiologists in patients with surgically-confirmed otosclerosis.

Study design: Retrospective chart review.

Setting: Tertiary-referral private otology-neurotology practice.

Patients: Adults (>18 years old) who underwent primary stapedectomy between 2012-2017 who also had a preoperative HRCT.

Intervention: Preoperative HRCT then stapedectomy.

Main outcome measures: Positive identification and location of otosclerosis as reported by the local radiologist. We then correlated this with surgical location as documented at time of surgery. Audiometry, demographic data, intraoperative findings, and surgical technique were secondarily reviewed.

Results: 708 stapedectomies were performed during the study time frame. Preoperative HRCT scans were available for 70 primary stapedectomy surgeries performed in 56 patients. Otosclerosis was reported in 20/70 (28.6%). Following a negative report by the local radiologist, a re-review by the surgeon and/or collaborating neuroradiologist confirmed otosclerosis in 10/50 additional cases (20%). There was an overall sensitivity of 43%. Intraoperatively, cases with negative reads tended to have more limited localization at the ligament (8.3%) or anterior crus (37.5%), compared with positive reads, which demonstrated more extensive involvement, with bipolar foci (30.0%), diffuse (20.0%), or obliterated (5.0%) manifestations more common. Acoustic reflexes were characteristically absent.

Conclusions: While HRCT may aid diagnosis and rule out concomitant pathology in certain cases of clinical uncertainty or unexplained symptoms, its sensitivity for otosclerosis remains low. HRCT should not be relied upon to diagnose routine fenestral otosclerosis.

Define Professional Practice Gap & Educational Need: Prior studies have investigated sensitivity of high-resolution computed tomography (HRCT) when read by neuroradiologists in a study setting. In clinical practice, however, patients are often referred for initial consultation with a CT report and no study images. In this setting, there is a lack of knowledge of the more clinically-applicable question of sensitivity of the local radiologist's interpretation of otosclerosis as documented in the CT report.

Learning Objective: To understand the low sensitivity of HRCT as read by local radiologists in patients with surgically-confirmed otosclerosis.

Desired Result: Attendees will maintain a high level of suspicion for otosclerosis even if a preoperative HRCT is negative for the disease. Additionally, attendees will not order HRCT for diagnostic workup of otosclerosis in routine cases with no unusual symptoms, thereby reducing financial waste in the medical system.

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB: Approved

Management of Acute Mastoiditis with Immediate Needle Aspiration for Subperiosteal Abscess

*Noam Bartov, MD; Yonatan Lahav, MD; Gil Lahav, MD
Elchanan Zloczower, MD; Udi Katzenell, MD
Ohad Hilly, MD; Hagit Shoffel-Havakuk, MD*

Objectives: To assess the safety and outcome of a conservative management scheme of acute mastoiditis with immediate myringotomy and postauricular needle aspiration of a subperiosteal abscess.

Study Design: Retrospective cohort.

Setting: Tertiary referral-hospital.

Patients: 283 Children (age<12) with acute mastoiditis admitted between 1999 and 2017. Data collection includes patient characteristics, signs and symptoms, physical examination, laboratory tests, treatment regime, imaging findings and long-term outcomes.

Intervention: Treatment under a conservative management scheme of acute mastoiditis, with immediate myringotomy and postauricular needle aspiration of a subperiosteal abscess. Computed tomography and mastoidectomy were reserved for selected cases.

Main outcomes: Duration of hospitalization, readmission rate, immediate intracranial complications and late neurologic or otologic complications.

Results: Ninety-eight children (34.6%) had a suspected subperiosteal-abscess on admission and underwent a trial of immediate postauricular needle aspiration, and 56.1% (55 cases) were positive. Of these 55, 83.6% (46) did not subsequently undergo mastoidectomy. Twenty-four additional children had a subperiosteal-abscess, proven by computed tomography or surgery, bringing the total subperiosteal abscess cases to 79 (27.9%). Of children with proven subperiosteal abscess, 70.9% (56) did not subsequently undergo mastoidectomy. Intracranial complication rates were 4.9% (14) and 8.8% (25) underwent mastoidectomy. Long term follow-up was available for 250 children with one child suffering a moderate bilateral mixed hearing-loss. There were no cases of neurological sequela.

