

SELECTED ABSTRACTS

***POSTER
PRESENTATIONS***



***151st Annual Meeting
AMERICAN OTOLOGICAL SOCIETY***

***April 20-21, 2018
Gaylord National Resort
National Harbor, MD***

POSTERS WILL BE VIEWED ON FRIDAY & SATURDAY

Simultaneous Labyrinthectomy and Cochlear Implantation in Unilateral Meniere's Disease

*Elizabeth L. Perkins, MD; Meredith Anderson Rooth, AuD
Margaret T. Dillon, AuD; Kevin D. Brown, MD, PhD*

Objective: In a single-institution, FDA-approved IDE study, subjects with unilateral Meniere's disease and intractable vertigo underwent concurrent labyrinthectomy and cochlear implantation to determine speech perception, localization, and quality of life outcomes.

Study Design: Prospective cohort study

Setting: Tertiary referral center

Patients: Subjects with unilateral Meniere's disease and intractable vertigo with normal or near-normal hearing in the contralateral ear

Intervention: Rehabilitative

Main Outcome Measures: Sound localization, AzBio, CNC in quiet, THI, SSQ, APHAB

Results: Three subjects with unilateral Meniere's disease underwent simultaneous labyrinthectomy and cochlear implantation. Sound localization testing demonstrated immediate benefit post-implantation with the cochlear implant (CI). RMS error with CI on was 22 degrees (± 2) and with CI off was 63 (± 15) at 6 months. Mean CI-alone scores were 22% (± 20) at 1-month and improved to 43% (± 20) and 49% (± 11) at the 3- and 6-month intervals, respectively. AzBio sentences in babble (0 dB SNR) scores presented in the most challenging listening condition (S0NContra) were 28% (± 20) at 1-month, 38% (± 18) at 3-months, and 45% (± 24) at 6-months. Tinnitus Handicap Inventory (THI) significantly improved from an average pre-operative score of 42 (± 26) to zero at 6 months. Quality of life measures improved overall over the post-implantation follow-up intervals.

Conclusions: Subjects with unilateral Meniere's Disease who underwent simultaneous labyrinthectomy and cochlear implantation experienced improvements in sound localization, speech understanding, tinnitus severity, and quality of life with device use. There was a trend for better performance over the postoperative intervals.

Define Professional Practice Gap & Educational Need: 1. Simultaneous labyrinthectomy and cochlear implantation provides a unique opportunity to eliminate debilitating vertigo and restore hearing in a non-aidable ear in patients with unilateral Meniere's Disease. 2. Current studies of outcomes following simultaneous labyrinthectomy and CI in Meniere's Disease are limited to retrospective studies of either bilateral disease or results part of a larger cohort. There is a current lack of prospective outcomes with consistent post-operative testing intervals.

Learning Objective: 1. To identify patients with unilateral Meniere's Disease who may benefit from simultaneous labyrinthectomy and cochlear implantation. 2. To recognize the post-operative improvement in sound localization, speech perception, and quality of life following simultaneous labyrinthectomy and cochlear implantation in patients with unilateral Meniere's Disease.

Desired Result: To expand the practice of unilateral cochlear implantation in patients with Meniere's Disease by the way of simultaneous labyrinthectomy and cochlear implantation. In addition, to provide support for future broadening of FDA approval of cochlear implantation for single sided deafness.

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

IRB: Approved

Trends in Intraoperative Testing during Cochlear Implantation

*Joshua C. Page, MD; Matthew D. Cox, MD
Blake Holloway, BS; Juliana Bonilla-Velez, MD
Aaron Trinidad, FRCS; John L. Dornhoffer, MD*

Objective: No consensus guidelines exist regarding intraoperative testing during cochlear implantation (CI) and wide variation in practice habits exists. The objective of this observational study was to survey otologists/neurotologists to understand practice habits and overall opinion of usefulness of intraoperative testing.

Study Design: Cross-sectional survey

Setting: A web-based survey was sent to 194 practicing Otologists/Neurotologists

Main Outcome Measures: Questions included practice setting and experience, habits with respect to electrodes used, intraoperative testing modalities used, overall opinion of intraoperative testing and practice habits in various scenarios.

Results: 39/194 (20%) completed the survey. For routine cases, ECAPs and EIs were most commonly used together (38%) while 33% do not perform testing at all. 89% note that testing 'rarely' or 'never' changes management. 51% marked the most important reason for testing is the reassurance provided to the family and/or the surgeon.

Conclusion: Intraoperative testing habits and opinions regarding testing during CI vary widely among otologic surgeons. The majority of surgeons use testing but many feel there is minimal benefit and that surgical decision-making is rarely impacted. The importance of testing may change as electrodes continue to evolve.

Define Professional Practice Gap & Educational Need: Lack of knowledge regarding how intraoperative testing during cochlear implantation is being used and perceived across the nation.

Learning Objective: The learner will better understand how intraoperative testing is being used across the nation and gain an understanding regarding the current opinion of intraoperative testing.

Desired Result: Our hope is that attendees may incorporate this data into his/her practice, specifically regarding use of intraoperative testing during cochlear implantation.

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

IRB: Exempt

**Treatment Outcomes of Rituximab for Intractable Otitis Media
with ANCA-Associated Vasculitis Running head:
Rituximab for OMAAV**

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Objective: To investigate treatment outcomes, hearing outcome, and adverse effects of rituximab (RTX) for intractable otitis media with antineutrophil cytoplasmic antibody (ANCA)-associated vasculitis (OMAAV).

Study design: Retrospective case review.

Setting: University hospital

Patients: Twenty-three patients who met the criteria proposed by the OMAAV study group were included. RTX was used for patients who had difficulty achieving induction of remission using glucocorticoids and intravenous cyclophosphamide.

Main outcome measures: Treatment outcomes, hearing outcome, and adverse effects

Results: Results: Six patients were treated with RTX (RTX group), while 17 patients did not require RTX for induction of remission (no RTX group). All 6 patients in the RTX group achieved remission. Age, sex, and months from onset to diagnosis were not significantly different between the RTX and no RTX groups. Hearing thresholds at diagnosis and remission were 71.7 ± 6.3 dB and 50.1 ± 5.1 dB in the RTX group, and 56.8 ± 4.8 dB and 35.8 ± 4.8 dB in the no RTX group, respectively. Hearing level at remission was significantly better in the no RTX group than in the RTX group ($p < 0.05$), while hearing gain was not significantly different between groups. Infectious complications were similar between groups.

Conclusions: Our findings suggest that RTX is effective and safe for intractable OMAAV. As hearing levels at remission were worse in the RTX group than in the no RTX group while hearing gain was similar between groups, earlier diagnosis may be needed to improve hearing outcome.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge about treatment outcomes, hearing outcomes, and adverse effects of rituximab for otitis media with ANCA-associated vasculitis (OMAAV)

Learning Objective: Rituximab is effective and safe for intractable OMAAV, and hearing gain is equivalent to glucocorticoids and/or immunosuppressants.

Desired Result: Rituximab is one of the treatment choices for intractable otitis media with ANCA-associated vasculitis (OMAAV).

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

IRB: Approved

An Evaluation of Intraoperative Testing during Cochlear Implantation from a Time and Cost Perspective

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Tristan Allsopp, MD; Saleema Karim, PhD, MBA, MHA
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Objective: To measure the time spent performing intraoperative testing during cochlear implantation (CI) and determine the impact on hospital charges.

Study Design: Prospective, blinded time study

Setting: Tertiary referral hospital

Patients: Twenty-two children (7 months-18 years old) who underwent a total of 22 consecutive primary and/or revision CI by a single surgeon from December 2016 to July 2017.

Intervention: The time spent performing intraoperative testing including evoked compound action potentials (ECAP) and electrical impedances (EI) was recorded for each case. The audiologist performing the testing was blinded to the time study. Billing information was used to determine if the testing contributed to increased operative charges to the patient.

Outcome Measures: Whether intraoperative testing contributed to increased operative charges to the patient.

Results: The average time spent testing (ECAPs/EIs in all cases) was 6.7 minutes (range: 2-26 minutes). No correlation was found between testing time and preoperative CT findings, the audiologist performing testing or the electrode type used ($p>.05$). Based on billing data including time spent in the operating room (OR), 6/22 (27%) cases incurred greater charges than if intraoperative testing had not been performed.

Conclusion: Our data suggests that intraoperative testing increases time in the OR and can contribute to increased hospital charges for CI patients. The utility of intraoperative testing in routine CI cases has been questioned and by using it selectively, costs incurred by patients and hospitals may be reduced. This is of interest in a healthcare environment that is increasingly focused on cost, quality and outcomes.

Define Professional Practice Gap & Educational Need: Lack of knowledge regarding the time it takes to perform intraoperative testing during cochlear implantation and its impact on hospital charges to patients.

Learning Objective: To share the results of our time study and cost analysis of intraoperative testing and discuss the implications each may have on practice habits.

Desired Result: Learners will better understand intraoperative testing from a time and cost perspective and how these factors impact billing and charges to patients.

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

IRB: Approved

Smoking Cessation and Risk of Hearing Loss

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Objective: To prospectively examine the relation between smoking cessation and risk of hearing loss.

Study design: Cohort study

Setting: Nurses' Health Study II

Patients: Eligible women included 81,676 participants in the Nurses' Health Study II aged 27-44 years in 1991 who provided information on smoking status in 1991, provided information on hearing loss on either the 2009 or 2013 questionnaire, and reported hearing loss with date of onset after 1991. Information on smoking and covariates was updated biennially.

Intervention(s): None

Main outcome measure(s): Self-reported moderate or worse hearing loss

Results: During 1,546,664 person-years of follow-up, 2,799 cases of moderate or worse hearing loss were reported. There was a trend towards higher risk of hearing loss among current smokers with higher cigarette/day use (multivariable-adjusted relative risk (MVRR) of hearing loss, 1-4 cigarettes/day compared with never smokers (1.03 [0.76, 1.41]), 15+ cigarettes/day compared with never smokers (1.27, [1.07, 1.51]) *P-trend*<0.001). Among past smokers, the MVRR for hearing loss was 1.18 [1.08, 1.29], compared with never smokers. There was a trend towards lower risk of hearing loss with longer time since smoking cessation (MVRR for <5 years since smoking cessation compared with never smoker 1.33 [1.07, 1.64]; MVRR for 20+ years since smoking cessation compared with never smoker 1.18 [1.05, 1.33], *P-trend* 0.006).

Conclusions: In this large, prospective cohort of US women, past smokers and current smokers had a higher risk of hearing loss compared with never smokers, and longer time since smoking cessation was associated with lower risk of hearing loss.

Define Professional Practice Gap & Educational Need: Smoking is associated with higher risk of hearing loss, but the relation between risk of hearing loss and time since smoking cessation is unclear.

Learning Objective: Risk of hearing loss decreases with longer time since smoking cessation

Desired Result: To better understand the relation between time since smoking cessation and risk of hearing loss.

