SELECTED ABSTRACTS

POSTER PRESENTATIONS

53rd Annual Spring Meeting
AMERICAN NEUROTOLOGY SOCIETY

April 20-22, 2018
Gaylord National Resort
National Harbor, MD

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

Prevalence of Obstructive Sleep Apnea (OSA) in Spontaneous Cerebrospinal Fluid (CSF) Leaks: a Prospective Observational Study

Cyrus C. Rabbani, MD; Mohamad Z. Saltagi, BA
Shalini K. Manchanda, MD; Charles W. Yates, MD
Rick F. Nelson, MD, PhD

Objective: To determine the prevalence of obstructive sleep apnea (OSA) in a prospective cohort of patients with spontaneous cerebrospinal fluid (sCSF) leaks of the temporal bone.

Study Design: Prospective cohort study

Setting: Tertiary referral center

Patients: Consecutive sCSF leak patients (21) over a 3-year period. Four patients presented with a history of OSA and 17 patients were prospectively offered PSG testing during the initial clinic encounter.

Intervention: Level I polysomnogram (PSG)

Main Outcome Measures: Patient characteristics (age, sex, BMI), apnea hypopnea index (AHI), presence of snoring, and presence of hypoxia (oxygen saturation less than 88% for > 5 minutes). OSA was defined as mild (AHI ≥5 and <15/hr), moderate (AHI ≥15 and <30/hr), and severe (AHI ≥30/hr).

Results: The prevalence of OSA in sCSF leak patients is 83.3%. PSG studies were performed on 18 of 21 patients. There were 15 females and 6 males with an average age (SD) of 56.3 (11.3) years and an average BMI of 35.3 (7.7) kg/m2. Objectively, the AHI ranged from mild to severe (range = 5.7–92, median = 20.5). Snoring was present in 61% of patients and hypoxia was present in 33% of patients. sCSF leak patients with OSA were significantly older than sCSF leak patients without OSA (56.9 (8.3) vs. 43.8 (11.3) years, p=0.02).

Conclusions: OSA is highly prevalent among patients with sCSF leaks. All patients with sCSF leaks should undergo formal polysomnogram testing. Future studies are needed to determine the role of OSA in the development of sCSF leaks.

Define Professional Practice Gap & Educational Need: Lack of understanding of the relationship between obstructive sleep apnea and spontaneous cerebrospinal fluid leaks.

Learning Objective: To determine the prevalence of obstructive sleep apnea in a prospective cohort of patients with spontaneous cerebrospinal fluid leaks of the temporal bone

Desired Result: All patients evaluated for lateral skull base spontaneous CSF leaks should undergo a formal polysomnogram.

IRB or IACUC Approval: Exempt

Level of Evidence: 4

Prediction of Hearing Outcomes Using Intraoperative Monitoring for Removal of Vestibular Schwannomas via a Middle Cranial Fossa Approach

C. Blake Sullivan MD; Daniel Q. Sun MD
Raymund W. Kung MD; Megan Asklof
Marlan R. Hansen MD; Bruce J. Gantz MD

Objective: To evaluate the association between signal changes during intra-operative audiologic monitoring and post-operative audiometric outcome in patients undergoing vestibular schwannoma (VS) resection via middle cranial fossa (MCF) approach.

Study Design: Retrospective chart review

Setting: Academic tertiary referral center

Patients: One hundred twenty five consecutive patients (mean age 48.6 years, range 16-67; mean tumor size 9.9mm, range 1.8-18.9 mm) who underwent MCF VS resection.
Interventions: Intra-operative audiologic monitoring using auditory brainstem reflex (ABR) and direct cochlear nerve action potential (CNAP).

Main outcome measures: Intra-operative ABR wave V and CNAP amplitudes and post-operative pure-tone average (PTA) and word recognition score (WRS).

Results: On ABR, decreased wave V amplitude or absent waveform was associated with 65.3% and 81.1% increase, respectively, in post-operative PTA; and 63.8% and 82.3% decrease, respectively, in post-operative WRS. Similarly, decreased amplitude or absent waveform on CNAP was associated with 47.3 and 100% increase, respectively, in post-operative PTA; and 45.3% and 100% decrease, respectively, in post-operative WRS. Receiver-operating curve analysis showed that ABR combined with CNAP achieved the highest diagnostic accuracy in predicting post-operative hearing decline (sensitivity 70.3%, specificity 100%), and performed better compared to each modality alone (ABR: sensitivity 60.3%, specificity 92.4%; CNAP: sensitivity 57.9%, specificity 100%).

Conclusions: Intra-operative ABR wave V and CNAP amplitude changes are associated with changes in post-operative hearing, and dual modality monitoring was more diagnostic of post-operative hearing decline compared to each modality alone during MCF VS resection. Overall, intra-operative ABR and CNAP were more specific than sensitive for post-operative hearing decline.

Define Professional Practice Gap & Educational Need: There is a lack of contemporary knowledge in regards to intraoperative auditory monitoring during middle cranial fossa tumor removal and how these monitoring methods are related to postoperative hearing loss.

Learning Objective: To demonstrate that dual modality auditory monitoring intraoperatively is a better predictor of postoperative hearing loss compared to single modality monitoring.

Desired Result: Assess one's institutional techniques for monitoring auditory changes during middle cranial fossa tumor removal and that dual modality monitoring can be used as a more predictive guide to counsel patients about potential postoperative hearing loss.

IRB or IACUC Approval: Approved

Level of Evidence: 4

Impact of Cochlear Implantation on Environmental Sound Awareness

Kevin R. McMahon, BS; Aaron C. Moberly, MD
Michael S. Harris, MD

Objective: To determine if post-lingually deaf adult cochlear implant (CI) users have better environmental sound awareness (ESA) compared to adult patients eligible for CIs who have not yet undergone implantation.

Study Design: Cross-sectional cohort study.

Setting: Tertiary referral center

Patients: A group of 42 post-lingually deaf adult patients who are experienced CI users (ECI), and a group of 19 post-lingually deaf adult patients who are CI candidates (CIC) awaiting implantation.

Intervention: Cochlear implantation

Main outcome measure: Environmental sound awareness as measured by accuracy using a computerized, Familiar Environmental Sounds Test—Identification (FEST-I).

Results: There was no significant difference between environmental sound awareness in our sample of ECI users versus CIC patients. The ECI users scored an average FEST-I accuracy of 60% (SD 15). In comparison, the CICs had an average FEST-I accuracy of 52% (SD 26). This difference was not statistically significant. To determine if the observed similiarity in environmental sound awareness between groups was related to differences in pre-operative auditory perception abilities (e.g., if CIC participants had better pre-operative hearing than ECI users), we also compared pre-implantation best-aided AzBio sentence recognition performance where available from clinical records: these scores were similar between groups (ECI 57%, CIC 56%, respectively).

Conclusions: Our findings suggest that, despite the commonly held notion that environmental sound awareness may be a benefit of cochlear implantation, our sample of ECI users did not demonstrate superior environmental sound awareness performance compared to CICs.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge regarding the impact of cochlear implantation on environmental sound awareness.

Learning Objective: To determine if cochlear implantation improves environmental sound awareness in the post-lingually deaf population.

Desired Result: Attendees will be able to provide cochlear implant candidates with information on the expected impact of cochlear implantation on environmental sound awareness.

IRB or IACUC Approval: Approved

Level of Evidence: 3

Imaging in the Diagnosis and Management of Necrotizing Otitis Externa: A Survey of Practice Patterns

Timothy Cooper, MD; Douglas Hildrew, MD
Jacob S. McAfee, MD; Andrew A. McCall, MD
Barton F. Branstetter IV, MD; Barry E. Hirsch, MD

Objective: To survey neurotologists and head and neck radiologists regarding use of imaging in the diagnosis and management of necrotizing otitis externa (NOE).

Participants: Neurotologists and head and neck radiologists with membership in either the American Neurotology Society or The American Society of Head and Neck Radiology.

Intervention: Cross sectional online survey study distributed through email to specialty society membership lists.

Main outcome measures: Responses to survey consisting of 2 demographics and 7 clinically oriented questions related to the use of imaging in the diagnosis and management of NOE.