Conclusions: Conservative management of acute mastoiditis, involving prompt myringotomy for all patients and postauricular needle aspiration for subperiosteal abscess, is safe, effective, and reduces the need for computed tomography and mastoidectomy. Conservative management obviates unnecessary radiation, general anesthesia and surgery, without increasing the risk of complications.

Define Professional Practice Gap & Educational Need: 1. No consensus regarding whether children with acute mastoiditis and a sub-periosteal abscess should be treated aggressively, i.e. with a computed tomography and a cortical mastoidectomy or conservatively, with a needle aspiration of the abscess. 2. No long term data showing that conservative treatment is safe.

Learning Objective: To create a better understanding of how to treat children with mastoiditis and a sub-periosteal abscess. To understand the safety of a conservative treatment.

Desired Result: When dealing with a child with acute mastoiditis with a subperiosteal abscess, a myringotomy and a post-auricular needle aspiration of the abscess are the first actions needed. All children should also receive a parenteral antibiotic treatment. Children who have signs of an intracranial complication on presentation, or those who fail to improve in 48 hours, under the initial treatment, should undergo a computed tomography and a cortical mastoidectomy.

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

IRB - Approved

Predicting Cochlear Implant Candidacy using Routine Audiometric Data

John Wilson IV, BS; Ashley Altman, MD; Jeffrey Yu, MD

Objective: To determine whether cochlear implant candidacy can be reliably predicted using data from routine audiograms.

Study design: Retrospective case review.

Setting: Ambulatory patients at a tertiary referral center.

Patients: 41 English speaking adults (62 ears) that received audiogram testing prior to formal cochlear implant evaluation using AzBio in quiet.

Main outcome measure(s): Receiver operating characteristic (ROC) curves, sensitivity, specificity, and negative/positive predictive values were compared among different prediction methods.

Result(s): The word recognition score (WRS) threshold of $\leq 20\%$ had a sensitivity of 92% and a specificity of 93% for predicting cochlear implant candidacy in the ipsilateral ear (defined as scoring $\leq 40\%$ on AzBio testing). The positive predictive value was 96% and the negative predictive value was 75%. The four-frequency pure tone average (4FPTA) threshold of 70 dB HL had a sensitivity of 96% and a specificity of 31%. The positive predictive value was 85% and the negative predictive value was 75%.

Conclusions: In our sample of adults with significant hearing loss, WRS represents the most useful screening method to determine cochlear implant candidacy in the ipsilateral ear.

Define Professional Practice Gap & Educational Need: 1. Lack of contemporary knowledge for when to refer patients with hearing loss to a cochlear implant center.

Learning Objective: 1. To inform clinicians on how to predict cochlear implant candidacy using routine audiograms.

Desired Result: 1. Clinicians will incorporate this information into their practice to improve referral patterns and avoid gaps in the cochlear implantation process in order to improve hearing outcomes in the population at large.

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - Approved

Cochlear Histopathology in Human Genetic Hearing Loss: Implications for Gene Therapy

*Krishna Bommakanti, BA; Janani Iyer, BA
Konstantina M. Stankovic, MD, PhD*

Background: Sensorineural hearing loss is the most common sensory deficit, disabling 466 million people worldwide. Everything we know about the cellular basis of human deafness comes from studies of human temporal bones *post mortem*. Because the inner ear is small and encased in the densest bone in the body, it evades cellular-level imaging *in vivo* and diagnostic biopsy. With over 6000 variants in over 150 deafness-causing genes identified, it is astounding that human cochlear histopathology has been reported for only 14 genes.