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

IRB: Approved

The Cleating Stitch: An Adjunctive Technique for Percutaneous and Revision Osseointegration Screws

*Matthew M. Fort, MD; Megan E. Scarbrough, BS
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Objective: The bone anchored hearing aid (BAHA) has become a widely used and successful option in treatment of conductive and mixed hearing loss, and single sided deafness. Despite improvements in technique and cosmesis, complications remain that can result in implant revision or removal. Herein we describe a unique adjunctive technique, the cleating stitch, in placement of osseointegration screws and examine its impact on complication rates.

Study Design: Retrospective case review

Setting: Tertiary academic medical center

Patients: A total of 66 implants in 65 patients (35 male, 30 female) with an average age of 54 years (15-81 years). Average follow up 10.8 months.

Intervention: All patients underwent BAHA implant placement by a single surgeon between April 2012 to June 2017 using the linear incision or punch techniques with soft tissue reduction and placement of a cleating stitch.

Main Outcome Measure: Main outcome measures include rates of revision surgery, overgrowth, extrusion and Holgers reaction ≥ 2 . Secondary outcome measures include associations between main outcome measures and outlying factors (Obesity, Smoking, Diabetes Mellitus, Coronary Artery Disease, Age).

Results: The overall rate of revision was 3%, rate of overgrowth 1.5%, rate of extrusion 1.5%, and Holgers reaction ≥ 2 10.6%. Overgrowth and extrusion both required revision. Older age was associated with decreased risk of Holgers reaction ≥ 2 ($p=0.03$) with a Hazard Ratio of 0.95 (Confidence Interval 0.9-1.0). There were no other statistically significant associations between primary outcome measures and outlying factors.

Conclusion: The cleating stitch is an effective adjunctive technique in placement of osseointegration screws associated with low rates of overgrowth and overall revision surgery.

Define Professional Practice Gap & Educational Need: 1. Variability in surgical techniques with osseointegration devices 2. Significant complications associated with procedures

Learning Objective: Introduction/demonstration of a unique surgical technique

Desired Result: 1. Improved surgical outcomes 2. Adopting a new technique in practice

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

IRB: Approved

Soft Canal Wall Reconstruction in Modified Radical Tympanomastoidectomy for Aggressive Cholesteatoma

Karl Doerfer, MD, David R. Friedland, MD, PhD

Objective: To assess clinical outcomes of cholesteatoma surgery consisting of a modified radical tympanomastoidectomy with soft wall reconstruction (MRTMSWR).

Study design: Retrospective chart review. Level IV

Setting: Tertiary referral center

Patients: Patients with primary and recurrent cholesteatoma with ossicular involvement.

Intervention: Surgery for cholesteatoma consisting of a modified radical tympanomastoidectomy with reconstruction of the posterior canal wall with temporalis fascia.

Main outcome measures: Patients were assessed regarding recurrence of cholesteatoma, hearing status, post-operative healing, and surgical complications.

Results: 41 ears had sufficient follow-up for analysis. Only 13% of soft wall reconstructions broke down while 35% appeared as normal caliber external canals and 52% formed limited cavities. Retractions were typically over a broad front without small pockets or diverticula to trap debris. All ears achieved full epithelialization regardless of cavity formation with 91.7% achieving this before 3 months. Over 90% of ears were within 20dB of pre-operative thresholds after MRTMSWR and 38.5% of those undergoing second-look OCR were able to be improved. Despite starting with advanced disease, 61% of ears were free from disease on follow-up second-look or MRI. Of the 16 ears showing recurrent/residual disease, 69% of these had only a small foci of <5mm.

Conclusions: Treatment of aggressive cholesteatoma with a canal wall down approach does not necessarily commit the patient to a lifetime of cavity cleanings. Soft wall reconstruction affords the opportunity for rapid epithelialization, potential ossicular reconstruction, and broad retractions minimizing the risk of recurrent disease.

Define Professional Practice Gap & Educational Need: 1) Variations in practice patterns for cholesteatoma surgery 2) Lack of awareness of alternatives to canal wall down cholesteatoma surgery

Learning Objective: To understand alternative options for radical cholesteatoma surgery

Desired Result: Attendees would be able to use gain new surgical techniques and care options for cholesteatoma.

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

IRB: Approved

Novel Computer-Based Therapy Enhances Speech Perception in Cochlear Implant Users

Akshay R. Narayan, BSc

Introduction: Our main goal was to investigate if personalized auditory therapy in the comforts of patient's homes, is more effective at improving speech perception than conventional computer-based auditory therapy in cochlear implant users.

Methods: In this randomized, prospective study, candidates were split into two groups. In round one, candidates underwent testing to record the percentage of correctly identified words. In round two, they received training by listening to sentences and identifying the constituent words. If they could not identify a word correctly, the sentence was replayed identically for candidates in the first group. In the second group, emphasis was placed on the difficult words by varying its tone and pitch. In round three, they underwent testing again and the percentage of words they were able to correctly identify before and after training was compared. A paired t-test was used to look for any significant difference in the levels of improvements.

Results: There were 8 and 9 candidates in the first and second group respectively. The mean percentages for candidates in the first round of testing in the first and second group were: 50.63%(95%CI 37.3-65.2) and 53.5%(95%CI 38.1-69.3). The mean percentages for candidates in the second round of testing were 52.5%(95%CI 38.4-68.2) and 67.78%(95%CI 54.6-80.9). The mean improvement in scores was greater in those in the second group than first group($p=0.0432$).

Conclusion: Given our new computer program improves their speech perception to a greater extent, broadening the study to a larger patient population would be ideal.

Define Professional Practice Gap & Educational Need: Auditory therapy is offered post-surgery to cochlear implant users and helps them to differentiate between specific sounds, phonemes, and identify words. In the UK, there are very limited facilities for provision of auditory therapy. The main limitations of auditory therapy in the UK are twofold: 1) they mostly require face-to-face interaction which requires patients to come into healthcare centres to receive therapy and 2) computer-based programmes utilise the same pitch and tone. We are looking to explore the possibility that auditory therapy should be provided in the comforts of the patient's home and be unique to each patient's needs.

Learning Objective: 1. Auditory therapy can be provided via computer programmes 2. Auditory therapy can be tailored to each patient's unique needs 3. Auditory therapy combining the aforementioned attributes is superior to pre-existing auditory therapy

Desired Result: 1. Attendees will learn to embrace the role information technology in the provision of healthcare 2. Attendees can learn about the importance of auditory therapy in providing continuity of care to patients once they have left the hospital

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

IRB: Exempt

**Primary Middle Ear Mucosal Melanoma: Case Report
and Review of 21 Cases of Primary Middle Ear
and Eustachian Tube Melanoma in the Literature**

*Anne K. Maxwell, MD; Hiroki Takeda, MD
Samuel P. Gubbels, MD*

Objective: To present a case of primary middle ear mucosal melanoma and perform a comprehensive literature review of middle ear or eustachian tube mucosal melanoma.

Patient: A 61-year-old female presented with no prior history of melanoma and 3 months of aural fullness. A middle ear mass was identified and returned as primary mucosal melanoma upon biopsy. The mass extended from mesotympanum into hypotympanum, epitympanum, protympanum, eustachian tube and mastoid antrum. A non-enhancing expansile lesion of the petrous apex was noted on MRI additionally.

Intervention: Subtotal temporal bone resection with transotic approach to the petrous abnormality. Postoperative adjuvant radiation and immunotherapy were given.

Results: Our patient has no evidence of disease recurrence to date. Upon comprehensive literature review, patients with primary middle ear melanomas (n=10) present with otorrhea (50%), aural fullness (40%), and hearing loss (30%) most commonly, while hearing loss (81.8%) and aural fullness (54.5%) were most common symptoms for eustachian tube melanomas (n=11). Patients were treated with combinations of surgery, radiation and/or chemotherapy. Middle ear melanoma demonstrated particularly poor outcomes with 70% rate of death, 20% local recurrence, and 40% distant metastasis in the middle ear cohort, while ET origin demonstrated 9.1%, 18.2%, and 36.4%, respectively.

Conclusions: Middle ear and eustachian tube mucosal melanomas are exceedingly rare, with middle ear melanomas demonstrating a worse prognosis of the very few cases reported in the literature. Multimodality therapy is commonly used to treat patients with this disease; however, outcomes are poor with a high mortality rate amongst affected patients.

Define Professional Practice Gap & Educational Need: Lack of awareness of primary middle ear mucosal melanoma, a very rare disease, with management previously only described with isolated case reports

Learning Objective: Comprehensive review of the 21 cases of primary middle ear and eustachian tube melanoma reported in the literature with focus on presentation, management and outcomes

Desired Result: Improved awareness of this cancer, and improved ability to counsel patients regarding treatment options and outcomes

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

IRB: Exempt

Tablet-based Hearing Screening in Children Ages 5 to 17 in Rural Dominican Republic

*Dylan A. Levy, BS; Frank J. Bia, MD, MPH
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Objective: The principal aim of this study was to examine the feasibility of hearing screening using tablet audiometry among a cohort of school-aged children in rural Dominican Republic. The authors hypothesized that the tablet audiometer would serve as an expeditious means for hearing loss screening in various remote locations.

Study design: Cross-sectional.

Setting: The tablet audiometer was used in 23 remote locations in and around the city of La Romana, DR. The quietest location available in each site was used for testing.

Patients: Inclusion criteria comprised children ages 5 to 17 currently residing in the testing location. There were not exclusion criteria.

Intervention: Screening.

Main outcome measures: For each subject, air conduction thresholds were obtained bilaterally at 500, 1000, 2000, and 4000 Hz; testing duration was also measured. Hearing loss was suspected if any threshold was 30dB or greater.

Results: In this cohort, 10.4% of subjects failed the screening protocol. The mean thresholds for 500, 1000, 2000, and 4000 Hz frequencies were 26.05, 22.73, 17.57, and 17.15 dB, respectively. Of the 658 thresholds obtained at ≥ 30 dB, 81.1% were at 500 or 1000Hz. The median testing duration was 465 seconds.

Conclusions: These results suggest that children living in remote communities can be screened quickly for hearing loss using a tablet audiometer. However, significant background noise during testing negatively impacted the low frequency measurements, thus compromising test objectivity. Despite extending the reach of existing audiological services, the value of tablet audiometry is not entirely clear in rural environments with uncontrollable background noise.

Define Professional Practice Gap & Educational Need: There is currently a lack of contemporary knowledge regarding the use of tablet-based audiometers for hearing loss screening in rural communities in developing countries.

Learning Objective: The learning objective is to understand the advantages and disadvantages of using a tablet-based audiometer to screen for hearing loss among school-age children in remote communities in a developing country.

Desired Result: The attendees will apply the knowledge learned from this presentation to guide the development of outreach projects that may involve the assessment of the hearing system including, but not limited to, screening for hearing loss, in a pediatric population.

