

doi:10.1017/S0022215116002565

Advances in Understanding of Eustachian Tube Dysfunction and Cholesteatoma (N675)

ID: 675.2

Eustachian Tube Dilatory Dysfunction: Diagnosis and Deterioration

Presenting Author: **Dennis Poe**

Dennis Poe

Boston Children's Hospital

The middle ear and mastoid system behaves as an auxiliary sinus and the Eustachian tube (ET) can be thought of as a long, dynamic ostium with a functional valve located within the cartilaginous portion in order to optimize the ear's special sensory role of hearing. Failure of the "valve" to function properly can occur if it dilates insufficiently to adequately aerate the middle ear and it is affected by the same pathophysiological processes as the nose and other sinuses.

ET dilatory dysfunction occurs when tubal dilatory effort is consistently insufficient to adequately aerate the middle ear with the possible consequences of negative middle ear pressure, retraction of the tympanic membrane, otitis media with effusion, tympanic membrane perforation and conductive hearing loss.

There are a number of hypotheses as to how retraction of the tympanic membrane may become fixed to the middle ear mucosa and progress to a retraction pocket, begin to collect desquamated debris and ultimately deteriorate into a cholesteatoma. Upregulation of inflammatory mediators and biofilms have been demonstrated within retraction pockets and could play a role in epithelial migration. Mucosal traction has been proposed as another mechanism. It has been observed that tympanic membrane retraction correlates with the presence of inflammatory disease within the cartilaginous ET, but not with the severity of observed tubal pathology. Thus, it has been proposed that retraction may be initiated by ET dilatory dysfunction, but an independently mediated biological process of retraction ensues after reaching some "point of no return." After the retraction process has been activated, it may continue despite aeration of the middle ear, either by tympanostomy tube or resolution of the tubal dilatory dysfunction.

As an early intervention in children, lateralization of a retraction pocket with lysis of its binding adhesions can arrest the process and may be protective against development into a cholesteatoma. However, once a cholesteatoma has developed, cartilage grafting of the tympanic membrane is often needed to prevent recurrence, despite an aerated middle ear, suggesting that the biological process of retraction may remain active for some time after eradication of the obvious disease.

Most of the pathology that is responsible for dilatory dysfunction has been observed within the cartilaginous portion and is most commonly due to inflammatory disease, which can be readily diagnosed with transnasal endoscopy. Disorders of dilation may be observed and classified with a dynamic exam during swallows and yawns. Inflammatory disease can be graded on a recently validated mucosal inflammation score instrument. The etiology of the

inflammation can be investigated and treated, with the most common causes being infectious or reflux in younger children and over age 6, allergic disease, reflux, rhinosinusitis, adenoid hypertrophy and other commonly known causes of nasopharyngeal inflammation. Treatment of the underlying medical conditions can result in improvement of ET function and resolution of middle ear disease. Surgery may be indicated when the medical causes have been optimally treated, but ET dilatory dysfunction persists, possibly due to irreversibly injured mucosa, biofilms or other pathology.

This presentation will show a practical approach to evaluating ET function. The dynamic endoscopic examination of the cartilaginous portion of the ET will be discussed in detail, along with recognizing and grading inflammatory pathology. Comparisons will be made between the diffuse tympanic membrane retractions associated with ET dilatory dysfunction as opposed to the retraction pockets that are presumed to be due to biological processes. Differentiating between these two mechanisms is critically important in determining appropriate treatment. Indications for surgical intervention will be discussed.

doi:10.1017/S0022215116002577

Advances in Understanding of Eustachian Tube Dysfunction and Cholesteatoma (N675)

ID: 675.3

Controversies in Aetiology and Management of Cholesteatoma (N675): Managing Cholesteatoma: Something Old, Something New, and Something Borrowed

Presenting Author: **Sujana Chandrasekhar**

Sujana Chandrasekhar

New York Otolaryngology; Hofstra-Northwell School of Medicine

Learning Objectives: 1. Correlate histopathologic evidence to predict clinical location of cholesteatoma. 2. Appreciate new real-time imaging modalities to optimize complete removal of cholesteatoma while preserving normal structures. 3. Understand the utility of MR imaging in the management of cholesteatoma.