Objectives: Review all cases of human inner ear histopathology for all causes of genetic hearing loss. Compare and contrast human findings with cochlear histopathology in mouse models of the corresponding genetic hearing loss.

Study selection, data extraction, & synthesis: A review of literature was performed and relevant studies were identified by searching the PubMed database. Our search was completed in July 2018. In total, 42 human temporal bones have been studied for genetic causes of hearing loss. Fourteen genes underlying nonsyndromic and syndromic causes of hearing loss were identified. Of these 14 genes, ten have been studied in animal models.

Conclusion: This study presents a comprehensive account of human temporal bone histopathology that has been used to study genetic causes of hearing loss. Additionally, we compare and contrast this data to the corresponding mouse models. Our analysis highlights the major unmet medical need to develop tools for cellular-level diagnosis of hearing loss in living people, and to monitor responses to emerging genetic and pharmacologic therapies.

Define Professional Practice Gap & Educational Need: 1. Lack of awareness 2. Lack of contemporary knowledge

Learning Objective: We aim to review all cases of human inner ear histopathology for all causes of genetic hearing loss. We also compare and contrast human findings with cochlear histopathology in mouse models of the corresponding genetic hearing loss.

Desired Result: At the end of this presentation, attendees should recognize the limitations of current models to study human deafness and the need to develop tools for the diagnosis of hearing loss in living people.

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - Exempt

**Pharmacological Prevention of Noise-Induced Hearing Loss:
A Systematic Review and Meta-Analysis**

*Avigeet Gupta, BS; Sina Koochakzadeh, BS; Shaun A. Nguyen, MD, MA
Ted A. Meyer, MD, PhD; Paul R. Lambert, MD*

Objective: Perform a systematic review and meta-analysis to assess and determine current pharmacological prevention regimens for noise-induced hearing loss (NIHL) with significant outcomes

Data sources: Full-text, English language articles in PubMed, Scopus, and Cochrane Database of Systematic Reviews were searched up to October 2018

Study selection: Prospective randomized clinical trials and non-randomized trials with pharmacological interventions administered to prevent NIHL

Data extraction: The following variables were extracted: number of patients, level of evidence, definition of threshold shift, type of noise exposure, duration of exposure, use of hearing protection devices, pharmacological regimens, pharmacological treatment complications, follow-up time, initial hearing thresholds, post-administration threshold shifts

Data synthesis: 10 articles with 1461 patients were included after searching the following terms in the English language: noise-induced hearing loss, acoustic trauma, NIHL, prevention, and protection. Different pharmacological regimens included administration of carbogen, cyanocobalamin, ebselen, magnesium aspartate, and n-acetylcysteine. Noise exposures that were included were over 85 dB caused by assault rifles, white noise, music, and machinery noises. A meta-analysis of proportions is currently being performed to determine significance among the various modalities of pharmacological preventions for NIHL.

Conclusions: This is the first known meta-analysis being conducted regarding the pharmacological prevention of NIHL. Conclusions from this study alongside more randomized clinical trials can potentially contribute to the generation of clinical practice guidelines to prevent NIHL.

Define Professional Practice Gap & Educational Need: There is currently no clinical practice guideline or consensus statement regarding the pharmacological prevention of noise-induced hearing loss

Learning Objective: This study aims to address the gap of knowledge regarding the pharmacological prevention of noise-induced hearing loss as it can be applied to future clinical practice.

Desired Result: This systematic review and meta-analysis will summarize the current evidence regarding the pharmacological prevention of noise-induced hearing loss for otologists to use in clinical practice.

Level of Evidence: LEVEL II - Small RCTs with unclear results

IRB - Exempt

**Pre-Operative Criteria Predict Operative Time Variability
within Tympanoplasty CPT Codes**

*Karissa L. LeClair, BS; Isabelle L. Magro, BA, MS
Peter W. Kahng, BA; Amy L. Hamilton, BS
James E. Saunders, MD*

Objective: To identify pre-operative parameters that predict surgical duration in order to stratify variability in physician work within tympanoplasty CPT codes.