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

IRB: Approved

Clinical Doppler Optical Coherence Tomographic Imaging of Otosclerosis

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Loran Morrison; David P. Morris, MA, FRCS
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Objective: This study examines the use of Doppler optical coherence tomography (DOCT) in the diagnosis of otosclerosis.

Study design: This is an observational case-control study comparing ears with confirmed otosclerosis (N=10 ears) to normal controls (N=42 ears).

Patients: Inclusion criteria for the otosclerosis group were an air-bone gap >10dB, a history of otosclerosis in the contralateral ear and/or confirmation of otosclerosis during post-imaging surgery. Normal controls were selected for auditory thresholds within 10dB of normal and no previous history of ear disease.

Methods: Middle ear DOCT produces simultaneous 3D structural images and spatially-resolved functional measurements of the vibration of middle ear structures in response to sound. We used DOCT to measure the response of the lenticular process of the incus and the umbo to 90 dB SPL tones at 500 Hz, 1000 Hz and 2000 Hz.

Results: The best discrimination between the two groups was seen in the incus vibration at 500 Hz. Otosclerotic ears exhibited a mean incus vibration amplitude of 15.2 ± 17 nm (1σ) compared to 77 ± 55 nm for normal ears. In a receiver operator characteristic (ROC) analysis, incus vibration achieved an area under curve (AUC) of 0.91 compared to 0.74 for umbo vibration. At the optimal threshold sensitivity and specificity in detecting otosclerosis with DOCT were 0.90.

Conclusions: DOCT offers a promising new approach to diagnosing otosclerosis through spatially-resolved measurement of ossicular vibration. The increased diagnostic power observed at the incus compared to the umbo implies that DOCT may be superior to laser Doppler vibrometry for diagnosing otosclerosis.

Define Professional Practice Gap & Educational Need: 1. Lack of awareness of optical coherence tomography 2. Lack of awareness of Doppler optical coherence tomography

Learning Objective: 1. Understand the utility of Doppler optical coherence tomography for diagnosis of otosclerosis 2. Understand the potential for optical coherence tomography as a new imaging tool in otology

Desired Result: 1. Further research into new applications of OCT and DOCT 2. Clinical use of OCT as a diagnostic tool

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

IRB: Approved

**Cochlear Implant Receiver-Stimulator Migration
Using the Subperiosteal Pocket Technique:
Objective Measurements of Early and Late Positioning**

Anne K. Maxwell, MD; Stephen P. Cass, MD, MPH

Objective: Current fixation techniques for the cochlear implant (CI) receiver-stimulator (RS) may not follow recommended manufacturer surgical guidelines. We investigated RS migration using a current subperiosteal pocket technique via serial objective position measurements since prior literature provided only subjective or short-term evaluation.

Study design: Retrospective review

Setting: Tertiary referral center

Patients: 122 patients underwent 138 CIs between 2012 and 2017. Of these, at least two comparison measurements were available for 52 implants in 45 patients, 71.4% adults and 26.5% children.

Interventions: CI RS placement using subperiosteal pocket technique.

Main outcome measure: Distance between the pinna and RS magnet in the early (<6 month) and late (>6 months) postoperative period.

Results: In the early period, mean RS distance was 58.0mm (SD 10.0mm) from the pinna compared with baseline intraoperative distance of 57.0mm (SD 8.0mm), $p=0.57$. With some shifts closer and some farther from the pinna, there was a 3.4mm absolute value migration (median 2mm). 27.3% of implants migrated >5mm in the early period, 5/12 (41.7%) closer and 7/12 (58.3%) farther from pinna. In the late period, mean RS final distance was 54.8mm (SD 11.0mm), compared with its baseline of 57.2mm (SD 8.8mm), $p=0.48$. This late period mean 3.1mm shift (median 1mm) was driven by one adult patient with 2 implants that each migrated 14mm closer. All others demonstrated no or minimal migration of <5mm.

Conclusions: A subperiosteal pocket technique provides sufficient stabilization to avoid clinically significant RS migration. These small shifts were not associated with any electrode migrations or symptoms. Formal tie downs as indicated in the surgeon's manual are not required.

Define Professional Practice Gap & Educational Need: Lack of objective evidence of cochlear implant receiver-stimulator migration using a subperiosteal pocket technique. Previous reports only provide subjective reports of migration, short term follow up, or studies only in children.

Learning Objective: To bring attention to receiver-stimulator stability in both adults and children using a subperiosteal pocket technique. To make clinicians aware that objective evidence supports the assertion that formal tie down sutures or drilling bony wells as recommended by the manufacturer are not required to stabilize the implant.

Desired Result: Can use this objective evidence to make a surgical technique change to shorten operative time and increase safety of the procedure.

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

IRB: Approved

Modular High-Fidelity Otologic Surgical Simulator for the Training of Multiple Temporal Bone Procedures

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Hypothesis: Modern imaging and 3D technology may be used to create low-cost, high fidelity training simulations for otologic surgery.

Background: Cadaveric temporal bones are the current gold standard for the training of otologic procedures; however, they have their limitations, especially when training require abnormal anatomical formations. Advances in software and manufacturing processes provide a solution this limited system. Using 3D modeling and printing systems, our team has produced a surgical simulator platform for the training of multiple otologic procedures, specifically stapedotomy and cochlear implantation.

Methods: From microCT scans of cadaveric temporal bones and CT data from patients with known anatomic malformations, 3D models of middle and inner ear anatomy were generated. Models for both ‘normal’ and abnormal anatomy, such as severe otosclerosis and common cavity cochlea were created. These models may be 3D printed for rapid, low-cost manufacturing at high-resolutions. Electronic components were then included in both models to provide objective, measurable feedback of user performance.

Results: Low-cost, high fidelity simulators for the practice of stapedotomy and cochlear implant procedures on ‘normal’ and ‘abnormal’ variants could be produced. These models are reusable and allow for rapid reassembly between cases, facilitating multiple uses. Additionally, trainees may benefit from the metrics provided by the electronic components of the models.

Conclusion: We have generated a modular, high-fidelity simulator as an efficient training system for cochlear implantation and stapedotomy procedures, with the potential to be expanded to other procedures in the future.

Define Professional Practice Gap & Educational Need: Lack of awareness

Learning Objective: Efficient method of practicing otologic procedures

Desired Result: Be aware of alternative training systems to cadaveric temporal bones

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

IRB: Exempt

Electro-Natural Stimulation (ENS) in Partial Deafness Treatment: Pediatric Case Series

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Beata Dziendziel, MSc; Piotr H. Skarzynski, MSc, MD, PhD*

Objective: The aim of the study is to present pediatric cases with normal hearing in the frequencies 125– 1500 Hz and severe-to-profound hearing loss in frequencies above 1500 Hz. Cochlear implantation was conducted to restore functional hearing at high frequencies and preserve low and mid frequencies.

Study Design: Prospective clinical study based on the evaluation of hearing preservation.

Setting: Tertiary ENT center

Patients: A series of 11 children (aged 9 to 16 years old) with good functional hearing to 1.5 kHz and deafness in all other frequencies was evaluated pre- and postoperatively. All of them had a prelingual bilateral hearing loss.

Interventions: During cochlear implantation, a careful insertion of a flexible active electrode was inserted through the round window into scala tympani to a depth of 18 mm by an experienced surgeon.

Main outcomes measures: Hearing preservation was assessed according to the *Hearing Preservation Calculation* based on the pure-tone audiometry.

Result: In the 3-years observation period, the preoperative hearing threshold were completely preserved in 70% of children and partially in 30% of children.

Conclusion: As ENS patients are beyond the scope of effective rehabilitation with hearing aids, cochlear implantation seems to be a successful way of restoring hearing ability in the frequencies above 1.5 kHz. Our results are in favour of extending the inclusion criteria applied so far for this group of patients.

Define Professional Practice Gap & Educational Need: Lack of contemporary firm knowledge regarding the hearing preservation after cochlear implantation in the pediatric Electro-Natural Stimulation (ENS) group classified according to the Partial Deafness Treatment classification.

Learning Objective: To assess the hearing preservation in children with normal hearing in the frequencies 125– 1500 Hz and severe-to-profound hearing loss in frequencies above 1500 Hz.

Desired Result: The results confirm the possibility of complete hearing preservation in the majority of evaluated cases and are in favour of extending the inclusion criteria applied so far for this group of patients.

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

IRB: Approved

Spontaneous Resolution of Cholesteatoma in a Patient on Long-Term Infliximab

*Janet R. Chao, BA; Nicholas A. Dewyer, MD
Michael J. McKenna, MD*

Objective: To describe an observed case of spontaneous regression of cholesteatoma in a patient on chronic anti-tumor necrosis factor-alpha (TNFa) therapy and to inspire further research into the role of TNFa in cholesteatoma.

Patients: Case report

Intervention: Observational

Main Outcome Measure: Clinical assessment of disease

Results: A 49-year-old woman suffered a severe case of Stevens-Johnson syndrome when she was 12-years-old, leaving her with bilateral corneal opacification and tympanic membrane perforations with extensive cholesteatoma. For her corneal opacification, a corneal prosthesis was placed, which was complicated by a foreign body reaction necessitating long-term therapy with infliximab, a monoclonal antibody against TNFa that is therapeutic in some chronic inflammatory diseases. She was otherwise healthy and took no other medications. While on infliximab, the patient had spontaneous and complete resolution of her cholesteatoma, without any surgical intervention.

Conclusions: This surprising case suggests that there may be a prominent role of TNFa in cholesteatoma pathophysiology and that TNFa may be an effective target for non-surgical therapy.

Define Professional Practice Gap & Educational Need: Lack of awareness about the possibility for medical treatment of cholesteatoma and lack of contemporary knowledge about the role of anti-tumor necrosis factor-alpha therapy in the management of cholesteatoma

Learning Objective: To describe an observed case of spontaneous regression of cholesteatoma in a patient on chronic anti-tumor necrosis factor-alpha (TNFa) therapy and to inspire further research into the role of TNFa in cholesteatoma.

Desired Result: Attendees will be more aware of the potential role of medical treatment for cholesteatoma and researchers will consider possible future studies into the role of anti-tumor-necrosis-alpha therapy for cholesteatoma

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

IRB: Exempt

Use of Transcutaneous Vagal Nerve Stimulator Associated with Reversible Sensorineural Hearing Loss

Samuel A. Early MS; Konstantina M. Stankovic, MD, PhD

Objective: Transcutaneous vagal nerve stimulators (tVNSs) are indicated for treatment of refractory epilepsy in Europe, where they are available over-the-counter. We present a patient who developed sensorineural hearing loss (SNHL) after beginning to use a tVNS, and whose hearing improved upon device discontinuation.

Patient: The patient is a 58-year-old woman with dysautonomia, chronic fatigue syndrome and sarcoidosis, who started using a tVNS in her left concha and reported improvement in overall wellbeing. She previously had baseline SNHL for which she used hearing aids. She noticed a new, gradual decline in hearing on her left after several months of using tVNS.