Surgical extirpation of cholesteatoma must be adequate to negate recurrent or recidivistic disease but maintain as much hearing function as possible in a healthy mucosalized space. A thorough understanding of patterns of growth of various types of cholesteatoma enables the otologic surgeon to accomplish this. As the "something old" we have access to temporal bone histopathologic specimens that show us the usual path of an atticointral cholesteatoma vs. a tubotympanic one. Studying otopathologic slides allows for such in-depth understanding that it becomes second nature to the surgeon to anticipate the location of disease. The "something new" involves optical imaging with high resolution microendoscopes, multiwavelength fluorescent otoscopes, and multi-color reflectance imaging of middle ear pathology in vivo. Use of these methods should allow the surgeon to remove all disease while maintaining the integrity of the normal or

near-normal adjacent mucosa, at the time of initial surgery, preventing recidivism and potentially preventing repeat otologic surgical interventions. 'Something borrowed' is using new magnetic resonance imaging (MRI) techniques from radiology to image either nascent cholesteatomas or to use MRI as the 'second look' procedure. The goal is to enable minimally invasive techniques of complete cholesteatoma removal while preserving hearing function either naturally or by immediate reconstruction, and avoiding 'clean' second look surgeries. Details of using all of these techniques, including pitfalls that should be avoided, will be discussed.

doi:10.1017/S0022215116002589

Advances in Understanding of Eustachian Tube Dysfunction and Cholesteatoma (N675)

ID: 675.4

Controversies in Aetiology and Management of Cholesteatomas (N675) 6-6

Presenting Author: **Richard Chole**

Richard Chole

Washington University in St. Louis School of Medicine

Learning Objectives: The objective of this presentation is to critically evaluate the different theories of cholesteatoma pathogenesis and to discuss the evidence for and against various theories.

It is clear that cholesteatomas arise due to a number of different mechanisms. Clinical and experimental observations support the etiologies of cholesteatoma formation. Cholesteatomas clearly can arise by the ingrowth of keratinizing epithelium from the lateral surface of the tympanic membrane and ear canal into the middle ear. These so-called secondary cholesteatomas arise from implantation of keratinizing epithelium or ingrowth of a perforation. Experimental and clinical evidence supports this etiology.

Cholesteatomas may also arise by formation of retract pockets in the pars tensa or pars flaccida. The retraction pockets develop because of Eustachian tube malfunction and inflammatory degradation and weakening of the tympanic membrane. These retraction pockets are sometimes benign, but sometimes accumulate keratin debris. Once the keratin debris accumulates in a retraction pocket, expansion of the retraction pocket into a cholesteatoma is usually relentless.

Experimental and human temporal bone evidence has shown that cholesteatomas may arise by perforation of the basal lamina of the keratinizing epithelium of the tympanic membrane and the development of micro-cysts in enlarging intramural cholesteatomas.

A theory of mucosal traction by ciliated cells of an attic retraction pocket has been proposed. However, the epithelium of most of the middle ear and attic regions does not contain ciliated cells (Chole & Lim). Furthermore, recent evidence (Thompson & Tucker) has shown that the epithelium of the attic and around the ossicles is of neural crest origin and the area near the Eustachian tube is of endodermal origin. Neural crest derived epithelium does not form cilia.

doi:10.1017/S0022215116002590

Imaging for Cholesteatoma and ear structure (R676)

ID: 676.1

Labyrinthine Artery Detection in Patients with Idiopathic Sudden Sensorineural Hearing Loss by 7 T-MRI

Presenting Author: **Hiroaki Sato**

Hiroaki Sato, Kazuaki Kawagishi, Makoto Sasaki

Iwate Medical University

Learning Objectives:

Objective: The pathogenesis of idiopathic sudden sensorineural hearing loss (ISSHL) is still unknown, but an inner ear circulatory disturbance has been considered to be one possible pathogenesis. To date, there have been no reports evaluating the possibility of the labyrinthine artery infarction in ISSHL patients by ultra-high-field MRI. The present study aims to compare the detection rates of the labyrinthine artery in subjects with idiopathic sudden sensorineural hearing loss and in normal hearing controls using 7-T MRI.