Study Design: Retrospective study.

Setting: Tertiary referral center.

Patients: 140 patients who underwent tympanoplasty (CPT code 69631) or tympanoplasty with ossicular chain reconstruction (CPT code 69633) over three years.

Intervention(s): The following complexity modifiers were pre-operatively assigned to each procedure: Level 1 for small or posterior perforations, Level 2 for large perforations or other factors requiring a post-auricular incision, and Level 3 for cases involving cholesteatoma.

Main Outcome Measure(s): Surgical duration (preparation time and operative time).

Results: Within each CPT code, the following parameters were assessed versus time: a] Pre-operative complexity level designation, b] Main hospital vs. outpatient surgery center (OSC) location, c] Use of facial nerve monitoring. When controlled for surgeon and other stated parameters, pre-operative complexity level designation was an accurate predictor of operative time variability ($p < 0.0001$). Preparation time was significantly longer in the main hospital vs. OSC ($p < 0.0001$) and when facial nerve monitoring was utilized ($p = 0.003$), with an average difference in facial nerve monitoring of 8.7 minutes.

Conclusions: There is significant surgical time variability within existing tympanoplasty CPT codes, which can be accurately predicted with pre-operative application of complexity level modifiers and consideration of factors affecting case preparation. Adding complexity modifiers leads to more efficient surgical scheduling and could result in more accurate reimbursement rates for physician work.

Define Professional Practice Gap & Educational Need: 1. Limited knowledge of factors that influence otologic surgery times 2. Lack of strategies to improve surgical scheduling efficiency and reimbursement accuracy

Learning Objective: To describe the variability in physician work and surgical time within CPT codes, making practices aware of factors that can be used to predict operative times in otologic surgery.

Desired Result: To encourage consideration of specific patient and procedural criteria in pre-operative scheduling as a means to promote workflow efficiency

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

IRB - Approved

Effect of Spina Bifida and Congenital Hydrocephalus on Hearing Loss in Children

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Objective: To better understand the relation between spina bifida, congenital hydrocephalus, and hearing loss [HL] in children.

Study design: Retrospective review.

Setting: Tertiary referral hospital.

Patients: Children in the Audiological and Genetic Database with a diagnosis of spina bifida with or without hydrocephalus, or congenital hydrocephalus.

Interventions: None

Main outcome measures: Prevalence, type, severity (4-tone pure-tone average), and progression of HL.

Results: Of 740 children, 74.6% had HL, with 26.4% having at least moderate HL. We compared HL among three groups of children, those with: spina bifida and hydrocephalus [SBH], spina bifida without hydrocephalus [SB], and isolated congenital hydrocephalus [CH]. Children with CH had a higher prevalence of HL (80%) than children with SBH (67.5%, $p=0.001$) or SB (69% $p=0.013$). Conductive HL was more prevalent in children with SBH (28%, $p=0.002$) or SB (27%, $p=0.008$) than in children with CH (17%). Severity of hearing loss was not significantly different among the 3 groups. Further analysis of factors that influence severity and progression of hearing loss (e.g. shunt placement, neurologic disorders, seizures, congenital deformities) will be discussed.

Conclusions: HL is highly prevalent in children with spina bifida and particularly prevalent in children with congenital hydrocephalus, though severity of hearing loss may not be different between the disorders.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge of the relation between spina bifida, congenital hydrocephalus, and hearing loss in children.

Learning Objective: To better understand the relation between spina bifida, congenital hydrocephalus, and hearing loss [HL] in children.

Desired Result: Consideration of spina bifida and congenital hydrocephalus as an indicator of audiological screening.