Results: Compared to baseline hearing five months prior to starting tVNS, audiometry after 14 months of using tVNS revealed a 7dB increase in pure tone average bilaterally and reduced word recognition from 92% to 72% on the left only; right sided word recognition remained >90%. She discontinued tVNS and reported gradually improved hearing; repeat audiogram five months after discontinuation showed word recognition improvement to 98% on the left side. Electrical testing of the device revealed a small charge imbalance producing 61 nA direct current with typical use.

Conclusion: This is the first report of SNHL due to a vagal nerve stimulator. Possible mechanisms for SNHL include inadvertent stimulation of the trigeminal nerve (whose branches innervate the cochlear vasculature) through an adjacent auricular dermatome, autonomic system modulation in the setting of dysautonomia, or charge imbalance interfering with the endocochlear potential. Patients using tVNSs should be warned about the risk of SNHL due to the device.

Define Professional Practice Gap & Educational Need: Transcutaneous vagal nerve stimulators are over-the-counter devices that patients may use for a variety of indications. Side effects related to hearing have not been previously reported in the literature.

Learning Objective: To present an association between use of a transcutaneous vagal nerve stimulator and changes in hearing, and to describe possible causal mechanisms for this relationship.

Desired Result: 1. To appreciate the possible association between use of a transcutaneous vagal nerve stimulator and hearing loss 2. To highlight the need to develop better understanding of the pathway between attempted vagal nerve stimulation and cochlear end effects

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

IRB: Exempt

Is Audiometry of Diagnostic or Prognostic Use in Bell's Palsy Patients?

Yuan Jing; Shirish Johari, MBBS
Chong Yaw Khian, MBBS

OBJECTIVE: To determine if audiometry serves a diagnostic or prognostic purpose in Bell's palsy patients.

STUDY DESIGN: This is a retrospective review of the audiological results and outcomes of all patients diagnosed with Bell's palsy in a tertiary institution from 2013 to 2014. Audiometric results were reviewed at point of presentation. Asymmetric hearing threshold was defined as >20 Hz difference between left and right ear. Positive MRI findings were defined as any cerebellopontine lesion. Time to recovery was defined as achieving a House-Brackmann score of 1. Statistical analysis was performed using Statview 15.1, significance tests were 2-sided at the 5% significance level.

SETTING: Tertiary referral center.

PATIENTS: All Bell's palsy patients with no prior hearing impairment were included in the study (n=159). Mean age at presentation was 50.6yrs (16.9). Median follow-up duration was 85 days.

INTERVENTIONS: Diagnostic.

MAIN OUTCOME MEASURES: Do audiometry results correlate with severity of clinical presentation, time-to-recovery, and positive MRI findings?

RESULTS: There is no association between the audiometry results and severity of HB score at presentation ($p=0.389$). Ipsilateral pure-tone average was similar across all severities. No correlation was found between severity of audiometry results and time-to-recovery ($p=0.80$) with a median time-to-recovery of 59 days. No association was found between asymmetrical hearing thresholds and positive MRI findings ($p=0.168$). Of the 13 patients had MRI, 6 (46.2%) had symmetrical thresholds and 7 (53.9%) had asymmetrical thresholds. Of the 7 patients with asymmetrical hearing thresholds, only 1 had a positive MRI finding.

CONCLUSIONS: Audiometry is of limited diagnostic and prognostic utility in Bell's palsy, and should not be part of the routine clinical workup for the Bell's palsy patient.

Define Professional Practice Gap & Educational Need: Audiometry is often done routinely as standard practice for the Bell's palsy patient, regardless of whether patients present with hearing loss. However, there is little evidence to support the routine use of audiometry in Bell's palsy patients. To our best knowledge, no studies have been done so far in auditing the routine use of audiometry in Bell's palsy patients.

Learning Objective: At the conclusion of this presentation, participants should have an increased awareness of the standard routine workup in Bell's palsy patients, and an improved awareness when it comes to ordering audiometry for the Bell's palsy patient.

Desired Result: It is the authors' hope that attendees will come to the conclusion that routine use of audiometry in Bell's palsy patients is unwarranted and has limited diagnostic and prognostic purpose. Audiometry should not be routinely ordered for the Bell's palsy patient without clinical suspicion of hearing loss.

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

IRB: Exempt

A Volumetric Analysis of Glomus Jugulare Tumors Treated with Stereotactic Radiosurgery

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Objective: To assess the effect of stereotactic radiosurgery (SRS) on Glomus Jugulare Tumors (GJTs) over an extended follow up period.

Study Design: This retrospective study reviewed 30 adult patients with GJTs treated with SRS.

Setting: Tertiary referral center in an ambulatory setting.

Patients: Patients diagnosed with GJTs and treated with SRS were included. Mean age at diagnosis was 67.9 ± 10.7 years. 20% of patients were male and 80% were female.

Interventions: Treatment with either single or fractionated SRS, following the clinical diagnosis of a GJT.

Main Outcome Measure: A volumetric analysis was performed on initial pre-treatment and follow-up MRI images to assess tumor size over time. Tumor sizes, clinical characteristics, and treatment data were recorded using descriptive statistics.

Results: 20% of patients underwent prior subtotal surgical resection. 89.6% of patients underwent single fraction SRS and 10.4% underwent fractionated SRS. A headframe was used in 76.7% of treatments. Average follow up was 5.2 ± 3.6 years. Average pre-treatment tumor volume was $2.8 \pm 2.3 \text{ cm}^3$. Average tumor volume at most recent follow up was $2.4 \pm 2.2 \text{ cm}^3$. 90% of patients had no cranial nerve injury throughout the follow up period. 6.7% of patients developed permanent CN VII palsy, 1 of which was related to temporal bone osteonecrosis. 3.3% of patients developed permanent CN VIII disruption.

Conclusions: SRS effectively prevents GJT growth over long term follow up without significant morbidity. SRS is a safe and effective method to treat GJTs in the adult population.

Define Professional Practice Gap & Educational Need: 1. Lack of contemporary knowledge of the long-term treatment outcomes of Glomus Jugulare Tumors treated with stereotactic radiosurgery.

Learning Objective: 1. To assess the long-term effect of stereotactic radiosurgery on Glomus Jugulare Tumor growth. 2. To describe the evolving role of stereotactic radiosurgery in treatment of Glomus Jugulare Tumors.

Desired Result: Demonstrating the long term treatment outcomes in this patient population will allow for more targeted screening and interventions to minimize morbidity and optimize follow up in patients who have had Glomus Jugulare tumors treated with stereotactic radiosurgery.

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

IRB: Approved

Primary Endoscopic Stapes Surgery: Audiologic and Surgical Outcomes

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Objective: To evaluate postoperative outcomes following endoscopic stapes surgery.

Study Design: Retrospective case review.

Setting: Two tertiary otologic centers.

Patients: Eighty-five ears with stapes fixation that underwent primary endoscopic stapes surgeries.

Interventions: Endoscopic stapedotomy and stapedectomy.

Main outcome measures: Surgical and audiologic outcomes.

Results: Eighty-five subjects were included, of which 58% were female, with an average age of 44.2 years (range, 14-72 years). Patients had otosclerosis (94.1%), stapes tympanosclerosis (3.5%), congenital stapes fixation (1.2%), and traumatic stapes fracture (1.2%). The median follow-up was 10 months (range, 0.8-50 months). Despite use of the endoscope in all cases, 72.7% required scutum removal, and the chorda tympani nerve was transected in 9.1%. Two techniques were utilized, with 61.2% undergoing stapedectomy and 38.8% undergoing stapedotomy (with use of laser, drill or both in 63.6%, 36.4% and 6% of cases, respectively). The median air-bone gap (ABG) improved from 32.5 dB preoperatively to 7.5 dB postoperatively at last follow-up ($p<0.0001$). The ABG closed to <20 dB in 93.9% of patients. Comparison of the laser and drill groups showed that there was no difference between average postoperative ABG ($p=0.12$). The average postoperative bone conduction pure-tone average improved by 1.9 dB. Postoperative complications included altered taste in 27.3% of patients, 88.8% of which resolved within the first 3 months after surgery. Postoperative dizziness occurred in 21.2% of patients. There was no facial weakness.

Conclusions: Endoscopic stapes surgery is an effective technique to manage stapes fixation, with a median postoperative ABG of 7.5 dB.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge regarding the surgical and audiologic outcomes of endoscopic stapes surgery.

Learning Objective: Identify intraoperative findings and complications, postoperative complications, and audiologic outcomes of primary stapedotomy and stapedectomy with an endoscopic approach.

Desired Result: Attendees will learn that primary endoscopic stapes surgery has similar audiologic and surgical outcomes to microscopic approach. With this knowledge, attendees may elect to adopt this new approach for stapes surgery in their own practice.

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

IRB: Approved

Construct Validation of a Printed Bone Substitute in Otologic Education

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Hypothesis: A 3D printed temporal bone will permit differentiation of resident performance based on skill and experience.

Background: Patient safety, demand enhancements in training. Graduated cadaveric bone exposure is fundamental to the Otologic training process. Printed bone provides a lower cost, anatomically consistent alternative as an adjunct in trainee skill evolution.

Methods: Cadaveric bone microCT images are digitally deconstructed to allow removal of residual print material and penetration of hardening infiltrant. Reassembly of a complete printed bone structure is facilitated by digitally generated fiducials. Nineteen residents (11M,8F) from nine graduate programs, attending a National Otolaryngology Conference completed a mastoidectomy with posterior tympanotomy on identical 3D printed bone models and a Likert Scale [1-7] survey on subjective appreciation of the simulation. Four experts graded participant performance using the previously validated Welling Scale.

Results: ANOVA revealed significant performance differences between the junior/ intermediate and junior/senior PGY cohorts ($p < 0.05$). No difference was observed between intermediate/senior cohorts ($p > 0.05$) based on PGY or subjective mastoid experience. Printed bone was judged similar to cadaveric in drill quality (5.22 ± 0.92). The simulation was considered a beneficial training tool for mastoidectomy (5.87 ± 0.79), posterior tympanotomy (5.45 ± 1.54) and approaches to the skullbase (5.52 ± 1.42). Participants believed the simulation would improve surgical performance (5.78 ± 1.09), comfort with actual patients (5.78 ± 1.10) and operative speed (5.83 ± 1.31).

Conclusions: The printed bone compared favorably to cadaveric. The simulation demonstrated positive construct validity but was challenged in differentiating senior trainee performance, possibly owing to fidelity of the grading scale or sample size.

Define Professional Practice Gap & Educational Need: 1. Evaluation of trainee aptitude is problematic 2. Previous attempts at validation suffer from variability in the cadaveric models used for dissection.

Learning Objective: At the conclusion of this presentation, participants should understand the generation of internally accurate rapid prototyped temporal bone models with patent air cell reproduction and be aware of the option for use in surgical training.