Study Design: cross sectional study

Setting: Tertiary referral center

Subjects and Methods: In 22 patients (11 males, 11 females) with ISSHL and 43 volunteers (29 males, 14 females) with normal hearing, 7-T MRI (Discovery MR950, GE Medical Systems) was performed with the 3D time-of-flight spoiled gradient echo (3D TOF SPGR) sequence to compare the detection rates of the labyrinthine artery.

Results: MRI scans were performed from 3 to 173 days after onset. Of the 22 patients with ISSHL, 8 showed complete recovery, 10 showed partial recovery and the rest showed no recovery. The labyrinthine artery was depicted in 44 of 44 ears (100%) in the ISSHL group and 85 of 86 (98.8%) ears in the normal hearing group, with no significant difference in detection rates. Two ISSHL patients out of 4 patients with no recovery showed total deafness, but the labyrinthine artery was also depicted in both patients.

Conclusion: The present study is the first to report depiction of the labyrinthine artery by 7-T MRI. These preliminary results indicate occlusion of the labyrinthine artery would be rare in the pathogenesis of ISSHL and they also demonstrate that the labyrinthine artery could be detected by ultra-high-field MRI.

doi:10.1017/S0022215116002607

Imaging for Cholesteatoma and ear structure (R676)

ID: 676.2

Combine MR and CT imaging in cholesteatoma

Presenting Author: **Issam Saliba**

Issam Saliba¹, Musaed Alzahrani², Rami Alhazmi²,
Belair Manon¹

¹University of Montreal, ²King Fahad Specialist
Hospital-Dammam, Saudi Arabia.

Learning Objectives: 1) To learn the importance of MRI diffusion in cholesteatoma followup 2) to understand how fusion of mastoid CT scan and MRI diffusion cal localize precisely residual cholesteatoma.

Objective: To evaluate the ability of a preoperative mastoid Computerized tomography scan (CT scan) fusion with the postoperative diffusion weighted magnetic resonance imaging to accurately localize a residual cholesteatoma thus sparing an unnecessary postoperative CT scan radiation.

Study design: Prospective study

Setting: Tertiary care center.

Patients and methods: We followed up prospectively a consecutive group of patients presenting with middle ear cholesteatoma using preoperative mastoid CT scans, postoperative mastoid CT scan and diffusion weighted-MRI between 2008 and 2009.

Postoperative Diffusion Weighted-MRI images were fused to both: the preoperative and postoperative mastoid CT scans. Fused images were evaluated for their ability to detect accurately the location of residual cholesteatoma. If any, results were correlated to surgical findings.

Results: Twenty-seven patients were included in the study; only nine patients showed middle ear opacity on the postoperative CT scans; the remaining negative patients were excluded. Diffusion weighted MRI had detected residual cholesteatoma in 3 out of the nine patients. Both CT scans; preoperative and postoperative, were able to precisely localize the residual cholesteatoma when fused to the postoperative diffusion-weighted MRI. Intraoperatively, two patients had a residual cholesteatoma that correspond to the fused radiological images. The third was cholesteatoma free.

Conclusion: Diffusion weighted MRI / CT scan fusion combines the advantages of cholesteatoma detection and precise localization. Preoperative CT scan performed before the first surgery can be used for the fusion to spare the patient an unnecessary another CT scan and thus decreasing radiation exposure.

doi:10.1017/S0022215116002619

Imaging for Cholesteatoma and ear structure (R676)

ID: 676.3

DWI imaging in extensive petrous bone cholesteatoma

Presenting Author: **Simon Lloyd**

Simon Lloyd, Hannah North, Simon Freeman,
Scott Rutherford, Charlotte Ward, Andrew King
TBC

Learning Objectives: To assess the utility of DWI imaging in the assessment of recurrence of extensive petrous bone cholesteatomas.