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

IRB - Exempt

Postoperative Healthcare Utilization of Elderly Adults after Cochlear Implantation

*Mallory J. Raymond, MD; Samir Ballestas Naissir, MD
Esther X. Vivas, MD*

Objective: To determine whether geriatric age affects postoperative healthcare utilization after cochlear implantation

Study design: Retrospective chart review

Setting: Tertiary referral center

Patients: Older adults (>59 years) who underwent cochlear implantation from 2009 until 2017 with 3-month post-implantation speech recognition scores

Intervention(s): Cochlear implantation

Main outcome measure(s): Postoperative surgical and audiological visit rate after cochlear implantation for those aged 60-69, 70-79 and 80-90 years

Results: Of 40 older adult patients, the mean age was 71.9 ± 6.8 years. The mean number of postoperative surgical visits over the first year was 1.8 ± 1 . The mean number of audiological visits over the first year was 4.8 ± 1.3 ; this dropped significantly over the second year to 1.5 ± 1 visits ($p < 0.001$). There was no significant difference in duration of hearing loss, preoperative and 3-month postoperative AzBio scores or postoperative visit rate between the three age groups. Additionally, on linear regression, 3-month postoperative AzBio scores did not predict greater postoperative healthcare utilization.

Conclusions: Older adults do not have higher than expected rates of postoperative healthcare utilization after cochlear implantation despite higher rates of frailty and comorbidity.

Define Professional Practice Gap & Educational Need: Lack of geriatric cochlear implantation outcomes and postoperative healthcare utilization

Learning Objective: The objective is to examine postoperative healthcare utilization among geriatric patients who have undergone cochlear implantation

Desired Result: Attendees will understand the postoperative healthcare utilization of elderly patients after cochlear implantation

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - Exempt

**Benign Paroxysmal Positional Vertigo in Young Adults:
A Nine-Year Retrospective Review**

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Michael LaRouere, MD; John Zappia, MD
Eric W. Sargent, MD; Seilesh Babu, MD*

Benign paroxysmal positional (BPPV) classically affects older patients, and is significantly less common in children and young adults. We performed an IRB-approved retrospective chart review from 2008-2017. A total of 1,972 total patients with BPPV clinical encounters were identified.

All patients were positive by both history and Dix-Hallpike exam. The mean age of all patients reviewed was 64.2 (+/- 14.72) with a range from 8.0 - 98.8. For purposes of this review, "young adult" was defined as 17-26. A total of 23 patients were identified with a mean age of 23.9 (+/-2.7). Seventeen of the patients were females (74%) and 6 were males (26%).

The most common associated comorbidities were migraine (n=3; 13%) and head trauma (n=3; 13%), while one patient (4%) had a prior episode of sudden sensorineural hearing loss one month prior to vertigo onset. The posterior semicircular canal was almost exclusively affected (n=22; 96%), however the superior semicircular canal was affected in one patient (n=1; 4%). In total, over 30% of patients (n=7) reviewed had symptom recurrence within six months of the first attack, one of which ultimately required surgical intervention via posterior semicircular canal plugging.

Our institutional review agreed with previous data suggesting BPPV in young adults is rare and comprised only 1.1% of all patients reviewed. Patients in this age range commonly recurred within the first six months after initial treatment, underscoring the importance of careful follow up and appropriate patient counseling.

Define Professional Practice Gap & Educational Need: Lack of awareness Lack of contemporary knowledge

Learning Objective: The learning objective is to raise awareness regarding the potential for BPPV in adolescents as well as review potential pitfalls in the care of these patients

Desired Result: Attendees will be better able to approach the management of young patients with dizziness and vertigo.

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - Approved

Review of the Safety and Efficacy of the Slot Middle Fossa Craniotomy Approach for Cerebral Spinal Fluid (CSF) Leak Repair Secondary to Tegmen Dehiscence

Naushad M. Khakoo, MD; Alex J. F. Tampio, MD; Charles I. Woods, MD

Objective: Review of the Safety and Efficacy of the Slot Middle Fossa Craniotomy Approach for Cerebral Spinal Fluid (CSF) Leak Repair Secondary to Tegmen Dehiscence.