Desired Result: The printed bone compared favorably to cadaveric. The attendees can use the 3D printed bone for the surgical training purposes. They should consider comfort with actual patients and also operative speed.

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

IRB: Approved

Evaluation of Trainee Drill Motion Patterns during Temporal Bone Simulation with a 3D Printed Model

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Hypothesis: Resident surgeon drill motion patterns during dissection of a printed and cadaveric temporal bone model are anticipated to be dissimilar owing to material properties.

Background: Virtual haptic and physical printed temporal bone simulations are commonly used to augment cadaveric training. Assessment of these tools is ongoing with a strong trainee preference for physical simulations. Trainees using virtual haptic models illustrate disparate drill motion patterns when compared to cadaveric opportunities. This has the potential to result in maladaptive skill development.

Methods: Resident surgeons dissected both printed bones generated from micro CT data and cadaveric specimens. Skill assessment was clustered into cortical mastoidectomy, thinning procedures (sigmoid sinus, dural plate, posterior canal wall) and development of a posterior tympanotomy. A magnetic position tracking system (TrakSTAR, Ascension) captured drill position and orientation at 200Hz. Dissection was performed by 8 trainees (n=5<PGY3>n=3) using kcos-metrics to analyze drill strokes within position recordings.

Results: T-tests between models showed no significant difference in drill stroke frequency (cadaveric=1.36/s, printed =1.50/s p=0.420) but demonstrate significantly shorter duration (cadaveric=0.37s, printed =0.16s p<0.05) and a higher percentage of curved strokes (cadaveric=31, printed=67 p<0.05) used in printed dissection procedures. Junior staff used a higher number of short strokes (junior=0.54, senior=0.38, p<0.05) and higher percent of curved strokes (junior=35%, senior=21%, p<0.05).

Conclusion: Significant differences in hand motions were present between the cadaveric specimens and printed simulations, questioning the employ of printed simulations as viable teaching instruments. Junior staff appears to adopt a more cautious approach to dissection.

Define Professional Practice Gap & Educational Need: 1. Lack of information regarding resident surgeon drill motion patterns during dissection of a printed and cadaveric temporal bone model 2. Difference between the performance of different PGY cohorts is challenging.

Learning Objective: At the conclusion of this presentation, participants should understand the generation of internally accurate rapid prototyped temporal bone models with patent air cell reproduction and be aware of the option for use in surgical training.

Desired Result: The attendees should be aware of significant differences in hand motions between the cadaveric specimens and printed simulations and evaluate their performance during drill motion on both cadaveric and 3D printed bone temporal bone model.

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

IRB: Approved

Initial Hearing Preservation Outcomes of Cochlear Implantation with a Slim Perimodiolar Electrode Array

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Objective: To assess the slim perimodiolar array as a hearing preservation electrode in cochlear implantation (CI)

Study design: Retrospective chart review

Setting: Tertiary referral center

Patients: All adult, post-lingual CI recipients implanted with a slim perimodiolar array from Sept 2016 to Sept 2017

Intervention(s): Cochlear implantation

Main outcome measure(s): Hearing preservation (HP). Baseline audiograms were obtained at initial CI evaluation. Patients with a threshold ≤ 70 dB in at least one low frequency (LF) (125Hz, 250Hz, 500Hz, 750Hz, or 1000Hz) were considered HP candidates. Postoperative audiograms were obtained before activation. Successful HP was defined as retention of any LF threshold ≤ 70 dB. A LF pure tone average (LFPTA) (125Hz, 250Hz, 500Hz, 750Hz, and 1000Hz) was calculated and the Δ LFPTA from pre- to post-operative state was used to stratify patients into three groups: full (≤ 15 dB), partial (16-30dB), or unsuccessful HP (>30 dB).

Results: 48 patients received the slim perimodiolar array, and 29 were HP candidates. Post-operative audiograms were obtained an average of 28 days after surgery. 55% of HP candidates retained at least one LF threshold of ≤ 70 dB. Mean Δ LFPTA was 24dB. Successful HP was achieved in 62% (45% full, 17% partial, 38% unsuccessful HP). Most of the HP failures occurred in the first 6 months of surgeon experience, suggesting a learning curve with the device. One patient (2%) experienced device deployment failure, requiring use of an alternative electrode array and resulting in complete hearing loss.

Conclusions: The slim perimodiolar array is effective at immediate hearing preservation after cochlear implantation.

Define Professional Practice Gap & Educational Need: Lack of knowledge of outcomes of a new device

Learning Objective: To better understand hearing preservation outcomes with use of the slim perimodiolar array

Desired Result: We hope that this will influence attendees practices when choosing hearing preservation cochlear implantation strategies. We hope that this can improve hearing preservation options for patients.

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

IRB: Approved

Recidivism after Endoscopic Treatment of Cholesteatoma

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Objective: The endoscope has gained favor in treating cholesteatoma due to its improved visualization. The purpose of this study is to investigate recidivism of cholesteatomas treated endoscopically.

Study Design: Retrospective chart review

Setting: Tertiary Care Center

Patients: Adult patients with cholesteatomas treated endoscopically and one year of follow-up.

Intervention: Use of the endoscope for cholesteatoma dissection.

Main outcome measure: Residual cholesteatoma on second look surgery/MRI and recurrence on clinical exam.

Results: 37 patients with cholesteatoma treated endoscopically were analyzed. The mean age was 48.1 years (SD 16.6). Mean follow-up time was 19.9 months (SD 7.5). 70.3% of patients were treated with totally endoscopic transcanal tympanoplasty and cholesteatoma removal, and 29.7% underwent endoscopic middle ear dissection in combination with mastoidectomy. The overall recurrence rate was 18.9%. Of the 24 patients who had an MRI or second look surgery, 12.5% had residual disease. The overall recurrence rate at last follow-up was 10.9%. The mean word recognition score worsened by 2.4% (SD 26), but the mean pure tone average and mean air-bone gap improved by 10.5 dB (SD 14.8) and 8.9 dB (SD 12.7), respectively. Mean OR time was 194.3 minutes (SD 62.2). Complications included external auditory canal (EAC) stenosis (8.1%), residual perforation (8.1%), taste disturbance (8.1%), myringitis (5.4%), facial paresis (HB 2 at last visit) (2.7%), tragal hematoma (2.7%), tragal cellulitis (2.7%), EAC erosion (2.7%), and deep venous thrombosis (2.7%).

Conclusions: Cholesteatoma can be treated endoscopically with acceptable control rates with potentially less need for mastoidectomy.

Define Professional Practice Gap & Educational Need: Lack of knowledge about the recidivism of cholesteatoma treated endoscopically.

Learning Objective: Improve understanding of results of endoscopic treatment of cholesteatoma.

Desired Result: Attendees will have further understanding about the efficacy of endoscopic treatment of cholesteatoma.

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

IRB: Approved

Transcanal Endoscopic Tympanoplasty – Our Results

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Objective: To evaluate the outcomes of endoscopic transcanal tympanoplasty.

Study design: Retrospective clinical study

Setting: Tertiary referral center

Patients: 100 consecutive patients (adults and children) with tympanic membrane perforation without cholesteatoma who underwent tympanoplasty endoscopically.

Intervention: Transcanal endoscopic tympanoplasty for central or marginal tympanic membrane perforation. Tragal cartilage with perichondrium or Alloderm was used as underlay graft. Pre op and 3 months post op audiogram analyzed

Main outcome measure(s): Perforation closure, graft success and audiological improvement in hearing 3 months post op.

Results: Data of 93 ears was analyzed (7 ears were excluded as they did not have 3 month post audiogram). 3 children (3 ears) and 1 adult (1 ear) had residual perforation at 3 months post op. One child and two adults (3 ears) healed initially but developed recurrent perforation within one year. Out of 7 failures, Alloderm was used in 5 ears. Mean pure tone average and air bone gap showed statistically significant improvement. None of no patients had any complication.

Conclusions: Trans canal endoscopic ear surgery is a safe option with good surgical outcomes for management of tympanic membrane perforation. Tragal cartilage graft heals well with good audiologic improvement. Re perforation in cases with Alloderm graft is higher than cartilage. Long term follow up is necessary to compare success of different graft material.

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

Learning Objective: Trans canal endoscopic ear surgery is a safe option with good surgical outcomes for management of tympanic membrane perforation. Tragal cartilage graft heals well with good audiologic improvement.

Desired Result: Improve their use of endoscopes during tympanoplasty surgeries.

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

IRB: Approved

A Critical Analysis of the Information Available Online for Ménière's Disease

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Michael Carron, MD*

Objective: Physicians should be aware of the online information freely available to patients regarding Ménière's disease in order to provide quality care. This study analyzes the reliability, quality, and readability of internet sources regarding Ménière's disease using validated evaluation instruments.

Data sources: A Google search was performed using the keyword "Meniere's disease" in January 2017. The first five pages of results in English were included in this study. Websites were divided into 4 categories of publication: professional organization, academic, physician, and unidentified

Study selection: Any websites that provided information regarding Ménière's disease were considered for inclusion in this study. Excluded were any websites that were nonfunctional, unrelated to Ménière's disease, videos, and websites that required login credentials

Data extraction: The reliability, quality, and readability of websites from these four groups were then compared. The validated DISCERN instrument was used to measure reliability and quality, while the validated Flesch-Kincaid Grade Level was used to measure readability.

Data synthesis: Comparison of continuous variables was performed using Mann-Whitney U-tests, with threshold for significance set at $p < 0.05$.

Conclusions: Online information regarding Ménière's disease is deficient in both reliability and quality. Both academic and professional organizations should strongly consider publishing high-quality, easily-understood Ménière's disease literature that is freely available online in order to fill the current void. Physicians should likewise be aware of the current lack of readable, high-quality information available to patients online and be prepared to discuss possible strategies to avoid misinformation with their patients.

Define Professional Practice Gap & Educational Need: Lack of awareness

Learning Objective: Our goal is to make the physician community aware of the overall poor quality of information available online regarding Meniere's disease.

Desired Result: Our short term goal is to have attendees apply the knowledge learned from the presentation to help guide patients to better online material. We found that both professional and academic organizations scored the highest in the multiple categorized we used to grade each website, so hopefully the attendee can take a moment to mention to the patient to focus on these types of websites when they are reading information about Meniere's disease online. Our long term goal is to hopefully inspire both academic and professional organizations to publish better online material on Meniere's disease.

Level of Evidence - Does not apply, this was a review of the available online literature regarding Meniere's disease

IRB-Exempt

Neuroendocrine Tumors of The Middle Ear: A Multi-Institutional Study of 33 Cases

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Objective: To-date, less than 150 cases of middle ear neuroendocrine tumors (MENT) have been reported in the English literature, and considerable controversy exists surrounding their clinical behavior. This study aims to provide a contemporary multicenter examination of these rare lesions.

Study Design: Multi-center retrospective review.

Setting: Six tertiary referral centers.

Patients: Thirty-three patients with pathologically confirmed MENT.