Methods: A prospectively updated database of patients who had undergone surgery for extensive petrous bone cholesteatoma was interrogated. All patients had undergone annual DWI imaging. Data was collated including extent of disease, surgical approach and recurrence based on clinical assessment and DWI imaging. Analysis of factors associated with recurrence was undertaken.

Results: 63 patients were included. Age range was 10 to 83 years. 60% presented with good facial function (House-Brackmann grade I or II) and 33% presented with useable hearing. The most common location of disease was supralabyrinthine 33%) although 28 (44%) had apical disease. Complications were limited with one patient developing a CSF leak, one patient an abdominal wall haematoma, and one patient an infection in the wound. 11% had residual hearing following surgery. 63% had good facial function at 1 year post operatively. 5% had clinically apparent residual/recurrent cholesteatoma but 30% had residual/recurrent disease on DWI imaging. 70% of recurrence was initially managed conservatively but 60% eventually required repeat surgery.

Conclusions: DWI MRI is a useful technique for confirming the diagnosis and assessing extent of petrous bone cholesteatoma. It has also become the gold standard for identification of recurrent disease and has much better sensitivity and specificity than clinical assessment. Its extensive use has demonstrated that recurrence rates of petrous bone cholesteatoma are much higher than historic papers based on clinical assessment would suggest. Not all recurrence requires treatment, however.

doi:10.1017/S0022215116002620

Imaging for Cholesteatoma and ear structure (R676)

ID: 676.4

How the use of CBCT and MRI has changed our management of cholesteatoma

Presenting Author: **Thomas Somers**

Thomas Somers, E Offeciers, J van Dinther, A Zarowski,
B Defoer, J Casselman
European Institute for ORL

Cholesteatoma remains a clinical diagnosis but today imaging has become an important cornerstone in the diagnostic work-up of this condition. Conebeam CT offers a much higher resolution of the interface between bone, air and soft tissue, while the associated irradiation dose is substantially lower, as compared to multi-detector CT scans. As such, CBCT has become very useful for the pre-op work-up of patients with cholesteatoma showing with precision bony erosion of the ossicular chain and erosion of the petrous bone (as fistulae, perilyabyrinthine erosion, intracranial invasion). Also the aeration of the

ME-cleft is shown (important for the functional prognosis) and important preoperative landmarks warn the surgeon for eventual pitfalls.

The advent of the non-EP diffusion weighted sequence in MR-imaging makes this sequence a very useful adjunctive tool in the pre-op work-up of cholesteatoma cases specially in cases suspected of intralabyrinthine spread, or extension medial to the otic capsule or intracranial invasion. Its today almost undisputed value has been demonstrated in the postoperative follow-up of cholesteatoma by the high sensitivity and specificity (in most studies well above 90%). By this innovation many “unnecessary” (because absence of residual pathology) second stage operations can today be avoided. Advantages and limitations of the two imaging techniques will be discussed.

An algorithm usefull in clinical practice will be proposed

doi:10.1017/S0022215116002632

Percutaneous and transcutaneous BCHD (V677)

ID: 677.1

Implantation technique of the semi-implantable transcutaneous bone conduction hearing device Sophono

Presenting Author: **Ralf Siegert**

Ralf Siegert

Prosper-Hospital

Learning Objectives:

Introduction: Patients with air bone gaps can be treated with bone conducting hearing aids. The disadvantages of the conventional and percutaneous systems are the obvious external fixation components or the biological and psychosocial problems of open implants. This project was set up to develop a semi-implantable transcutaneous bone conducting device, introduce it into clinical application and follow-up on the results.

Material and Method: The principle of this bone conducting device is the magnetic coupling between implanted and external magnets. After extensive lab tests it was introduced clinically in 2006. Since then there have been performed more than 300 implantations in Recklinghausen and more than 3000 worldwide.