Study Design: Retrospective case series.

Setting: Tertiary referral hospital.

Patients: A retrospective review was conducted from 2012-2017 of patients who received repair of a CSF leak from a tegmen defect that included a slot middle fossa craniotomy approach.

Intervention(s): All patients underwent a combined approach for repair with a trans-mastoid and a middle fossa slot craniotomy using a window approximately 3-5cm x 0.5cm (in anteroposterior and supero-inferior dimensions respectively).

Main Outcome Measures: Surgical outcomes as outlined by the American College of Surgeons Risk Calculator.

Results: 14 patients were identified. The average patient age was 60.5 years ranging 19-74 years. 79% (11/14) were right-sided defects and 21% (3/14) were left-sided. The tegmen defect averaged 9.5 mm in maximum dimension (range 3-15mm). Graft repair was with tragal cartilage in 85% (12/14), conchal bowl cartilage in 7% (1/14), and temporalis muscle in 7% (1/14). 3 patients had persistent otorrhea after surgery; 2 resolved within 1 month of surgery. Major complications included a pulmonary embolism and hypoxic respiratory failure in one patient requiring therapeutic anticoagulation and intubation. Minor complications included headache in 29% (4/14) and surgical site paresthesia in 21% (3/14). No patients experienced neurological sequelae, surgical site infections or readmission.

Conclusions: The slot craniotomy approach with cartilage graft is a safe and effective alternative to the traditional middle fossa approach for repair of tegmen tympani defects resulting in CSF leaks.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge

Learning Objective: To communicate the efficacy and complications of a surgical technique

Desired Result: The attendees will be able to counsel patients on success rates and complications if a slot middle cranial fossa approach is used in the repair of tegmen defects

Level of Evidence: LEVEL V - Case series, studies with no controls

IRB - Exempt

Following Mild Traumatic Brain Injury Patients Have Auditory Symptoms Despite Normal Behavioral Audiometry

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David H. Jung, MD, PhD; Elliott D. Kozin, MD*

Objective: Emerging evidence related to cochlear synaptopathy indicates the potential for auditory symptoms from synaptic pathology despite normal behavioral pure tone threshold audiometry. We hypothesize that individuals following mild traumatic brain injury (mTBI) can experience bothersome auditory symptoms in the presence of normal audiometry.

Study Design: Prospective cohort study.

Setting: Tertiary care hospital.

Patients: Adults with history of mTBI.

Interventions: Determination of auditory symptomology, Hearing Handicap Inventory for Adults (HHIA), Tinnitus Handicap Inventory (THI), and behavioral pure tone audiometry (PTA) and word recognition scores (WRS).

Main outcome measure(s): Main outcomes included HHIA and THI scores, as well as PTA and WRS. Comparisons were made to mTBI patients with normal (Group A) and abnormal (Group B) PTA (>20 dB).

Results: Twenty-nine patients with mTBI met study criteria. Mean age was 54.2 years and 79.3% were female. Hyperacusis (72.4%), tinnitus (68.9%) and HL (62%) were commonly reported in study participants. Sixty-two percent (18/29) of patients showed normal hearing thresholds (Group A). In Group A, 55.5% (10/18) patients complained of subjective hearing loss. Mean HHIA scores were similar in Group A and Group B (40.8 and 39.5, respectively; $p=0.829$). No difference in mean THI scores was found between groups. (16.5 and 27.3 respectively; $p=0.274$). Patients in Group B had a mean WRS of 94.2% in the worse ear.

Conclusion: Auditory symptoms after mTBI can be present even in the setting of normal PTA. Findings have implications for auditory pathophysiology in mTBI.

Define Professional Practice Gap & Educational Need: Lack of understanding of auditory symptoms in civilian following traumatic brain injury.

Learning Objective: Determine patterns of auditory dysfunction in civilians following traumatic brain injury.