Intervention: Surgical resection +/- adjuvant therapy.

Main Outcome Measures: Preoperative clinical features, intraoperative findings, recurrence-free survival, and malignant potential.

Results: Twenty-one (64%) patients presented with primary disease, while 12 (36%) were referred for management of residual/recurrent disease. The median year-of-diagnosis was 2011 (IQR, 2008-2015) with an average clinical follow-up of 45 months (IQR, 12-64). The median time-to-diagnosis following onset of symptoms was 12 months (IQR, 6-48). Ninety-percent of patients presented with progressive hearing loss, while no patient displayed evidence of cranial neuropathy at time of diagnosis. Temporal bone paraganglioma (31%) and cholesteatoma (19%) represented the most common initial clinical diagnoses before surgery. Intraoperatively, tumors often exhibited dense adherence to surrounding critical structures. Two patients (10%) who presented with primary disease experienced recurrence, both of whom were initially treated with gross-total resection. The median time-to-recurrence for the entire cohort was 72 months (IQR, 39-108). Malignant transformation occurred in two patients (6%).

Conclusions: MENTs exhibit a proclivity for dense adhesion to surrounding critical structures. Nonetheless, recurrence among patients presenting with primary disease remained low in this cohort. MENTs have the potential for malignant transformation, and this feature necessitates long-term clinical follow-up.

Define Professional Practice Gap & Educational Need: Neuroendocrine tumors of the middle ear are rare with fewer than 150 reported cases in the English literature. As a result, significant controversy exists surrounding the most appropriate classification as well as the clinical behavior of these lesions. Further, many of the reported cases pre-date key developments in disease classification (eg, recognition of endolymphatic sac tumors as a unique entity). Therefore, there exists a lack of contemporary knowledge examining these tumors and their management.

Learning Objective: (1) Describe the typical clinical manifestations of neuroendocrine tumors of the middle ear. (2) Recognize the intraoperative challenges posed by neuroendocrine tumors of the middle ear. (3) Describe the management strategies for patients treated with gross-total and sub-total resections. (4) Recognize the risk for disease recurrence and potential for malignant transformation. (5) Understand the contemporary classification of neuroendocrine tumors of the middle ear in light of their varying historical designations.

Desired Result: Attendees will gain knowledge that will facilitate accurate diagnosis and operative planning. Attendees' knowledge surrounding management of subtotal resections, disease recurrence, and the possibility of malignant transformation will facilitate improved long-term patient outcomes. Attendees' understanding of the contemporary classification of neuroendocrine tumors of the middle ear will facilitate their interpretation of previous literature and guide future patient-care and research.

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

IRB-Approval

Prevalence of Cranial Nerve Imaging Abnormalities in Patients with Hereditary Peripheral Neuropathies

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Objective: To estimate the prevalence of intracranial imaging findings, with particular attention to cranial nerves at the skull base, and associated symptoms in patients with hereditary peripheral neuropathies.

Study Design: Multicenter retrospective review.

Setting: Four tertiary academic medical centers.

Patients: 29 patients with hereditary peripheral neuropathy diagnoses who have had magnetic resonance imaging (MRI) of the brain. Patient demographics, hereditary peripheral neuropathy diagnosis type, imaging indication, and symptoms were tabulated and analyzed.

Intervention(s): Contrast-enhanced MRI sequences were reviewed in detail using axial, coronal and sagittal planes.

Main Outcome Measure(s): Prevalence of intracranial cranial nerve (CN) abnormalities, including enhancement and thickening; presence or absence of associated cranial nerve deficits.

Results: Among 29 patients, 8 had CN abnormalities on imaging (27.6%). All 8 patients had enhancement and/or thickening of the CN VII/VIII complex in the internal auditory canal (5/8 unilaterally, 3/8 bilaterally), with 1 patient also having unilateral thickening of CN V. Only 2/8 patients had unexplained CN deficits, each with sensorineural hearing loss and tinnitus. Another patient had an unexplained unilateral CN IV palsy without associated imaging abnormalities.

Conclusions: Hereditary peripheral neuropathies are a heterogeneous group of rare genetic conditions characterized by peripheral motor and sensory deficits. Intracranial involvement has largely been limited to single patient case reports. Our data however suggests that CN involvement in these patients is not uncommon, although it is infrequently associated with symptoms of CN deficit. CN imaging abnormalities in patients with hereditary peripheral neuropathies are unlikely to require surgical management and instead are likely reflective of the underlying neuropathy.

Define Professional Practice Gap & Educational Need: 1. Lack of contemporary knowledge about intracranial involvement in, and manifestations of, hereditary peripheral neuropathies 2. Lack of awareness that cranial nerve imaging abnormalities in patients with hereditary peripheral neuropathies may not be reflective of tumor

Learning Objective: 1. Hereditary peripheral neuropathies can manifest with cranial nerve involvement on imaging although it may not translate to a phenotype of cranial nerve deficit. 2. To learn that cranial nerve imaging abnormalities in patients with hereditary peripheral neuropathies may just be reflective of the patient's underlying neuropathy.

Desired Result: Physicians managing hereditary peripheral neuropathies will learn about the prevalence of cranial nerve involvement and surgeons who receive referrals of these patients will learn that their cranial nerve imaging abnormalities may not require surgical management.

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

IRB: Approved

Incus Position of Stapes Prosthesis Affects Sound Transmission in Human Cadaveric Temporal Bones

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Hypothesis: Specific position of the stapes piston prosthesis along the incus long process influences sound-induced displacement magnitude.

Background: During reconstruction following stapedotomy, a wire piston prosthesis placed over the incus and through the fenestrated footplate can reestablish sound transmission to the inner ear. Little is known, however, about how the discrete position of the wire along the length of the incus long process affects ossicular sound transmission.

Methods: Cadaveric temporal bones without history of otologic disease underwent laser stapedotomy through a facial recess approach, maintaining an intact tympanic membrane. Stapes prosthesis was placed within the fenestrated footplate and crimped at three different locations (distal, middle and proximal), each 1 mm apart as measured from the end of the incus long process. Pure tone sound (200-10kHz) induced displacement measurements were obtained by laser Doppler vibrometry (LDV) at each incus long process position.

Results: Prosthesis position influenced sound induced displacement in reproducible ways across the tested frequency range. The middle and distal positions demonstrated up to 4x greater displacement between 1k-4kHz compared to proximal position. Above 6 kHz, middle and distal positions delivered, on average 2x greater displacement than proximal positioning. Anatomic variability in incus long process position was observed between specimens.

Conclusion: The position of stapes prostheses along the incus long process in stapedotomy affects sound induced motion. Middle and distal positioning tend to result in higher displacement magnitude than proximal positioning. These findings have implications for intraoperative positioning of stapes prostheses. Further studies are required to determine if position influences audiometric outcomes in humans.

Define Professional Practice Gap & Educational Need: Little is known about how the incus position of a wire/piston stapes prosthesis affects sound induced motion after stapedectomy. To maximize sound conduction, especially at mid and high frequencies, optimal positioning of the prosthesis may afford improved audiometric results.

Learning Objective: Understand how the relative position of the stapes piston along the incus long process affects sound induced motion of the prosthesis.

Desired Result: Knowledge of the sound transmission effects of stapes prosthesis position will help guide surgical planning in stapedectomy.

Level of Evidence: Does not apply, Basic science report

IRB: Exempt

Cochlear Implantation in Pediatric Single Sided Deafness

*Justin D. Miller, MD; Lisa R. Park, AuD
Holly F. Teagle, AuD; Erica Gagnon, AuD
Jennifer Woodard, AuD*

Objective: Cochlear implantation in the setting of single sided deafness has been demonstrated to result in improved speech in noise, sound localization and quality of life in adults. Limited studies to date have examined cochlear implantation in pediatric single sided deafness (SSD). The objective of this study was to evaluate outcomes of cochlear implantation for asymmetric hearing loss/SSD in children.

Study Design: Retrospective case review

Setting: Tertiary referral center

Patients: Children (age 0-12) with asymmetric hearing loss with no worse than moderate loss in the better ear.

Intervention: Unilateral cochlear implantation between years 2014-2015

Main Outcome Measures: Age at implantation, age at hearing loss, sound localization error, pre-operative, 1 and 2 year speech recognition outcomes of implanted and contralateral ears. Ratios of implanted ear word scores to contralateral ear word scores were calculated.

Results: Seven patients underwent cochlear implantation for single sided deafness. As different tests were used at different stages of subjects' development, ratios of the implanted ear to normal ear word scores were created. Pre-operative ratios of implanted ear word recognition scores (WRS) to contralateral ear WRS had a mean of 0.02(range 0-0.14). One year WRS ratios had a mean of 0.80(range 0.45-1.09) and two year WRS a mean of 1.0(0.41-1.31). Mean RMS error with devices turned off was 56.3(range 41-72) and 30.7(16-41) with devices on.

Conclusion: Pediatric SSD patients with normal or near-normal hearing in the contralateral ear experienced significant improvement in word recognition scores up to 2 years post-implant and demonstrated substantial improvement in localization scores.

Define Professional Practice Gap & Educational Need: Lack of knowledge of potential benefit of cochlear implantation in the setting of single sided deafness. Specifically, the significant benefit received by children and significant impact on development and learning after pediatric cochlear implantation for single sided deafness.

Learning Objective: To understand the benefits of cochlear implantation for asymmetric hearing loss/single sided deafness in children. Additionally, to understand the importance of age at implantation with regard to hearing outcomes.

Desired Result: To further advance the indications for cochlear implantation in the situation of asymmetric hearing loss/single sided deafness, and to have a better understanding of appropriate indications for implantation and post-operative expectations.

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

IRB: Approved

Awake Trans-Tympanic Membrane Otoendoscopy for Diagnosis of Stapedial Myoclonus

*Elliott Kozin, MD; Eric Barbarite, MD
C. Eduardo Corrales, MD*

Objective: Stapedial myoclonus is the rhythmic contraction stapedius muscle that can result in a host of symptoms, including tinnitus. There is a dearth of robust diagnostic modalities for stapedial myoclonus, and most patients are treated without a definitive diagnosis. Herein, we hypothesize that stapedial myoclonus can be readily diagnosed by awake otoendoscopy.

Study design: Case report

Setting: Tertiary care center

Patient: 21-year-old male professional singer described five years of “thumping” tinnitus, which was triggered by singing. His right ear was more symptomatic than left. Work-up, including otologic exam, audiometry, stapedial reflex testing, and imaging of the temporal bone, was unrevealing. Stapedial tendon myoclonus was suspected.

Intervention: Awake transtympanic membrane otoendoscopy in the operating room to evaluate stapedial tendon, followed by transection of the stapedial tendon.

Main outcome measure: Resolution of tinnitus.