Results: 136 participants responded to the survey. The imaging modality of choice in establishing the diagnosis of NOE selected by the respondents was computed tomography (CT) (37.5%) followed by technetium scintigraphy (21.3%). Magnetic resonance imaging (MRI) was the preferred investigation by 41.9% of participants for determining extent of disease. Gallium scanning was the imaging modality preferred by 32.4% of respondents for determining when to cease medical therapy. Ninety-five percent of participants responded that CT scans were always or frequently used in the diagnosis and management of NOE compared to 72.8% for MRI, 34.5% for gallium scans, and 34.2% for technetium scans.

Conclusions: There is considerable heterogeneity in the preferred imaging modalities used in the diagnosis and management of NOE. CT and MRI are the preferred contemporary modalities utilized by many physicians, demonstrating a shift away from the historic use of nuclear medicine scans.

Define Professional Practice Gap & Educational Need: (Examples: Necrotizing otitis externa (NOE) is a rare condition involving invasive infection and osteomyelitis of the temporal bone. The diagnosis and management of this condition is supported by imaging studies including computed tomography (CT), magnetic resonance imaging (MRI), and nuclear medicine scans. However, a widely accepted protocol outlining the use of imaging in NOE has not been established and there is significant variation in the use of diagnostic imaging studies.

Learning Objective: At the conclusion of this activity, the learner will be able to: 1. Recognize the heterogeneity in the use of imaging in the management of NOE by neurotologists and head and neck radiologists. 2. Describe the strengths and limitations of imaging studies commonly used in NOE. 3. Evaluate their own practice pattern in the use of imaging in the diagnosis and management of NOE.

Desired Result: To stimulate discussion on the utility and availability of imaging modalities in the diagnosis and treatment of NOE.

IRB or IACUC Approval: Exempt

Level of Evidence: 5

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

Akshay R. Narayan, MBBS

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 groups 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.

Learning Objective: 1. Investigate if computer-based therapy can improve speech perception 2. Investigate if computer-based therapy with variable pitch and tone produces greater improvements in speech perception than monotonous computer-based therapy

Desired Result: 1. Appreciate that auditory therapy can be provided in the comforts of the patient's home 2. Appreciate that computer-based therapy can be tailored to the unique needs of the patient

IRB or IACUC Approval: Exempt

Level of Evidence: 2

Association Between Smoking and Dizziness in the U.S. Adult Population

Eric J. Formeister, MD, MS; Jeffrey D. Sharon, MD

Objective: To examine the relationship between smoking and dizziness in the U.S. adult population.

Study Design: Cross-sectional survey study.

Setting and Subjects: Non-incarcerated U.S. adults who responded to the National Health Interview Survey in 2008 (n = 21,781).

Patients: n/a

Interventions: Diagnostic

Main Outcome Measures: Self-reported smoking status and/or dizziness problem.

Results: Of the 21,781 adults in the survey, 41.8% smoked more than 100 cigarettes in their lifetime. Of the 2,490 adults who had a self-diagnosed problem with dizziness, 54.1% had smoked more than 100 cigarettes in their lifetime. This corresponded to an odds ratio of 1.72 (95% CI, 1.56 – 1.89; $p<0.001$) for experiencing dizziness with a history of smoking. In a multivariate analysis that included prior lung disease (asthma, emphysema) preexisting cardiovascular disease, diabetes, hypertension, prior stroke, prior head trauma, age, sex, hearing loss, and vision loss, anxiety, depression, and history of migraines, smoking was still a significant risk factor for dizziness (OR 1.30; 95% CI, 1.17 – 1.46; $p<0.001$).

Conclusions: In a representative nationwide survey of U.S. adults, smoking is an independent risk factor for dizziness, even after controlling for demographic variables, known risk factors for dizziness, and smoking related diseases.

Define Professional Practice Gap & Educational Need: 1. Lack of contemporary knowledge of the association between smoking and dizziness within the context of a large, population-based study. Dizziness is an extremely common presenting complaint to otolaryngologists and neurotologists, but very little is known about the epidemiologic associations between demographic variables, preexisting conditions, and social habits such as smoking in the U.S. population, when studied on a large, population-based scale.

Learning Objective: 1. To describe the association between smoking and dizziness in the adult U.S. population. 2. To show, through multivariate analyses, that smoking is an independent risk factor for dizziness in the adult U.S. population. after controlling for other smoking-related diseases and other known risk factors for dizziness.

Desired Result: Attendees will better understand the association between smoking and dizziness, and will hopefully ask all dizzy patients about smoking history and offer smoking cessation counseling or therapeutic interventions for smoking cessation, if needed.

IRB or IACUC Approval: Exempt

Level of Evidence: 3

Pilot Study of Diffusion MRI Tractography for Identification of the Cochleovestibular Nerve in Children with Unilateral Profound Sensorineural Hearing Loss

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Marta Kulich, BA; Ryan B. Cabeen, PhD
Arthur W. Toga, PhD; Laurel M. Fisher, PhD

Objective: To develop a reliable measure of cochleovestibular nerve (CVN) integrity in children with sensorineural hearing loss as a guide for cochlear implantation. Current imaging protocols do not provide biomarker information for the integrity, size, or functional ability of the CVN. This information is urgently needed for parent counseling before cochlear implant surgery.

Study Design: Feasibility study

Setting: Academic pediatric clinic and imaging center

Patients: Children with unilateral SNHL who are able to tolerate magnetic resonance imaging without sedation (n=3, average 11 years old, 1M, 2F)

Intervention(s): Diffusion-weighted magnetic resonance imaging (dMRI) of the temporal bone was conducted with voxel size $1.5mm^3$ and a multi-shell protocol, 28 scans at $b=0s/mm^2$, 185 scans at $b=1500s/mm^2$, and 184 scans at $b=3000s/mm^2$. Pre-processing the imaging data reduced the effects of noise, motion, eddy currents, and susceptibility-induced distortion. Geometric models of each CVN were reconstructed using multi-fiber streamline tractography with manually placed seed, inclusion, and exclusion masks drawn relative to the baseline scan.

Main outcome measure(s): Acquisition protocol parameters, hearing, and dMRI CVN size, density, and tracts from the bony structures to the brainstem.

Results: The dMRI acquisition protocol was refined and CVN was visualized for all subjects. The small areas within the temporal bone had some movement artefact, primarily from respiration. The respiration artefact indicates that transition to a clinical measure will require sedation in children. Hearing and tractography-derived nerve morphometry were significantly associated.

Conclusions: dMRI is promising for excellent CVN visualization and for prognostic information in children with abnormal inner ear anatomy.

Define Professional Practice Gap & Educational Need: 1. Inconsistencies between conventional imaging and integrity of the CVN 2. Lack of a biomarker for functional status of the CVN as it pertains to counseling before cochlear implant surgery

Learning Objective: 1. Conventional imaging is not adequate for assessing the integrity, size, or functional ability of the CVN 2. DTI of the temporal bone is a novel approach for visualization of the CVN and providing prognostic information in children with abnormal inner ear anatomy

Desired Result: Attendees will recognize DTI of the IAC as a prospective tool to improve counseling before cochlear implant.

IRB or IACUC Approval: Approved

Level of Evidence: 4

Evaluation of 3D Printed Temporal Bone Models in Preparation for Middle Cranial Fossa Surgery

Monika E. Freiser, MD, MPH; Anish Ghodadra, MD
Barry E. Hirsch, MD: Andrew A. McCall, MD

Hypothesis: Patient-specific 3D printed models are useful pre-surgical planning tools because they accurately represent the anatomy and drilling characteristics of the middle cranial fossa (MCF) approach to the internal auditory canal (IAC).

Background: The MCF surgical approach to the IAC can be challenging due to variability of the bony architecture along the floor of the middle fossa. Patient-specific 3D printed models may enhance surgeon knowledge of a given patient's anatomy when preparing for MCF surgery.