Desired Result: Improve screening and treating potentially overlooked auditory symptoms in this population.

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

IRB - Approved

Internal Auditory Canal Diameter is a Marker of Hearing Loss Severity in CHARGE Syndrome

Kareem O. Tawfik, MD; Brittany A. Leader, MD; Daniel I. Choo, MD

Objectives: Determine whether small internal auditory canal (IAC) diameter is associated with worse hearing thresholds and cochlear nerve deficiency (CND) in CHARGE Syndrome. Determine whether asymmetric IAC dimensions are associated with asymmetric hearing and cochlear nerve (CN) status in patients with CHARGE Syndrome.

Study Design: Retrospective case review.

Setting: Tertiary referral center.

Patients: Children meeting diagnostic criteria for CHARGE Syndrome.

Interventions: High-resolution magnetic resonance imaging of the temporal bones and ear-specific audiometric testing.

Main outcome measures: IAC diameter, pure-tone average (5-point scale: (normal=0, mild=1, moderate=2, moderate-severe=3, severe=4, and profound=5), and CN development (normal, hypoplastic or aplastic CN).

Results: Twenty ears (10 patients) were analyzed. Mean IAC diameters at the porus, mid-point, and fundus decreased in relation to severity of hearing loss and degree of CN underdevelopment. Additionally, in all patients with asymmetric hearing or asymmetric CN development, within-subject comparison of the IACs showed universally smaller IAC diameters at the porus, mid-point, and fundus in the more affected ear.

Conclusions: In children with CHARGE Syndrome, small IAC diameter can serve as a useful indicator of sensorineural hearing loss. Importantly, in children in whom asymmetric hearing (and/or asymmetric CN development) is suspected, the smaller IAC can reliably indicate the more affected ear. As ear-specific audiometric testing of children with CHARGE Syndrome can be challenging, measuring the dimensions of the IAC can be a useful strategy for identifying a worse-hearing ear in this cohort.

Define Professional Practice Gap & Educational Need: Lack of awareness of the relationship of internal auditory canal diameter with severity of hearing loss in patients with CHARGE Syndrome.

Learning Objective: Understand the association between internal auditory canal diameter and severity of hearing loss in patients with CHARGE Syndrome.

Desired Result: Attendees will apply knowledge from the presentation in evaluation of children with CHARGE Syndrome and sensorineural hearing loss. Specifically, they may become aware that measuring the dimensions of the internal auditory canal can be a useful strategy for identifying a worse-hearing ear in this cohort.

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

IRB - Approved

Correlation of Preoperative Mini-MoCA Testing and Postoperative Speech Outcomes in Cochlear Implant Recipients

*Karl W. Doerfer, MD; Benjamin S. Johnson; Caroline Ziegler, MS
Kristin Kozlowski, AuD; Michael S. Harris, MD*

Objective: To assess the relationship between a preoperative cognitive screening measure and postoperative speech perception outcomes in adult cochlear implant (CI) recipients.

Study design: Retrospective chart review. Level IV

Setting: Tertiary referral center

Patients: Adults with post-lingual, profound, sensorineural hearing loss who qualify for cochlear implantation.

Intervention: Cochlear implantation

Main outcome measures: CI candidates underwent pre-operative testing using a validated, visual version of the Mini Montreal Cognitive Assessment (MoCA). Results were then analyzed in conjunction with postoperative speech testing to determine the presence and strength of correlation between the two.

Results: 51 patients completed pre-operative Mini MoCA assessments and underwent postoperative speech testing. A moderate, positive correlation ($R = 0.55$) was found between preoperative Mini MoCA scores and 3-month post-operative AZBio scores. Weak but positive correlations were also found with 1-month AZBio scores ($R = 0.39$), 3-month CNC Words scores ($R = 0.37$), and 1- and 3-month CNC Phoneme scores ($R = 0.31$, $R = 0.40$).