Results: While awake in the operating room, a 2mm inferior myringotomy was made, and a 1.9mm 0 and 30 degree 3-CCD Hopkins rod endoscope was used to visualize the stapedial tendon. On vocalization by the patient, there was movement of the tendon that corresponded with the timing of his tinnitus. The patient subsequently underwent transection of the stapedial tendon and removal of pyramidal eminence under general anesthesia. The patient had resolution of his symptoms, and he underwent a successful identical procedure on the contralateral ear three months later.

Conclusions: We describe a case of stapedial myoclonus that was diagnosed by transtympanic otoendoscopic in an awake patient. This approach may be readily applied in patients suspected of having stapedial myoclonus.

Define Professional Practice Gap & Educational Need: Stapedial myoclonus can result in a host of symptoms, including tinnitus; however, there is a dearth of robust diagnostic modalities.

Learning Objective: In this presentation, we will present a method to diagnose stapedial myoclonus.

Desired Result: Attendees will be able to apply the techniques learned in the presentation to diagnose stapedial myoclonus

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

IRB: Exempt

Long term Otologic Outcomes Following Blast Injury: The Boston Marathon Bombings

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Objective: Blast-related otologic trauma was the most common physical injury sustained at the Boston Marathon Bombings on April 15th, 2013. In this follow-up study, we aim to 1) report long-term tympanoplasty results from traumatic perforations, 2) understand long-term audiologic effects of blast injury, and 3) quantify long-term changes in audio-vestibular quality of life among affected individuals.

Study Design: Multi-institutional, prospective cohort study

Setting: Tertiary Referral-Center

Patients: Individuals sustaining otologic trauma at the 2013 Boston Marathon Bombings

Interventions: Tympanoplasty, audiometry and quality of life assessment

Main Outcomes measures: Tympanoplasty closure rate, high-frequency pure tone thresholds and hearing, tinnitus, dizziness handicap inventory

Results: Of the more than 90 patients identified at the time of the initial study, long-term follow up data was available in 41 patients. The most common ongoing complaints were hearing loss and tinnitus. Of 62 initial perforations in 48 patients, spontaneous healing was observed in 20 ears. Twenty-six patients underwent tympanoplasty with a revision rate of 15.4%, including two patients with late failure. High frequency bone conduction thresholds were not significantly elevated in long-term follow up when compared to initial thresholds. Quality of life scores for hearing, tinnitus and dizziness demonstrated ongoing, severe impairment in participants responding at 48 months.

Conclusion: Four years following the Boston Marathon bombings, audio-vestibular quality of life remains impaired in survivors, despite a lack of distinct audiometric changes on standard testing. Further audiometric evaluation using advanced techniques may reveal objective findings due to blast induced inner ear trauma.

Define Professional Practice Gap & Educational Need: The long-term effects of blast injury to the ear are poorly understood. Durability of tympanoplasty for blast induced perforations, progressive changes in sensorineural hearing after acoustic trauma and long-term audio-vestibular quality of life are not well described in patients having been exposed to blast trauma.

Learning Objective: To improve understanding of the unique long-term challenges faced by individuals suffering from blast related otologic trauma. Specifically, tympanoplasty outcomes, sensorineural hearing loss and audiovestibular quality of life will be addressed.

Desired Result: Knowledge gained from this presentation should help guide participants to recognize the unique characteristics of blast related otologic trauma and direct appropriate long-term diagnostic and therapeutic care.

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

IRB: Approved

Partial Auricular Reconstruction After Dog Bites in Children: Building Bridges and Not Burning Them

Erin K. Haser, MD; Andrew R. Scott, MD

Objective: To demonstrate the impact of initial management of partial auricular avulsions on downstream reconstructive options and outcomes through the description of a case series of children with varying degrees of auricular avulsions due to dog bites.

Study design: Case series

Setting: Single tertiary medical center

Patients: Three pediatric patients with partial auricular avulsions from dog bites.

Background: Auricular injury caused by dog bites may range from laceration without tissue loss to skin avulsion or partial amputation. Partial avulsion of the auricle can be a reconstructive challenge due to the contours of the ear formed by the underlying cartilage. The antihelix and scaphoid fossa are particularly challenging. Management strategies at the time of injury impact the degree of reconstruction needed in follow-up.

Results: Three pediatric patients with varying degrees of partial auricular avulsions from dog bites are described. Initial management included use of the amputated tissue as a composite graft as well as burying exposed cartilage in a post-auricular pocket. Their clinical course and final outcome are described with accompanying pictures. All three patients had excellent outcomes due to the preservation of the antihelix and scaphoid fossa in the initial care of the patient.

Conclusions: On initial encounter of a partial auricular avulsion, it is imperative the provider takes all measures to preserve the antihelix and scaphoid fossa. While more time consuming, maximizing the cartilage preserved will provide the reconstructing surgeon with a scaffold on which to build and may obviate the need for more extensive and invasive grafts.

Define Professional Practice Gap & Educational Need: Management strategies for partial auricular avulsion from dog bites in pediatric patients may vary at the time of injury. Some providers favor cartilage trimming and primary closure while others prefer to conserve residual exposed cartilage or amputated cartilage by burying it in a post-auricular well-vascularized pocket with plans for a second stage procedure. This case series demonstrates the importance of conservation of cartilage at the time of injury on the reconstructive outcomes.

Learning Objective: 1. To understand the importance and feasibility of cartilage preservation during the initial management of pediatric auricular trauma from dog bites with specific attention to the antihelix and scaphoid fossa. 2. To understand the goals of reconstruction of the auricle and reconstructive options as described in the literature.

Desired Result: Our hope is that attendees will understand the importance and feasibility of preserving as much cartilage as possible in the initial management of a partial auricular avulsion in the pediatric patient, with special attention to salvage of the antihelix and scaphoid fossa. While the physician initially taking care of the patient may not necessarily perform the final reconstruction of the auricle, they play a key role in the patient's final outcome by preserving cartilage. This may save the patient from needing more invasive reconstruction later.

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

IRB: Exempt

Radiographic Opacification of the Protympanum and Eustachian Tube Predicts Inferior Hearing Outcomes after Ossiculoplasty

*Joseph T. Breen, MD; Gavriel D. Kohlberg, MD
Ravi N. Samy, MD; Myles L. Pensak, MD*

Objective: To examine the relationship between the radiographic finding of Eustachian tube and protympanic opacification and hearing outcomes after ossiculoplasty.

Study design: Retrospective case review.

Setting: Academic medical center.

Patients: Adults and children undergoing primary or staged ossiculoplasty after surgery for cholesteatoma. Patients with additional causes of conductive hearing loss (e.g. inner ear fistula, stapes footplate fixation), patent tympanostomy tubes, or tympanic membrane perforations were excluded. Preoperative CT scans were reviewed to determine whether the protympanum and bony Eustachian tube were aerated, partially opacified, or completely opacified.

Intervention: Ossiculoplasty with artificial or autologous prostheses.

Main outcome measures: Air conduction thresholds and air-bone gaps (ABGs) on preoperative and postoperative pure tone audiometry.

Results: Eighty-one patients met inclusion criteria. Complete or partial CT opacification of the protympanum and bony Eustachian tube was seen in 29 subjects. Opacification was strongly predictive of a larger postoperative ABG (24.8 dB vs 17.9 dB, $p < 0.01$). When examining the 58 patients with a preoperative ABG >20 dB, opacification was not correlated with higher preoperative ABG (31.2 dB vs 30.6 dB, $p = 0.78$), but predicted a higher postoperative ABG (26.5 dB vs 20.3 dB, $p = 0.027$) as well as a lower probability of an acceptable ossiculoplasty outcome, defined as ABG <20 dB (37.3% vs 57.6%, $p = 0.03$).

Conclusions: For patients with cholesteatoma who undergo ossiculoplasty, preoperative radiographic opacification of the protympanum and bony Eustachian tube is an independent predictor of poor hearing outcomes.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge regarding how CT scan findings can be used to help predict hearing outcomes after ossiculoplasty.

Learning Objective: The learner will understand the impact that opacification of the bony Eustachian tube and protympanum has on the air-bone gap after ossiculoplasty.

Desired Result: Surgeons will be able to better predict postoperative air-bone gaps and counsel their patients who undergo ossiculoplasty.

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

IRB: Approved

Window Shade Tympanoplasty Technique for Anterior Membrane Perforations: An Update

*Elizabeth A. Mannino, Andrew Bluher, MD
Barry Strasnick, MD*

Objective: Anterior marginal perforations present unique challenges in the repair of tympanic membranes. Traditional underlay and overlay techniques are complicated by poor visualization and graft blunting, respectively. The “window shade” tympanoplasty technique was developed to address these issues. The aim of the present study is to demonstrate the efficacy of the window shade technique in the largest series thus far.

Study design: We present a retrospective review of pediatric and adult patients ranging from 6 to 76 years old who have undergone a window shade tympanoplasty from 1994 to 2016 by a single surgeon at a tertiary referral center. Indications for surgery included anterior marginal tympanic membrane perforation with or without cholesteatoma.

Intervention: The “window shade” technique employs a laterally-based anterior skin flap, incorporating the tympanomeatal flap, residual tympanic membrane, anterior fibrous annulus and anterior canal wall skin. Such a flap allows for excellent visualization of anterior perforations while using the anterior fibrous annulus as an anchor to avoid issues with blunting occasionally observed in lateral graft techniques.

Main outcome measures: The main outcome measures were graft take success rate, postoperative complications, and postoperative air bone gap values.

Results: Post-operative outcomes of 412 patients were assessed. The graft take success rate was 94.2%, with only 4.6% of the patients experiencing postoperative complications. Postoperative air-bone gap values below 10 dB were present in 96.2% of patients.

Conclusions: The results of this study further reinforce the success of the window shade technique in repairing marginal tympanic membrane perforations.

Define Professional Practice Gap & Educational Need: Various tympanoplasty techniques have been utilized for membrane perforations. However, these techniques are not always ideal for anterior membrane perforations. The “window shade” technique has been developed to address some of the complications associated with the other techniques and has been successful in repairing these perforations. The degree to which this technique has been adopted is unclear; only one other paper has been written on the subject since the original description of the technique. We seek to demonstrate the technique’s efficacy and increase awareness of its applications to anterior marginal perforations.

Learning Objective: The objective is to demonstrate the efficacy of the “window shade” tympanoplasty technique for anterior membrane perforations.

Desired Result: Attendees will have increased awareness of a surgical technique tailored to the unique challenges presented by anterior membrane perforations. Adopters of the technique will be able to avoid many of the complications associated with other tympanoplasty techniques.

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

IRB: Approved

The Potential for Preserved Cochleovestibular Function in the Setting of Prolonged Pneumolabyrinth

*Joseph T. Breen, MD; Alex D. Sweeney, MD
Jeffrey T. Vrabec, MD*

Objective: To discuss the natural history and management of pneumolabyrinth.

Design: Case series and literature review.

Setting: Two academic medical centers.

Intervention: Documentation of pneumolabyrinth on CT imaging with subsequent surgery or observation.

Methods: Individuals with pneumolabyrinth on imaging were evaluated. Inner ear function is documented with audiometry and vestibular testing.