Methods: Six temporal bone models were printed from photoacrylic resin based on CT data obtained from cadaveric specimens using a previously described method. Critical structures to avoid injuring, the facial nerve and membranous labyrinth, were modeled as hollow cavities and filled with indicator paint. Two neurotologists performed drilling of the models followed immediately by drilling of the corresponding cadaveric specimen, and then completed a 41-item questionnaire (score range of each item: 0-10) to assess the model's accuracy, utility, and potential as a training tool.

Results: Drilling the model was favorably rated (median score 9.2; range 7.3-9.6) for its ability to provide surgeons with an accurate mental image of the corresponding cadaveric anatomy. Overall similarity of feel of drilling the model in comparison to human bone was moderate (median 7.6; range 6.6-9.0). Surgeons would use this model to prepare for future cases (median 9.4; range 5.1-9.9) and felt it had excellent utility for training purposes (median 9.3; range 8.4-9.9).

Conclusions: Patient-specific 3D printed models provide an anatomically accurate and favorable tool for preparing for MCF surgery.

Define Professional Practice Gap & Educational Need: With recent significant advancements in 3D printing technology, new opportunities to enhance surgeon preparation for cases in a patient-specific manner using 3D printing technologies are now possible. The MCF approach to the IAC can be particularly challenging given the variability of the bony architecture along the floor of the middle fossa. We address this challenge by developing a novel 3D printed model designed to demonstrate specific bony architecture in relation to underlying critical structures and evaluate its accuracy, utility, and potential as a training tool.

Learning Objective: 1. Recognize the strengths and weaknesses of using a patient-specific 3D printed model for middle cranial fossa surgery preparation and training. 2. Describe how to create patient-specific 3D printed temporal bone models with indicator colors to identify critical structures using a commercially available 3D printer. 3. Evaluate the utility of this model in the context of their own practice environment.

Desired Result: To expand the capabilities of both trainees and seasoned neurotologists to prepare for middle cranial fossa cases in a novel patient-specific manner. To inspire further work in 3D printing for trainee education and case preparation.

IRB or IACUC Approval: Exempt

Level of Evidence: 5

Diaph3 Expression and Localization in the Inner Ear Suggests Constitutive Function

Laura K. House, MD; Bradley J. Walters, PhD

Hypothesis: Diaphanous homolog 3 (DIAPH3) is expressed in the developing and mature inner ear and may contribute to normal function.

Background: Auditory neuropathy is a clinical entity characterized by abnormal or absent ABRs, with normal outer hair cell function and without evidence of CNS lesions. Mutations in the DIAPH3 gene that cause its overexpression are linked to nonsyndromic auditory neuropathy. However, whether DIAPH3 is constitutively expressed in the inner ear and whether it contributes to normal hearing or balance function remain unanswered questions.

Methods: Mouse embryos taken at embryonic day (E)14.5 and temporal bones from 30-day old (P30) mice, were cryosectioned and in situ hybridization was conducted using probes specific for mouse Diaph3. Sections were co-labeled with antibodies against parvalbumin or $p27^{Kip1}$ to label hair cells and neurons, or prosensory cells, respectively.

Results: Consistent with previous reports, Diaph3 was highly expressed in the lateral ventricles at E14.5, but was also detected in the cochlear duct, in the vestibulocochlear ganglia, and in the developing vestibular epithelia. At P30, Diaph3 was detectable in cochlear hair cells and supporting cells, but in the vestibular organs was only prominent in hair cells.

Conclusions: Constitutive expression of Diaph3 in sensory and nonsensory cells of the inner ear during development and adulthood suggest that Diaph3 likely plays a role in the development and function of the inner ear sensory organs. Therapeutic strategies to reduce DIAPH3 expression or function in patients with DIAPH3 mutations may therefore require careful titration so as not to harm constitutive function.

Define Professional Practice Gap & Educational Need: Knowledge regarding causes of auditory neuropathy and diagnosis of auditory neuropathy are not well described in the literature. Therefore, practice patterns of physicians diagnosing and treating auditory neuropathy inevitably vary.

Learning Objective: The learner will gain knowledge regarding DIAPH3 gene and how it may play a role in inner ear development and function, specifically relating to auditory neuropathy.

Desired Result: Knowledge from this presentation may affect therapeutic strategies aimed at patients with DIAPH3 mutations.

IRB or IACUC Approval: Approved

Level of Evidence: Does not apply- Basic Science Research

The Incidence of Vestibular Schwannoma in Patients with Sudden Sensorineural Hearing Loss

Takeshi Fujita, MD, PhD; Kazuya Saito, MD
Toru Seo, MD, PhD; Katsumi Doi, MD, PhD

Objective: To assess the incidence of vestibular schwannoma (VS) in patients with sudden sensorineural hearing loss (SSNHL).

Study design: Retrospective chart review.

Setting: Tertiary academic center

Patients: Eight hundred sixty-one patients who were diagnosed or treated for SSHNL.

Intervention: Patients with SSNHL underwent Magnetic resonance imaging (MRI). The MRI images were reviewed retrospectively.

Main outcome measure: Incidence of VS found by MRI in patients with SSHNL.

Results: From 2008 to 2017, 499 patients out of 861 patients underwent MRI scans in our department. Of the 499 cases, tumors were found at the cerebellopontine angle in 16 cases (3.21%). In 16 cases, 9 were with VS Koos grade I, intracanalicular tumor. Six were with Koos grade II, up to 2 cm. One was Grade III, up to 3 cm. None of the tumors were with Koos Grade IV, which consit of large tumors with displacement of the trunk or cranial nerves.

Conclusions: The incidence of VS patients in SSNHL patients found by MRI was 3.21%. Since the ratio is not low, further examinations besides audiometry should be considered for the patients with SSNHL.

Define Professional Practice Gap & Educational Need: Lack of precise data about VS incidence in patients with SSNHL.

Learning Objective: Awareness of the VS incidence in SSNHL patients and utilization of the obtained information to improve patient care.

Desired Result: The attendees will obtain additional information for counseling of patients with SSNHL.

IRB or IACUC Approval: Approved

Level of Evidence: 5

Intra-operative Evaluation of the Cochlear Implant Electrodes Using Intra-Operative Mobile Cone-beam CT

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Hiroshi Yamazaki, MD, PhD; Harukazu Hiraumi, MD, PhD
Tatsunori Sakamoto, MD, PhD; Juichi Ito, MD, PhD
Koichi Omori, MD, PhD

Objective: To evaluate the electrode status during cochlear implantation (CI) using mobile cone-beam CT (mCBCT)

Study design: Retrospective case review

Setting: Tertiary referral hospital

Patients: Forty-four patients (four bilateral surgeries) who underwent cochlear implantation (CI) and took the intra-operative mCBCT images. Nineteen patients were less than 10 years old (mean age: 3.3 years old).

Intervention: Cochlear implantation and CBCT during surgery

Main outcome measure: The electrode location and angular insertion depth (AID) determined by intra-operative mCBCT images.

Results: Five were cochlear malformation cases where intra-operative mCBCT was useful to confirm the electrode location. Among 43 cases with normal cochlear morphology, perimodiolar, slim straight and mid-scalar electrodes were used in 20 (cochleostomy), 22 (21 round window (RW) and one extended round window (ERW) insertion), and 1 (RW insertion) cases, respectively. Complete scala-tympani (ST) insertion was achieved in 23 cases (six cochleostomy and 17 RW or ERW cases). The complete ST-insertion rate was significantly higher in the RW or ERW insertion than cochleostomy insertion ($p=0.006$). The AID values (average ± standard deviation) for perimodiolar electrodes (346.9 ± 20.99 degrees) were significantly smaller than those for Cochlear slim straight (389.7 ± 43.22 degrees), Flex24 (464.8 ± 114 degrees), and Flex28 (517.0 ± 43.09 degrees) electrodes ($p<0.05$).

Conclusions: Evaluation results of the CI electrodes by intra-operative mCBCT were comparative to those utilizing fan-beam CT or C-arm based CBCT. Considering the low radiation dose of mCBCT and its availability in any operation room, mCBCT is the better selection as a modality to evaluate CI electrodes.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge regarding the usefulness of the intra-operative mobile cone-beam CT for cochlear implantation.

Learning Objective: To learn how intra-operative mobile cone-beam CT images can show the status of cochlear implant electrodes.