We will demonstrate different implantation techniques: The “classical” one and the Up-Side-Down-Technique” and discuss pros and cons of each.

doi:10.1017/S0022215116002644

Percutaneous and transcutaneous BCHD (V677)

ID: 677.2

Bone Conduction Implant, clinical trial of a new transcutaneous implant and results so far

Presenting Author: **Peter Monksfield**

Peter Monksfield¹, Malou Hultcrantz², Sabine Reinfeldt³, Bo Håkansson³, Måns Eeg-Olofsson⁴

¹University Hospitals Birmingham, ²Karolinska University Hospital, the ³Chalmers University of Technology, ⁴Sahlgrenska Academy, University of Gothenburg

Introduction: The bone conduction implant (BCI), is a new active transcutaneous hearing implant with a transducer surgically implanted under intact skin.

We present the surgical procedure and the results so far of a multicentre clinical trial of this novel device.

Patients and Methods: 11 patients aged 18–67 years at 2 academic university hospitals in Sweden have been recruited and implanted with the BCI.

All patients have a mild to moderate conductive or mixed hearing loss and underwent audiometric assessment as well as completed abbreviated profile of hearing aid benefit (APHAB) and Glasgow benefit inventory (GBI) questionnaires. Results presented here are from the 6 month follow up the first 6 patients. As a reference device, a Ponto Pro Power (Oticon Medical) was used on a softband for a month prior to surgery.

All patients then underwent placement of the BCI device under general anaesthesia. The device was switched on at 1 month post surgery and audiometric assessment was repeated.

Results: The surgical procedure was uneventful with no immediate adverse events.

The BCI had a statistically significant improvement over the unaided condition with a pure-tone-average improvement of 31.0 dB, a speech recognition threshold improvement in quiet (27.0 dB), and a speech recognition score improvement in noise (51.2 %). At speech levels, the signal-to-noise ratio threshold for BCI was - 5.5 dB. All BCI results were better than, or similar to the reference device results, and the APHAB and GBI questionnaire scores showed statistically significant improvements versus the unaided situation.

Conclusion: The BCI provides significant hearing rehabilitation for patients with mild-to-moderate conductive or mixed hearing impairments, and can be easily and safely implanted under intact skin.

doi:10.1017/S0022215116002656

Long-term results of chronic ear surgery (R711)

ID: 711.1

Long-term outcome obliteration of radical cavities with autogenous cortical bone

Presenting Author: **Jussi Jero**

Jussi Jero¹, Saku Sinkkonen², Akram Abdel-Rahman³, Matti Pietola², Teemu Kinnari², Hans Ramsay², Antti Aarnisalo²

¹Helsinki University Hospital, ²Dep of ORL, Helsinki University Hospital, Finland, ³Dep of Audiology, Mansoura University, Egypt

Learning Objectives: Obliteration of radical cavities in canal-wall down (CWD) operations due to cholesteatoma with autologous cortical bone chips, bone pate and meatally-based musculoperiosteal (Palva) flap technique is safe and considerably stable in terms of cavitation and hearing outcome. In our material, no intracranial complications due to hidden residual cholesteatoma have been observed.

In Helsinki University Hospital we are used to obliterate radical cavities in canal-wall down (CWD) operations due to cholesteatoma with autologous cortical bone chips, bone pate and meatally-based musculoperiosteal (Palva) flap technique. In this study we retrospectively evaluated 70 patients operated in our institution during 1986–1991 with a mean follow-up of 18 years. Outer ear canal configuration was evaluated with a modified Likert scale (1–4) and outer ear canal physical volume assessed by tympanometry. The posterior wall of the ear canal and the attic region were analyzed separately. The posterior wall results were 1.8 (\pm 0.9 SD) in Likert scale and the attic region 1.8 (\pm 0.9 SD) indicating no cavity formation or minor formation of a cavity. The functional result was usually good. The mean volume of the operated ear canal was 1.7 (\pm 0.5 SD) ml. The volume of the contralateral ear canal was 1.2 (\pm 0.3 SD) ml. One tympanic membrane perforation was seen. An aerated tympanum was found in 52 patients and an adhesive tympanum was found in 18 patients. In audiometry a comparison of the current mean ABG to the preoperative mean ABG and to the ABG at one-year postoperatively, 5-years postoperatively or 10-years postoperatively showed no statistical significance. 36% of the patients had an excellent or good air-bone gap closure in the operated ear after follow-up. The need for debridement generally diminished over time and 50% of the patients had no need for debridement of the cavity after 18 years' of follow-up. To date no intracranial complications due to hidden residual cholesteatoma have been observed. In summary, our obliteration method is considerably stable in terms of cavitation and hearing outcome.