Results: All patients presented with severe hearing loss following blunt trauma with or without temporal bone fracture (3 cases), penetrating trauma (1 case), or stapedectomy (3 cases). Late pneumolabyrinth, defined as air in the labyrinth more than 1 month after the initial injury, was detailed in four cases with resolution of vestibular symptoms and partial recovery of hearing after surgery in two cases. Two patients with additional inner ear abnormalities (enlarged vestibular aqueduct, prior otic capsule-violating temporal bone fracture) were observed to have continuous egress of CSF through the oval window at the time of surgery.

Conclusion: Management of pneumolabyrinth is individualized based on the mechanism of injury, severity of symptoms, and timing of the imaging study. In most cases, the defect is expected to heal spontaneously, leading to rapid resolution of pneumolabyrinth. However, even in cases where pneumolabyrinth persists for weeks to months following an injury, repair can lead to improvement in audiologic and vestibular symptoms and can be considered before ablative options. As such, the presence of air in the vestibule, even weeks or months after trauma, cannot be assumed to be indicative of irreversible inner ear damage.

Define Professional Practice Gap & Educational Need: Pneumolabyrinth is an uncommonly encountered condition without well-defined management principles.

Learning Objective: The learner will be aware that surgical repair of persistent defects at the oval window can result in a return of cochleovestibular function in some cases. The learner will be introduced to a proposed underlying mechanism for these imaging and clinical findings.

Desired Result: Pneumolabyrinth present weeks or months after an initial injury should not be assumed to be indicative of irreversible damage, and surgeons should not necessarily resort to ablative treatments to treat this condition.

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

IRB: Approved

**Pediatric Single-Sided Deafness Cochlear Implant Candidacy:
A Study of Prevalence and Imaging Characteristics**

*Sullivan Smith, BS; Nicholas A. Dewyer, MD
Peter Marciniak, MSc; Daniel J. Lee, MD*

Objective: To determine the prevalence and imaging characteristics of children with single-sided deafness (SSD) who are candidates for cochlear implant (CI) surgery.

Study design: Retrospective case series

Setting: Tertiary pediatric otology center.

Patients: Children less than 18 years old who underwent audiometric testing from 1999-2017.

Intervention(s): Comprehensive audiometric testing, temporal bone computed tomography (CT) and magnetic resonance imaging (MRI).

Main outcome measure(s): Prevalence of SSD in children from a single institution, and proportion of patients with favorable anatomy for CI surgery based on imaging.

Results: Audiograms from 32,695 children were reviewed. 137 (0.42%) patients had SSD (pure tone average ≥ 70 dB in one ear and ≤ 30 dB in the other ear). 19/137 (14%) had an MRI with or without CT that demonstrated favorable anatomy for CI surgery, 87/137 (64%) had neither CT nor MRI or had imaging with inconclusive findings, and 31/137 (23%) had anomalies on CT or MRI that would preclude CI. Cochlear nerve hypoplasia/aplasia was the most common finding that precluded CI (58% of excluded patients). 41/137 (30%) had temporal bone MRIs adequate for resolving cochlear nerve anatomy.

Conclusions: SSD among children is rare, with a prevalence of 1:235 in our population. Temporal bone MRI scans should be obtained to determine CI candidacy in pediatric SSD patients as there is a high prevalence of cochlear nerve anomalies that would preclude surgery.

Define Professional Practice Gap & Educational Need: Lack of understanding about the prevalence of pediatric single-sided deafness (CI), and awareness about potential rehabilitation with cochlear implant (CI) surgery.

Learning Objective: Improve understanding of the issue of pediatric SSD and the proportion of these patients that could potentially benefit from CI.

Desired Result: Audience members will understand that pediatric SSD is rare, CI is a rehabilitation option, and evaluation with an MRI is important because of a high rate of cochlear nerve hypoplasia/aplasia.

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

IRB: Exempt

Diagnostic Value of Delayed High-Resolution Contrast-Enhanced MRI in the Diagnosis of Perilymphatic Fistula

*Janice Erica Chang, MD, PhD; Gail Ishiyama, MD
Stellios Karnezis, MD; Akira Ishiyama, MD*

Objective: Perilymphatic fistulas (PLF) of the ear can be difficult to diagnose and conventional CT and MRI imaging are normal. We present for the first time the findings using delayed high-resolution contrast-enhanced MRI designed to distinguish perilymph from endolymph in two cases of documented PLF.

Setting: Tertiary academic center

Patients: A 24-year-old male and 37-year-old female presented to outside hospitals following head trauma with unilateral sensorineural hearing loss and severe prolonged vertigo. Both had a positive Halmagyi-Curthoys head impulse.

Interventions and Main Outcome Measures: MRI sequences with 3T scanner using high resolution: “cisternographic” T2 and delayed intravenous-enhanced 3-D fluid-attenuation inversion recovery sequences, performed with 2350 ms (bright perilymph) and 2050 ms (bright endolymph) inversion times and subtracted images.

Results: Audiovestibular testing demonstrated profound hearing loss and ipsilateral 100% caloric paresis. In both, routine MRI with contrast of the internal auditory canal was normal. Specialized MRI demonstrated complete lack of visualization of the utricle. CT in one patient demonstrated a temporal bone fracture through the round window confirming the site of the PLF. The CT in the other patient was normal, but given an ipsilateral Tullio’s phenomenon, persistent spontaneous nystagmus, and sensitivity to Valsalva, the patient underwent exploratory surgery. Intraoperatively, a large round window PLF was noted. Following repair, the post-surgical MRI demonstrated normal uptake of gadolinium in the utricle, and the patient had significant improvement in hearing and absence of spontaneous nystagmus.

Conclusions: High-resolution MRI IAC with a 4-hour post-contrast delay may be an invaluable tool to identify and treat patients with suspected PLF.

Define Professional Practice Gap & Educational Need: 1. Challenges in diagnosis of perilymphatic fistulas 2. Utilizing modified imaging techniques to support clinical diagnosis of perilymphatic fistulas

Learning Objective: 1. Identify clinical and objective findings to support the diagnosis of perilymphatic fistulas.

Desired Result: 1. Attendees may utilize this modified MRI imaging technique to aid in the diagnosis and treatment of patients with suspected perilymphatic fistulas.

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

IRB: Approved

Impact of Residual Hearing in the Non-Implanted Ear on Speech and Quality of Life Outcomes after Cochlear Implantation for Single-Sided Deafness

*Tiffany Peng, MD; Abby Owen; Megan Kuhlmeier, AuD
Ilana Cellum, AuD; Anil K. Lalwani, MD
Lawrence R. Lustig, MD; Ana H. Kim, MD*

Objective: Our objective was to compare outcomes in speech and quality of life in those undergoing cochlear implantation for single-sided deafness, with a specific aim to characterize the clinical impact of preoperative residual hearing in the non-implanted ear.

Study Design: Prospective case series

Setting: Academic Cochlear Implant Center

Patients: We review the outcome of 24 adult patients implanted with the diagnosis of single-sided deafness.

Interventions: All patients were evaluated at 3- and 6-months post-operatively using AZBio® sentence and speech, consonant-nucleus-consonant (CNC), and Bamford-Kowal-Bench Sentences in Noise (BKB-SIN) tests depending on appropriate testing level. Our previously validated Comprehensive Cochlear Implant Quality of Life (CCIQ) questionnaire was administered pre and 6-month post implantation.

Main Outcome Measures: Speech perception, quality of life

Results: Subjects were stratified by the pure tone average (PTA) of the non-implanted ear: Group 1 (< 20dB), Group 2 (21-50dB), Group 3 (>50dB). The mean preoperative PTA of the implanted ear was 80dB±18. Group 3 demonstrated the lowest speech perception score at 3 months (27%), but demonstrated the greatest improvement at 6 months (45%). Groups 1 and 2 speech perception score at 3 months was 46% and 45%, respectively. At 6 months, Group 1 further improved to 56%, but Group 2 demonstrated no significant change (42%). All 3 groups reported improved quality of life on CCIQ testing.

Conclusions: Degree of residual hearing in the non-implanted ear impacts both speech performance and quality of life measures in cochlear implantation for single sided deafness.

Define Professional Practice Gap & Educational Need: 1. Lack of contemporary knowledge regarding natural history of post-operative adaptation after cochlear implantation for single sided deafness as it pertains to residual hearing in the non-implanted ear 2. Need for risk stratification of speech and quality of life outcomes for cochlear implantation performed for single-sided deafness

Learning Objective: 1. Quantification of how residual hearing in the non-implanted ear impacts adaptation and improvement after cochlear implantation for single-sided deafness 2. Risk stratification of speech and quality of life outcomes as they pertain to residual hearing in the non-implanted ear

Desired Result: Attendees will attain a deeper understanding of how residual hearing in the non-implanted ear affects patients who have undergone cochlear implantation for single-sided deafness. This information will allow attendees to improve pre-operative counseling of their patients and quantify expectations in their post-operative course.

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

IRB: Approved

Minimally Invasive, Image-Guided Approach to Congenital Aural Atresia Repair, A Demonstration of Concept

*Kyle S. Kimura, MD; Robert F. Labadie, MD, PhD
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Hypothesis: Image-guided surgery permits safe and accurate access to the middle ear and facilitates an anatomically functional external ear canal in patients with aural atresia

Background: Congenital aural atresia, thought to affect one in 10-20,000 births, can often prove exceptionally difficult to repair due to lack of anatomical landmarks, requiring meticulous surgical technique. Our institution has developed a novel image-guided drilling system studied in other otologic surgeries which have demonstrated the feasibility of using image-guided technique to safely identify important structures and decrease the need for wide-field local exposure necessary in standard dissection.

Methods: Computed tomography (CT) scans of patients with diagnoses of aural atresia were reviewed and uploaded to proprietary image-guided drilling software. Using this software and anatomically normal ear as a template, safest drilling paths were created. Three-dimensional printed phantoms were used to test accuracy of the drilling paths and distances from critical structures were measured to determine safety.

Results: Complete set of results available at time of presentation: feasibility of creating 3D phantom temporal bones for drilling and distance of drilling path from critical structures (tegmen, ossicles, facial nerve) for each scan.

Conclusion: An image-guided approach to congenital aural atresia repair provides accurate access to the middle ear in a minimally invasive fashion, increasing safety by decreasing the need for real-time surgical landmarks. While the presenting study was confined to in vitro demonstration, these results warrant in vivo testing, which may lead to clinically applicable access.

Define Professional Practice Gap & Educational Need: 1. Lack of awareness of surgical options for correction of aural atresia 2. Lack of alternatives for correction of aural atresia

Learning Objective: Attendees will be aware of potential alternative options for surgical correction of aural atresia

Desired Result: Attendees will be aware of potential alternative options for surgical correction of aural atresia

Level of Evidence: Does not apply- Proof of concept for novel surgical approach to aural atresia repair

IRB: Approved