Desired Result: The attendees will understand the merit of using mobile cone-beam CT during the cochlear implantation surgery.

IRB or IACUC Approval: Approved

Level of Evidence: 5

Application of Ultrasonic Bone Aspirator for Decompression of the Internal Auditory Canal via the Middle Cranial Fossa Approach

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Joseph T. Breen, MD; Mario Zuccarello, MD
Ravi N. Samy, MD

Objective: To evaluate the safety and efficacy of the ultrasonic bone aspirator (UBA) during the middle cranial fossa (MCF) approach to vestibular schwannoma (VS).

Study design: Retrospective case series.

Setting: Tertiary referral center.

Patients: The charts of 192 VS patients over 18 years of age were reviewed to identify 26 patients who underwent MCF approach to VS resection with use of the UBA for decompression of the internal auditory canal (IAC) between 2012 and 2017.

Intervention(s): Use of the UBA during vestibular schwannoma surgery via MCF approach for decompression of the IAC.

Main outcome measure(s): Post-operative facial nerve outcomes are reported using the House-Brackmann (HB) facial nerve grading scale. Rates of gross total resection are also reported.

Results: Twenty-six patients underwent IAC decompression with UBA via MCF approach. Twenty-four out of twenty-six patients (92%) had a postoperative HB Grade I or II facial nerve function. Twenty-five out of twenty-six patients (96%) had gross total resection of their tumor. There were no instances of a transected facial nerve or of entrance into the cochlea or ampullated portion of the superior semicircular canal in any case.

Conclusions: Ultrasonic bone removal is a safe and effective alternative to high speed drilling during MCF approach to expose the IAC contents. This surgical tool allows for bone removal with a low risk of injury to adjacent structures.

Define Professional Practice Gap & Educational Need: Lack of awareness of Ultrasonic Bone Aspirator (UBA) as a tool for skull base surgery.

Learning Objective: To promote awareness of the ability to use UBA for decompression of the internal auditory canal during middle cranial fossa surgery for vestibular schwannoma resection.

Desired Result: Provide insight into the application of UBA for internal auditory canal decompression during middle cranial fossa approach to vestibular schwannoma resection.

IRB or IACUC Approval: Approved

Level of Evidence: 5

Prevalence of Radiographic Cochlear-Facial Dehiscence

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Ryan A. Bartholomew, BS; Yona Vaisbuch, MD
C. Eduardo Corrales, MD; Nikolas H. Blevins, MD

Objective: To determine the prevalence of radiographic cochlear-facial dehiscence (CFD).

Study Design: Retrospective radiological study

Setting: Two Tertiary-Referral Centers

Patients: 206 temporal-bone computed tomography (CT) scans (405 total ears) of otology/neurotology clinic patients at two academic institutions between the years 2014-2017.

Intervention: Diagnostic

Main Outcome Measures: The Cochlear-facial partition width (CFPW) was measured on coronal cross-sections and defined as the shortest distance between the cochlear basal turn and FN labyrinthine segment. We used multiple regression analyses to determine positive predictors for CFD. Our variables included age, sex, CT slice-thickness, Cone-beam CT use, fallopian-canal width, cochlear and FN pathologies, and presence of other third windows.

Results: The overall prevalence of radiographic CFD was 6.4% (26/405 ears). 10.6% of patients (22/206) had CFD. Of these 22 patients, only one patient had mixed hearing loss that could not be explained by any other vestibular or auditory pathology. 4 out of 206 patients had dehiscence in both ears (1.9%). The average CFPW was 0.6 ± 0.2 mm, and fallopian canal width was 1.3 ± 0.2 mm (n=405). The prevalence of SCCD in our cohort was similar to that of CFD at 6.9% (28/405 ears). None of our variables were significant predictors for radiographic CFD.

Conclusions: Our data demonstrates that the prevalence of radiographic CFD may be higher than what is reported in histologic studies and may over-estimate the true prevalence of CFD.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge of the significance of cochlear-facial dehiscence.

Learning Objective: Provide further information of what a cochlear-facial dehiscence could signify when discovered on radiographic imaging.

Desired Result: Our study may help clinicians determine the significance of cochlear-facial dehiscence when discovered on imaging.

IRB or IACUC Approval: Approved

Level of Evidence: 4

Round Window Reinforcement versus Transmastoid Superior Canal Occlusion in the Treatment of Superior Semicircular Canal Dehiscence Syndrome

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Sumit K. Agrawal, MD; Lorne S. Parnes, MD

Objective: Outcome study of round window reinforcement (RWR) and canal occlusion (CO) to treat superior canal dehiscence syndrome (SCDS)

Study design: Prospective case series comparing RWR and CO procedures

Setting: Tertiary referral center

Patients: Diagnosis of superior semicircular canal dehiscence by clinical history, physical exam, imaging, and other ancillary testing. Consecutive patients undergoing primary surgery between 2010 – 2016. Twenty-three RWR procedures and sixteen CO procedures included in the study.

Intervention(s): The two surgical interventions, RWR and CO, were performed and results analyzed

Main outcome measure(s): Symptom questionnaire scores and audiometric data

Results: We collected and analyzed data using a published, nine-item questionnaire. Both surgical techniques achieved statistically significant improvement in symptom scores: 40% improvement ($p < 0.001$) for RWR and 56.5% improvement ($p < 0.001$) for CO. The difference in score improvement between the two groups was statistically significant ($p = 0.011$). Preoperative and postoperative audiometric data showed no difference in hearing outcomes using the two surgical interventions. One patient who failed RWR went on to receive CO with a good result.

Conclusions: Round window reinforcement and transmastoid canal occlusion are both effective and safe treatments for symptoms associated with SCDS. The former is less invasive while the latter seems more effective. Treatment decisions should be made on a case by case basis using a patient-centered approach.

Define Professional Practice Gap & Educational Need: 1. The round window reinforcement and transmastoid canal occlusion approaches have been described as surgical treatment options for superior semicircular canal dehiscence (SSCD) syndrome. Analysis of outcome data for these surgical options is needed to evaluate their efficacies and safety.

Learning Objective: 1. Understand the round window reinforcement and transmastoid canal occlusion approaches. 2. Become familiarized with a nine-item questionnaire for standardized evaluation of SSCD symptom severity. 3. Evaluate the efficacies and safety of the two procedures.

Desired Result: 1. Incorporate a consistent symptom severity metric in assessing patients with SSCD. 2. Use the data provided to appraise the two surgical approaches. 3. Apply the appropriate surgical option in a patient-centered approach.

IRB or IACUC Approval: Approved

Level of Evidence: 5

Complex Pitch Perception in Cochlear Implant Users: A Comparison of Monopolar and Tripolar Stimulation

Divya A. Chari, MD; Patpong Jiradejvong, MD
Charles J. Limb, MD

Objective: Cochlear implant (CI) users struggle with pitch perception, particularly for polyphonic stimuli. Tripolar stimulation has been proposed as a way to mitigate the broad spread of neural excitation observed in traditional monophonic stimulation, thereby potentially improving perception of polyphony. We evaluated the effect of tripolar stimulation on pitch perception in CI users.

Study design: Prospective cohort study.

Setting: Tertiary academic center.

Patients: Six post-lingually deafened adults with Advanced Bionics HiRes 90K CIs.

Intervention(s): To assess pitch discrimination, users were asked to identify the higher pitch between two notes. In polyphonic pitch testing, users were asked to distinguish between single-pitch tones and two-pitch tones. Two-pitch stimuli consisted of one of three base frequencies (392, 523, 740 Hz) and one pitch between one and 12 semitones above the base frequency. Testing was performed under monopolar and tripolar configurations.

Main outcome measure: Response rates were analyzed as a function of pitch distance, with smaller semitone intervals indicating better performance.

Results: In pitch discrimination, tripolar configuration did not confer an advantage over monopolar configuration. In polyphonic perception, however, tripolar stimulation improved performance in lower frequencies and resulted in statistically significant ($p < 0.05$) improvement at the highest frequency, 740 Hz. Data acquisition with additional subjects is currently underway to determine the statistical robustness of these findings.