doi:10.1017/S0022215116002668

Long-term results of chronic ear surgery (R711)

ID: 711.2

Our long-term outcomes of tympanoplasty and mastoidectomy in patients with cholesteatoma and chronic otitis media (COM)

Presenting Author: **Masafumi Sakagami**

Masafumi Sakagami

Hyogo College of Medicine

Learning Objectives: How to report on term results of tympanoplasty and mastoidectomy.

Introduction: (1) Exact etiology of middle ear cholesteatoma remains unknown and its recurrence is unavoidable during the long-term follow up. We showed recurrence rate using Kaplan-Meier analysis because follow-up patients decreased with the time. (2) We analyzed the long-term outcomes of perforated COM using multivariate analysis to examine the prognostic factors and to determine whether mastoidectomy is useful for tympanoplasty in patients with perforated COM.

Subjects: (1) Between 1987 and 2002, 345 patients with cholesteatoma were operated on by the same surgeon. They were 140 attic cholesteatomas (40.6%) and 90 pars tensa cholesteatoma, and 115 other types (33.3%). Canal wall down tympanoplasty (CWDT) was performed in 113 patients (32.8%), canal wall reconstruction (CWR) after CWDT in 70 patients (20.3%) and intact canal wall up tympanoplasty (ICWT) in 162 patients (47.0%). (2) Between 1989 and 2002, 213 patients with perforated COM underwent tympanoplasty with mastoidectomy (34 ears, 16.0%) and without mastoidectomy (179 ears, 84.0%), and were followed up for more than 5 years.

Results: (1) The mean follow-up period was 6.3 years. Using the standard calculation method, the 5-year recurrence rate in patients with CWDT and with ICWT/CWR were 3.5% and 12.1%, respectively. Using Kaplan-Meier analysis, they were 3.9 and 16.7%, respectively. (2) Successful hearing outcomes (A-B gap: 20 dB or smaller) was 174/213 (81.7%). Using multivariate logistic regression analysis, normal ossicular chain was the only factor to long-term successful hearing outcomes. Graft success rate was 204/213 (95.8%). There were no significant predictors of long-term successful graft outcomes.

Conclusion: (1) Because the follow-up rate decreased with year, Kaplan-Meier analysis shows more correct recurrence rate than the standard calculation method. (2) Mastoidectomy was not a significant factor predicting long-term outcomes.

doi:10.1017/S002221511600267X

Long-term results of chronic ear surgery (R711)

ID: 711.3

Long-Term Hearing and Functional Outcomes and Complications after Ossiculoplasty

Presenting Author: **John Dornhoffer**

John Dornhoffer, Matthew Cox

UAMS

Learning Objectives: To study intermediate-term and long-term hearing results after ossiculoplasty and long-term goodness-of-fit for the ossiculoplasty outcomes parameter staging (OOPS) index.

Objective: To study intermediate-term and long-term hearing results after ossiculoplasty and long-term goodness-of-fit for the ossiculoplasty outcomes parameter staging (OOPS) index.

Patients: 417 patients (3-88 years of age; 258 adults and 159 children) undergoing ossiculoplasty with tympanoplasty or tympanomastoidectomy using cartilage tympanic membrane grafts, retrograde mastoidectomy with canal wall reconstruction or mastoid obliteration techniques between July 1998 and July 2012. All patients had at least 1 year of clinical follow-up. All patients had a minimum of 1 year of post-operative audiometric data and 185 (44.4%) patients (111 adults and 74 children) had \geq 5 years of post-operative audiometric data.

Outcome Measures: Early (<1 year after surgery), intermediate-term (1–5 years after surgery) and long-term (>5 years after surgery) post-operative audiometric data.