Conclusions: Preoperative cognitive screening using a validated, visual version of the Mini MoCA correlates positively with post cochlear implantation speech perception scores on a variety of clinical speech measures. Brief, clinic-based, cognitive testing for CI candidates may help predict postoperative CI performance and allow patients and families to calibrate expectations.

Define Professional Practice Gap & Educational Need: There is currently a lack of knowledge regarding factors that determine the wide variability of cochlear implant (CI) outcomes. Preoperative cognitive status appears to play a role in CI performance. However, clinicians lack validated, practical, clinic-based testing strategies that can help predict postoperative performance for CI candidates.

Learning Objective: Attendees will learn that preoperative cognitive screening using a validated, visual version of the Mini MoCA correlates positively with post cochlear implantation speech perception scores on a variety of clinical speech measures.

Desired Result: Clinicians may opt to use brief, clinic-based, cognitive testing for CI candidates to help predict postoperative CI performance and to allow patients and families to calibrate expectations.

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

IRB - Approved

Comparing Outcomes and Programming Parameters for Precurved and Straight Electrodes: A Matched Cohort Comparison Study

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Objective: Characterize differences in adult cochlear implant (CI) outcomes and programming parameters for precurved, non-stylet electrode arrays (EA) versus straight EAs from a single manufacturer.

Study Design: Review of prospective database

Setting: CI program at tertiary otologic center

Patients: Fifty-eight adults—29 implanted with straight EA (Cochlear CI422/522) and 29 implanted with precurved EA (Cochlear CI532) using an external straightening sheath for insertion—were included. CI recipients from each group were matched with respect to age, preoperative hearing thresholds, and duration of CI use.

Interventions: CI

Outcome measures: Consonant-Nucleus-Consonant (CNC) words, AzBio sentences, and residual hearing thresholds were measured at least 6 months post activation. Pulse duration, maxima, impedances, and overall charge measurements were used to characterize programming parameters.

Results: Postoperative low frequency pure tone average was significantly lower (i.e. better) for the precurved EA group (94.71 ± 14.79 dB HL) than the straight EA group (102.13 ± 9.57 dB HL, $p=0.028$). CNC scores were significantly higher for the precurved group ($56.97 \pm 21.47\%$) than the straight EA group ($43.34 \pm 20.38\%$, $p=0.016$). Impedances and pulse durations were statistically significantly lower for the precurved group, but there was no difference in overall charge for upper stimulation levels between the two groups.

Conclusions: The precurved EA group (CI532) showed favorable or similar results on all measures when compared to the straight EA group (CI422/522). Results suggest that the precurved EA may be an advantageous substitute for straight EA, which exploits better perimodiolar positioning leading to decreased channel interaction and superior speech recognition.

Define Professional Practice Gap & Educational Need: 1. Matched, cohort comparison study design controls for variables such as age, preoperative hearing thresholds, and duration of CI use between groups of precurved and straight electrode arrays. Such variables have confounded many previous reports. 2. Lack of awareness that new precurved cochlear implant electrode arrays show favorable or similar rates of hearing preservation and superior speech recognition scores unlike previous generations of precurved arrays. 3. Lack of consideration for differences in audiologic programming parameters (pulse duration, impedances, and charge) between electrode types.

Learning Objective: 1. Describe differences in outcomes (hearing preservation and speech recognition scores) between the precurved (CI532) and straight (CI522) electrode arrays. 2. Explain differences in programming parameters (pulse duration, impedances, and charge) between precurved (CI532) and straight (CI522) electrode arrays and how these differences may affect a recipient's sound quality or experience with their cochlear implant.

Desired Result: Attendees will apply their new understanding of differences between the precurved (CI532) and straight (CI522) electrode arrays to their decision-making process for selecting electrode arrays for their patients. Attendees will consider selecting the new, precurved electrode array (CI532) instead of a straight array (CI522) with the insight that the precurved array offers favorable or similar results on all measures including hearing preservation.

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

IRB - Approved