Conclusions: These data suggest that tripolar configuration may confer an advantage in the perception of polyphonic pitch, which may not be observed in monophonic pitch discrimination tasks. Since music is typically polyphonic, such data offer approaches towards improving perception of musical polyphony.

Define Professional Practice Gap & Educational Need: 1. Lack of awareness about poor music perception among cochlear implant users. 2. Lack of contemporary knowledge about techniques to improve pitch perception in cochlear implant users. 3. Inconsistencies within the literature regarding use of focused, experimental stimulation models to improve perception of complex sounds.

Learning Objective: To review the effect of a focused, experimental stimulation on complex pitch perception in cochlear implant users.

Desired Result: Attendees will gain an improved understanding about the effect of tripolar stimulation on the perception of complex sounds in cochlear implant users. This knowledge may then be applied to future studies within the field which may ultimately result in programming modifications that improve perception of complex pitch, such as musical polyphony.

IRB or IACUC Approval: Approved

Level of Evidence: 3

The Use of the Exoscope in Lateral Skull Base Surgery: Advantages and Limitations

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Maura K. Cosetti, MD; Constantinos G. Hadjipanayis, MD, PhD
George B. Wanna, MD

Objective: We describe our experience using the extracorporeal video microscope, the "exoscope" for various applications within the field of lateral skull base surgery.

Study Design: A retrospective case series was performed investigating patient demographics, indications for surgery, procedure type, operative time, approach to the skull base, complications, adequacy of visualization, and surgeon comfortability.

Patients: Seven cases were performed with a 3 dimensional surgical exoscope, obviating the use of a traditional binocular microscope.

Setting: Academic, tertiary referral center.

Main outcome measures: Type of surgical approach, operative time, patient demographics, surgical complications, and surgeon comfortability.

Results: The following procedures were performed; 5 vestibular schwannoma resections via suboccipital craniotomy (3) and translabyrinthine approach (2) and two combined transmastoid and transtemporal approaches for temporal lobe encephalocele repairs. The average operative time was 224 minutes and 553 minutes for temporal lobe encephalocele repairs and vestibular schwannoma cases, respectively. No intraoperative complications were encountered during these cases. None of the procedures required abandonment of the exoscope in favor of the microscope during the procedure. Advantages include high-resolution three-dimensional visualization, increased degrees of freedom for exoscope adjustment, and reduced surgeon fatigue in a fixed, unnatural posture. Limitations include decreased depth perception and increased operative time.

Conclusion: The exoscope system is a safe and effective alternative or adjunct to the existing binocular operating microscope for lateral skull based procedures. The exoscope provides the surgeon with a comfortable, high-resolution visualization without compromising surgical exposure and patient safety.

Define Professional Practice Gap & Educational Need: Lack of awareness of new technology in lateral skull base surgery.

Learning Objective: The reader will gain knowledge about the exoscope technology and its application to a variety of lateral skull base procedures.

Desired Result: The attendees will be able to apply the cutting edge technology in a clinical setting and tailor its use to their practice.

IRB or IACUC Approval: Exempt

Level of Evidence: 5

Amelioration of Pulsatile Tinnitus by Creation of a Sound Baffle

Yona Vaisbuch, MD; George S. Liu, AB
Nikolas Blevins, MD; Robert K. Jackler, MD

Background: Most pulsatile tinnitus (not associated with tumor or conductive hearing loss) stems from turbulent flow in the sigmoid-jugular venous system or carotid artery, which transmits sound to the middle ear via the mastoid air cell system.

Objective: To share our experience with insulating a dehiscent sigmoid sinus, jugular bulb, or carotid artery by resurfacing using a thick layer of hydroxyapatite.

Study design: Retrospective case series

Setting: Tertiary academic medical center.

Patients: Adult patients with troublesome pulsatile tinnitus emanating from the sigmoid sinus, jugular bulb, and/or intra-temporal carotid artery with radiologic evidence of dehiscence.

Intervention: Transmastoid (sigmoid sinus) or hypotympanic (jugular bulb or carotid artery) exposure of vessel followed by resurfacing using hydroxyapatite cement.

Main outcomes measures: Alleviation or reduction of pulsatile tinnitus.

Results: In our case series of 7 patients with a mean follow up period of 12.1 months, all 5 patients with venous etiologies (3 sigmoid sinus dehiscence, 1 jugular bulb diverticulum, 1 arachnoid granulations at transverse-sigmoid junction) treated by resurfacing had complete elimination of symptoms at most recent follow up. The 2 patients with carotid dehiscence treated by creation of a sound baffle had only partial resolution of symptoms with significantly improved QOL. There were no adverse outcomes (hearing loss, vascular injury or intracranial hypertension).

Conclusion: In properly selected patients, vascular resurfacing to establish a sound baffle can effectively improve pulsatile tinnitus with minimal risks.

Define Professional Practice Gap & Educational Need: Inconsistencies within the treatment of troublesome pulsatile tinnitus emanating from the sigmoid sinus, jugular bulb, and/or intra-temporal carotid artery.

Learning Objective: Vascular resurfacing to establish a sound baffle can effectively improve pulsatile tinnitus with minimal risks. compering the outcomes of the different techniques that were reported in the English literature.

Desired Result: Changes in physician knowledge regarding the outcomes of resurfacing techniques for the

IRB or IACUC Approval: Approved

Level of Evidence: 5

Evidence of Restoration of Binaural Hearing in Bilateral Cochlear Implant Receiver Using Spectral Fusion Test

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Jean Charles Ceccato, PhD; Jean Luc Puel, PhD
Frederic Venail, MD, PhD

Objective: Signal processing in cochlear implant can alter binaural hearing cues. This study aims at demonstrating that bilateral cochlear implantation restores binaural spectral fusion.

Study design: Prospective experimental study.

Setting: Tertiary referral implant center.

Patients: 30 subjects with bilateral cochlear implant aged 37±20 years. All were experienced CI users (mean use 6.7±5 years), and had speech perception PBK scores >60% with both CIs (mean 85±13%).

Intervention(s): Subjects were tested with either low-pass (LP 0-1.5 kHz) or high-pass (HP 1.5-8 kHz) filtered monosyllabic words. Fusion signals (LP in one ear and HP in the other one) were presented simultaneously to measure binaural fusion effect. SRTs for speech in noise test were calculated using the French Matrix test.

Main outcome measure(s): Speech perception scores were calculated for monaural HP, monaural LP, binaural full bandwidth (FB) and fusion conditions. Speech in noise SRTs were correlated with binaural fusion scores and PBK scores.

Results: Speech perception scores with LP and HP filtered lists were similar (43 and 38% respectively, $p>0.05$). Binaural FB scores were 92±3.5%. Fusion scores (84±6%) were significantly higher than monaural scores ($p<0.001$), but remained significantly lower than binaural FB scores ($p<0.001$).
SRT in binaural conditions was significantly higher than SRT in the best implanted ear (4.1 dB, $p<0.05$) and in the worst implanted ear (16 dB, $p<0.01$). Binaural SRT was positively correlated with binaural fusion score ($r=0.84$, $p<0.01$).

Conclusions: Bilateral cochlear implantation allows to restore binaural spectral fusion and enhances speech in noise perception.

Define Professional Practice Gap & Educational Need: Evaluation of speech perception improvement after bilateral cochlear implantation not only relies on speech perception in quiet, but also in speech perception in noise.

Learning Objective: Adding speech in noise and binaural fusion testing in cochlear implant recipients allows to evaluate the proficiency of binaural hearing functions.

Desired Result: A broader evaluation of binaural auditory function should support the use of bilateral auditory rehabilitation in severe to profound hearing impaired people, including bilateral cochlear implantation.

IRB or IACUC Approval: Approved

Level of Evidence: 5

A Comparison of Hearing Changes Over Time in Vestibular Schwannoma: Gamma Knife vs Observation

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Objective: To examine hearing loss over time for patients with sporadic vestibular schwannoma undergoing observation or following gamma knife.

Study design: Retrospective review

Setting: Tertiary academic medical center

Patients: Patients with sporadic vestibular schwannoma who underwent either primary observation or gamma knife and who had at least two audiograms available for review.

Interventions: Gamma knife radiation or observation

Main outcome measures: Pure tone average over time

Results: 202 patients met inclusion criteria. Of these, 169 underwent observation and 33 patients underwent gamma knife radiation. There was no difference in gender ($p = 0.14$) or side ($p > 0.9$) between groups. The mean follow up was 99 weeks for the observation group and 164 weeks for the gamma knife group ($p=0.002$). For all patients, there was a significant worsening of PTA over time (0.03 dB/week, $p = 0.001$), however there was not a significant different in the rate of change of PTA between the two groups ($p = 0.1$).

Conclusion: Despite increased hearing loss over time across both groups, there was no significant difference in the change in hearing over time between the two treatment groups. This information may be yet another valuable tool for counseling to determine appropriate therapy and improve outcomes for patients diagnosed with a vestibular schwannoma.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge of hearing loss over time following vestibular schwannoma treatment

Learning Objective: To understand that the rate of hearing loss may not be influenced by treatment type (eg, gamma knife radiation versus observation)

Desired Result: Application of knowledge in treatment planning for patients with vestibular schwannoma

IRB or IACUC Approval: Approved

Level of Evidence: 4

Ki-67 Index as a Predictor of Vestibular Schwannoma Re-growth or Recurrence

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Hypothesis: Ki-67 immunohistochemical staining is predictive of increased risk of vestibular schwannoma (VS) re-growth or recurrence after resection.

Background: Ki-67 is a monoclonal antibody that provides a means of rapidly evaluating the growth fraction of normal and neoplastic human cell populations.There currently is no accepted biological marker to predict re-growth or recurrence in total or subtotal resected VS. A Ki-67 index of less than 3% is expected for a typical schwannoma. Cells from total or subtotal resected VS with increased mitotic activity on routine pathological study that then stain positive for Ki-67 with an index greater than 3% are presumed to be actively proliferating and pose a theoretically higher risk for re-growth or recurrence requiring treatment.

Method: Retrospective chart review in a tertiary skull base surgery center.

Results: 90 consecutive patients treated between 2014-17 were included in the study. Those with prior radiation or surgery were excluded. Five or 5.5% of our cohort (4 male; 1 female) were identified with an elevated a Ki-67 labeling index above 3%. Two required treatment for aggressive tumor re-growth after gross total resection. One opted for revision surgery and the other underwent Cyberknife therapy. Three patients were tumor free at latest, 6-12 month, MRI follow up.

Conclusion: Ki-67 labeling index reliably identifies VS with an elevated potential for re-growth or recurrence. In patients with an elevated Ki-67 index we recommend more frequent clinical and radiological follow-up.

Define Professional Practice Gap & Educational Need: To optimize the management of patients with vestibular schwannoma this research will help to educate neurotologists

Learning Objective: Understand the importance of Ki-67 labeling index and the impact it will have on following patients with vestibular schwannoma

Desired Result: Attendees will implement Ki-67 labeling index in the pathologic evaluation of vestibular schwannoma

IRB or IACUC Approval: Approved

Level of Evidence: 5

Cochlear MRI FLAIR Signal Changes after Hearing Preservation Surgery for Vestibular Schwannoma

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Rick A. Friedman, MD, PhD

Objective: To evaluate the change in magnetic resonance imaging (MRI) T2-weighted cochlear fluid attenuation inversion recovery (FLAIR) signal intensity in vestibular schwannoma (VS) patients undergoing hearing preservation surgery.

Study Design: Retrospective review

Setting: Tertiary referral academic center

Patients: All VS patients who underwent middle fossa craniotomy (MF) approach or retrosigmoid (RS) craniotomy from January 2013 to June 2017 with FLAIR sequences on preoperative and 1-year postoperative MRI, and preoperative and postoperative audiograms.

Outcome Measure: Using the AAO-HNS hearing classification, patients were classified as hearing preserved (Class A or B) or not preserved. Mean signal intensity of the affected cochlea was evaluated by an operator-determined region-of-interest technique delineating the middle and apical turns of the cochlea and normalized against the contralateral cochlea.

Results: 9 of 34 MF and 26 of 106 RS patients were identified and included. Hearing preservation rates were 89% (8/9) for MF, and 27% (7/26) for RS. There was no difference in preoperative cochlear FLAIR signal intensity between hearing preserved and non-preserved groups (1.92 vs 2.01, p=0.38). Postoperative cochlear FLAIR signal intensity was lower in the hearing preserved group, but did not reach statistical significance (1.45 vs 1.73, p=0.13). The hearing preserved group demonstrated greater percent decrease than the non-preserved group (-19.4% vs 0.8%, p=0.19), but also did not reach significance.

Conclusion: In patients undergoing successful hearing preservation VS surgery, there is a trend toward greater improvement in cochlear FLAIR signal than in patients whose hearing is not preserved. A more highly powered and comprehensive study is required to establish statistical significance and may have potential implications in determining the timing of surgical intervention.

Define Professional Practice Gap & Educational Need: Lack of awareness regarding the utility of cochlear FLAIR signal in vestibular schwannoma patients.

Learning Objective: To gain knowledge regarding the use of cochlear FLAIR signal in vestibular schwannoma management and to understand how the signal may change after surgical intervention.

Desired Result: Consideration of cochlear FLAIR signal in counseling patients regarding the need for and timing of surgical intervention for vestibular schwannoma.

IRB or IACUC Approval: Approved

Level of Evidence: 4

Prevalence and Outcome of Hemifacial Spasm following Radiosurgical Treatment of Skull Base Tumors

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Objective: To determine the prevalence and clinical features of hemifacial spasm (HFS) following stereotactic radiosurgery (SRS) for lateral skull base tumors.

Study design: Retrospective case review

Setting: Tertiary referral center

Patients: Seventy-seven patients underwent SRS for skull base tumors; 45 tumors were vestibular schwannomas (VS) of the internal auditory canal and cerebellopontine angle (IAC/CPA), 4 facial nerve (FN) schwannomas (FS), 4 lower cranial nerve schwannomas, 6 meningiomas, 11 glomus tumors, and 7 malignant tumors. Of the non-VS and -FS tumors, one involved the CPA, 4 were located in the petrous bone, and others involved the jugular foramen, temporal lobe and cerebellar peduncle. Mean age was 64.8 years (17.4-87.3); mean follow-up was 27.3 months (1-59).

Intervention(s): None

Main outcome measures (s): 1) Prevalence of HFS; 2) Time between SRS and development of symptoms; 3) Persistence of HFS.

Results: Five patients (6.5%) developed new onset HFS after SRS (median time 32 months, range 19 – 40), including 4 VS and 1 FS (9% vs. 25%). In 2 patients HFS resolved spontaneously. Three patients had persistent HFS after an average of 12 months. One additional VS patient with prior HFS did not improve with SRS. Patients with pre-SRS abnormal FN function did not develop HFS, and one patient developed facial paresis without HFS after SRS.

Conclusions: Prevalence of HFS after SRS is low and is delayed. HFS only developed in patients with FS and VS; HFS risk is increased for tumors intrinsic to the IAC/CPA. HFS is independent of pre- and post-SRS FN function.

Define Professional Practice Gap & Educational Need: Hemifacial spasm have been noted in patients treated with stereotactic radiosurgery surgery for skull base tumors. There is currently no published study which specifically examined the prevalence, risk factors, and clinical outcome of hemifacial spasm related to radiosurgery.

Learning Objective: To understand the prevalence, risk factors, and clinical outcomes of hemifacial spasm after radiosurgery.

Desired Result: At the conclusion of the presentation, the audience should be better equipped to counsel patients on the probability of developing hemifacial spasm after stereotactic radiosurgery treatment of skull base tumors, and its anticipated clinical course. This allows for informed decision-making regarding further treatments such as medication or botulism injection for radiation-related hemifacial spasm.

IRB or IACUC Approval: Approved

Level of Evidence: 5

Outcomes following the Shield vs. Palisade Graft Technique during Combined Tympanoplasty and Ossicular Chain Reconstruction

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Objectives: 1) Discuss different approaches to cartilage grafting of the tympanic membrane. 2) Compare outcomes of the shield versus palisade technique combined with ossiculoplasty.

Study Design: Retrospective, case-control

Setting: Tertiary referral teaching hospital

Patients: Patients undergoing cartilage tympanoplasty and ossicular chain reconstruction for Eustachian tube dysfunction by one surgeon between 2006-2016 were identified. Patients with cholesteatoma were excluded. Thirty nine patients were included. Patients underwent a tympanoplasty with a shield (n=16) or palisade (n=23) graft and partial or total ossiculoplasty. Demographic information and medical history, including prior tube placement, tympanic membrane atelectasis or perforation was collected.

Intervention: Shield vs. palisade graft for tympanoplasty with ossiculoplasty.

Main Outcome Measures: Improvements in pure tone average (PTA), speech discrimination scores (SDS), revisions and complications.

Results: The average patient age in the shield group and palisade group was 42.3 and 42.1, respectively. The preoperative PTA was significantly greater in the palisade group (55.3 dB vs 45.7 dB). The pre-op SDS for the shield group was greater than the palisade group but the difference was not significant (96% vs 87%). The postoperative improvement in PTA was no different between groups (17 dB for shield, 17.4 dB for palisade). The postoperative SDS in the shield group and palisade group was 95.6% and 84.6%, respectively. There were two complications reported in each group but no revisions.

Conclusion: Cartilage tympanoplasty with ossiculoplasty addresses hearing loss and Eustachian tube disease concurrently. In this study, there were no significant differences in hearing outcomes, revisions and complication rates for patients undergoing a shield vs. palisade graft during combined tympanoplasty and ossiculoplasty.

Define Professional Practice Gap & Educational Need: 1. Inconsistencies in outcomes following different approaches to cartilage grafting of the tympanic membrane.

Learning Objective: 1. Discuss the different approaches to cartilage grafting of the tympanic membrane. 2. Compare outcomes of the shield graft versus palisade graft technique for tympanoplasty in combination with ossiculoplasty.

Desired Result: Improve knowledge regarding the shield graft technique and palisade graft technique for tympanoplasty with concurrent ossiculoplasty, including indications for each approach, technique details, outcomes and potential complications.

IRB or IACUC Approval: Approved

Level of Evidence: 4

Long-Term Outcomes of Primary Radiosurgery Treatment of Glomus Jugulare Tumors: A Systematic Review with Meta-Analysis

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Brian Wiseman, BS; Adam Cassis, MD

Objective: Determine long-term tumor control, symptomatic control, and complications of primary radiosurgery (PRS) for the treatment of glomus jugulare tumors (GJT) via systematic review and meta-analysis of the available data.

Data sources: 1) Search of English language articles of PubMed, Web of Science, Cochrane, and EBSCOhost databases from January 1950 to August 2017

Study selection: Inclusion criteria: 1) Treated patients with GJT with radiosurgery who had no previous treatment of any kind 2) Follow patients for greater than one year with magnetic resonance imaging 3) Reported pre and post-treatment symptoms, tumor control, and complications for individual PRS patients or for PRS patients as a group separately than from those who had received previous treatment

Data extraction: Data extraction was performed at the patient level because studies often did not report aggregate outcomes of PRS patients separately. For each patient meeting criteria the following were extracted: linear accelerator, maximum dose to tumor margin, pre-treatment tumor volume, tumor control, method of assessing tumor control, length of follow-up, complications, and pre and post-treatment symptoms.

Data synthesis: Eighteen studies encompassing 129 patients met criteria. Tumor control was achieved in 125 patients (96.9%). Pre-treatment symptoms worsened in 4 patients (3.1%). Ten (7.8%) patients developed transient cranial neuropathies. Six (4.7%) developed new permanent cranial neuropathies. There were no major complications.

Conclusions: In general, PRS is safe and effective at controlling growth and clinical symptoms for patients with GJTs, though there is significant selection bias and clinical heterogeneity among existing studies.

Define Professional Practice Gap & Educational Need: Lack of knowledge regarding long-term outcomes of primary radiosurgery for the treatment of glomus jugulare tumors.

Learning Objective: Understand the long-term outcomes of primary radiosurgery for the treatment of glomus jugulare tumors.

Desired Result: Attendees can more effectively and accurately counsel patients regarding their treatment options for glomus jugulare tumors.

IRB or IACUC Approval: Approved

Level of Evidence: 2

Reliability of Video Head Impulse Test Based on Clinician Experience

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Objective: The goal of this study is to determine the variability of six-canal video head impulse testing (vHIT) based on clinician experience.

Study Design: Descriptive

Setting: Continuing medical education course

Patients: Thirteen clinicians were recruited to perform a six-canal vHIT using the Otometrics ICS Impulse system on a subject with normal vestibular function. Each clinician performed a standard six-canal head impulse test in each canal plane until 20 were accepted in each canal by the vHIT system, or 50 rejected impulses in a canal pair. The head impulse motion profiles and resultant vestibulo-ocular reflex (VOR) gains were calculated and analyzed.

Results: There were 4 (31%) novice examiners, 5 (38%) with intermediate level of experience, and 4 (31%) experts. For the entire cohort, mean standard deviation of VOR gain was 0.027 ± 0.011 for the horizontal canal planes and 0.074 ± 0.054 for the vertical canal planes. Mean standard deviation of VOR gain correlated inversely with clinician experience in the vertical canal planes, but not in the horizontal canal planes.

Conclusion: Clinicians with greater experience performing vHIT obtain more consistent VOR gain in the vertical canals. Sensitivity and specificity of the vHIT may depend on clinician experience, particularly when examining the vertical canal planes.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge about the effect of clinician experience on video head impulse testing.

Learning Objective: 1. Become familiar with the role of video head impulse testing (vHIT) in the diagnosis of vestibular disorders. 2. Describe the factors that may affect vHIT results, including clinician experience level.

Desired Result: Knowledge gained from this study may be applied directly for clinical and research purposes to improve evaluation of the vestibulo-ocular reflex via the video head impulse test.

IRB or IACUC Approval: Approved

Level of Evidence: 5

Direct Parasagittal Diffusion Tensor Imaging (DTI) Improves Resolution of Facial and Vestibulocochlear Nerves in Patients with Vestibular Schwannoma

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Objective: Advanced magnetic resonance imaging (MRI) techniques such as diffusion tensor imaging (DTI) have the potential to improve preoperative assessment of facial (cranial nerve [CN] VII) and vestibulocochlear (CN VIII) nerve anatomy in patients with neoplasms of the lateral skull base. This is especially important in patients with vestibular schwannoma (VS) as the tumor often displaces the normal course of the nerves. Routine axial plane DTI scans provide a limited view of individual cranial nerves because the acquisition plane bisects the nerves at the cerebellopontine angle (CPA). We hypothesize that direct parasagittal DTI improves resolution of CN VII and VIII in patients with VS.

Study design: Retrospective case review

Setting: Tertiary referral center

Patients: Patients with VS

Intervention: Axial and parasagittal single-shot epi-planar DTI on a 3.0-Tesla Philips MRI scanner**.**

Main outcome measure(s): Resolution and continuity of CN VII and VIII in the CPA as seen on three-dimensional reconstructions and tractography.

Results: CN VII and CN VIII were more clearly identified in continuity along their course in the CPA using direct parasagittal plane compared to axial plane. Direct parasagittal DTI improved craniocaudal resolution (2mm to 0.9mm) without increasing acquisition time. Finally, direct parasagittal plane facilitated seeding for quantitative DTI analysis, such as diffusion anisotropy.

Conclusions: Use of the parasagittal plane for DTI acquisition is a novel and immediately clinically applicable imaging modality that improves the resolution of CN VII and VIII in the CPA compared to traditional axial plane DTI. Findings have implications for preoperative evaluation of patients with VS and surgical planning.

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

Learning Objective: Understanding of a new directly clinically applicable imaging modality that improves diffusion tensor imaging for the cranial nerves in tumors of the cerebellopontine angle

Desired Result: Incorporation of the new imaging modality in the preoperative workup of patients with vestibular schwannoma

IRB or IACUC Approval: Approved

Level of Evidence: 5

Unilateral versus Bilateral Cochlear Implantation in Children with Auditory Neuropathy Spectrum Disorder

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Objective: To evaluate audiologic outcomes following unilateral versus bilateral cochlear implantation in children with auditory neuropathy spectrum disorder (ANSD).

Study Design: Retrospective case review.

Setting: Tertiary Otologic Academic Medical Center.

Patients: Twenty-four patients with ANSD who underwent unilateral or bilateral cochlear implantation (CI).

Interventions: Rehabilitative (cochlear implantation).

Main outcome measures: Speech recognition scores and achievement of open set speech recognition.

Results: Prior to implantation, all patients had hearing aid trials with lack of auditory skills development. Twenty-four patients were included, of which 66.7% had comorbid developmental delay. Two therapeutic approaches were utilized, with 14 patients undergoing unilateral CI with contralateral hearing aid, and 10 patients undergoing bilateral CI (either simultaneous implantation or sequential implantation within 12 months). The median ages at CI activation were 39.4 and 17.1 months in the unilateral and bilateral CI groups, respectively (p=0.0007). The median postoperative follow-ups were 44.3 and 47.2 months in the unilateral and bilateral CI groups, respectively (p=0.52). No patients had achieved open set speech recognition prior to implantation. At last follow-up, 8 unilateral CI patients and 7 bilateral CI patients achieved open set speech recognition (p=0.68). The median time to achieve open set speech recognition after implantation was 32.9 and 38.1 months for unilateral and bilateral CI groups, respectively (p=.96).

Conclusions: Although the bilateral CI group is implanted at a younger age, they achieve open set speech recognition within a similar time period compared to the unilateral CI group. Bilateral CI in ANSD may prove advantageous for auditory skills development, but a statistically significant difference was not identified in this series.

Define Professional Practice Gap & Educational Need: Lack of information regarding the benefit of a second cochlear implant in patients with auditory neuropathy spectrum disorder (ANSD) who have inadequately benefitted from hearing amplification.

Learning Objective: To determine if patients with ANSD would benefit more from unilateral or bilateral cochlear implantation in regards to speech recognition and open set speech achievement.

Desired Result: Attendees will have additional information in this subject matter, which may directly impact their practices, and whether they complete bilateral or unilateral cochlear implantation in patients with ANSD.

IRB or IACUC Approval: Approved

Level of Evidence: 5

Volumetric Analysis of Sporadic Vestibular Schwannomas Treated with Gamma Knife Radiosurgery

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

Objective: To assess volumetric changes after stereotactic radiosurgery (SRS) of sporadic vestibular schwannomas (VS) that exhibit pretreatment growth.

Study Design: Retrospective case series

Setting: Two tertiary referral centers

Patients: VS that failed conservative management and underwent SRS with a minimum of 14 months post-SRS radiological surveillance.

Intervention: Volumetric tumor segmentation before and after SRS.

Main outcome measure: Persistent volumetric growth following SRS (i.e., treatment failure)

Results: Ninety-three patients met the inclusion criteria. Patients were observed for median pre- and post-treatment intervals of 28.8 and 36.5 months, respectively. The median dose to the tumor margin was 13 Gy (range 12-14 Gy). The median greatest axial tumor diameter and volume at the time of treatment was 16.3 mm (range 5.5 – 25.9 mm) and 0.70 cm^3 (range 0.077 – 3.75 cm^3). Post-treatment tumor control was achieved in 80% of patients. Patterns of transient volumetric tumor swell and features associated with treatment failure will be presented.

Conclusions: SRS provides effective tumor control in 80% of VS that exhibit pretreatment volumetric growth.

Define Professional Practice Gap & Educational Need: Lack of knowledge about the change in volume of vestibular schwannomas after radiation.

Learning Objective: Explain the effect of gamma knife radiation on vestibular schwannoma growth.

Desired Result: Improved understanding about the efficacy of radiation therapy

IRB or IACUC Approval: Approved

Level of Evidence: 5

Utility of Volume-Rendered Three-Dimensional (3D) Magnetic Resonance Imaging for Revision Superior Canal Dehiscence Surgery

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Objective: Durable outcomes are observed following middle fossa craniotomy for superior canal dehiscence (SCD). Persistent of symptoms after primary repair are uncommon but may be associated with inadequate occlusion of the defect. The extent of the plugged canal cannot be determined on computed tomography (CT) since most repair materials are not radiopaque. In this study, we hypothesize that volume-rendered three-dimensional (3D) magnetic resonance imaging (MRI) combined with 3D reconstruction of the bony defect on CT can determine the extent of repair following primary surgery for SCD.

Study design: Retrospective series**.**

Setting: Tertiary care center.

Patients: Adults with persistent symptoms following primary SCD repair with MRI and CT imaging prior to revision surgery.

Interventions: Revision surgery for SCD syndrome.

Main outcome measures: 3D rendering of MRI and CT.

Results: We identified revision cases from a cohort of 133 SCD patients who underwent surgery at our institution. We combined analysis of volume-rendered T2-weighted MRI sequences with 3D CT reconstruction of the bony defect. After normalizing for labyrinthine volume, the affected SSC showed significantly lower volumes compared to the contralateral side ($p<0.05$). Data highlighting the position of the plugged canal (MRI) relative to the canal defect (CT) will also be presented.

Conclusions: Lower SSC volumes seen in the operated ear indicate the extent of previous plugging from the primary repair and combined with CT can determine a persistent dehiscence. These data are valuable in the planning of revision surgery in SCD patients with persistent signs and symptoms following primary repair.

Define Professional Practice Gap & Educational Need: Lack of contemporary knowledge on the utility of volume-rendered three-dimensional (3D) magnetic resonance imaging for revision superior canal dehiscence surgery.

Learning Objective: The objective is to use volume-rendered three-dimensional (3D) magnetic resonance imaging to determine the extent of repair following primary surgery for superior canal dehiscence.

Desired Result: We hypothesize that volume-rendered three-dimensional (3D) magnetic resonance imaging may be valuable in planning of revision surgery in superior canal dehiscence patients with persistent signs and symptoms following primary repair.

IRB or IACUC Approval: Approved

Level of Evidence: 3

Bone Anchored Hearing in Children with Aural Atresia:
A Comparison of Performance with Surgical
and Non-Surgical Options

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Objective: The objective of this study is to compare speech perception, device use, and skin complications between pediatric atresia patients using a non-surgical bone anchored hearing (BAHA) on a soft band or transcutaneous magnetic stimulation (ie BAHA Attract ™.)
Study design: case-control study

Setting: Tertiary referral center

Patients: Two groups of age-matched pediatric patients with unilateral aural atresia who utilize a Cochlear Americas BAHA on a soft band (n=10) and those who use the BAHA Attract (n=10.) Patients with any sensorineural hearing loss (in either the amplified or non-atretic ear) and those who had undergone atresiaplasty were excluded.

Intervention: Surgical placement of a transcutaneous bone conduction device

Main outcome measure: Aided ear speech performance, Holgers classification for skin complications

Results: Age, length of follow-up (8 months- 3 years) and bone conduction thresholds for the atretic and non-atretic ear were comparable between groups. Holdger classification for skin complications were comparable between groups, despite utilization of high strength magnets in some Attract patients (n=5 using >/= #5 magnets.) Speech perception testing was comparable between groups, with a trend toward improved performance in the surgical group.

Conclusion: Minimal complications following Attract surgery and skin irritation following long-term soft band use suggest these are comparable options. Parents may consider the impact of future auricular reconstruction for microtia and improved speech perception in patients with the BAHA Attract when navigating amplification options.

Define Professional Practice Gap & Educational Need: 1. Incomplete understanding of benefits of surgical intervention for bone anchored hearing as compared to non-surgical options 2. Lack of awareness of factors involve in surgical decision-making process of parents of children with aural atresia

Learning Objective: to provide direct comparison of surgical intervention with the BAHA attract with continued use of the soft band BAHA in pediatric patients with aural atresia - complete understanding of the complications related to each option

Desired Result: Attendees will have greater understanding of the outcomes and complications related to each option and will have improved ability to counsel parents as they navigate these treatment decisions

IRB or IACUC Approval: Approved

Level of Evidence: 4