Results: Hearing results were assessed in all patients with 1 year of longer of audiometric follow-up. Despite worse pre-operative hearing (average intermediate PTA-ABG was 30.2 dB vs. 32.3 dB, respectively; $p = 0.0421$), there was no significant difference between adults and children for early post-operative (average early post-op PTA-ABG [pure tone average air-bone gap] was 18.2 dB vs. 19.6 dB, respectively; $p = 0.306$), intermediate (average intermediate PTA-ABG was 18.4 dB vs. 19.7 dB, respectively; $p = 0.235$), or long-term hearing result (average final PTA-ABG was 18.6 dB vs. 19.4 dB, respectively; $p = 0.439$). There was a significant improvement from pre-op to post-op and long-term PTA-ABG for all comparisons ($p < < < 0.01$). Additionally, the rate of air-bone gap closure to less than 20 dB was not significantly different (63.1% vs. 58.0% for adults vs. children, respectively; $p = 0.282$).

doi:10.1017/S0022215116002681

Long-term results of chronic ear surgery (R711)

ID: 711.4

Surgical treatment of adult and paediatric cholesteatoma – a comparison of 6 years follow-up

Presenting Author: **Lennart Edfeldt**

Lennart Edfeldt¹, Karin Strömbäck², Anders Kinnefors², Susanne Köbler², Helge Rask-Andersen²

¹University Hospital Uppsala, ²ENT/University Hospital Uppsala

Learning Objectives: The consistent performed and longterm follow-up after cholesteatoma surgery is essential for the evaluation and a prerequisite for a comparison of the surgical results.

Introduction: The aim with the study was to present and compare data from two separate studies of a 6-years follow-up after cholesteatoma surgery in adults and children.

Material and methods: 301 adult- (330 ears) and 57 paediatric patients were operated for cholesteatoma. In all cases an identical one-stage canal-wall down-technique with reconstruction of the middle ear and mastoid obliteration using autologous bone was used. In the adult group 47% had previous surgery, in the paediatric group 7%.

After surgery a standardized protocol for documentation of the intra- and postoperative findings and surgical steps including a sketch and the preoperative audiometric data -pure tone average (PTA) for air- and bone conduction threshold levels (0.5–3kHz) - were registered in the data based follow-up-program. All patients were examined annually after surgery and the surgical and the audiometric data fed into the program 1, 3 and 6 years after surgery.

Results: In the adult group residual disease was found in 3%, in the paediatric group in 5%. The recurrence rate was 10% and 12%. Chain revisions were performed in 19% and

14%. The rate of the postoperative water resistance was 5% and 7%, the postoperative infection rate 3% and 0%.

Long lasting improvement and/or preservation of hearing were obtained in both groups. The pre-and post-operative air conduction hearing levels were 45.8 dB and 35.8 dB in the adult group, in the paediatric group 33 dB and 25.5 dB.

Conclusions: Independent of preoperative middle ear condition, cholesteatoma extent and localization, the used surgical technique provided a long-term improvement of hearing with a low incidence of residual and recurrent disease. No differences in outcome between adult and children were found.

doi:10.1017/S0022215116002693

Free Papers (F712)

ID: 712.1

Effects of intensive microscopic work on neck and back strain and the benefits of a prototype ergonomic chair

Presenting Author: **Ananth Vijndren**

Ananth Vijndren¹, Gavin Devereux², Bruno Kenway³, Kathy Duffield³, Matthew Yung³

¹Luton and Dunstable | University of Antwerp,

²University Campus Suffolk, ³Ipswich Hospital Trust

Learning Objectives:

Introduction: Musculoskeletal pain is a common occupational hazard experienced by surgeons. Within the ENT community, Otologists have been noted to experience the most neck and back pain, possibly related to prolonged microscopic work.

Aims:

1. To investigate the effects of sustained microscopic work on the neck and back and its correlation to surgical experience
2. To assess the benefits of a prototype ergonomic chair during prolonged microscopic work

Methods: A crossover study was performed on 10 male ENT clinicians using a standard operating chair and a prototype ergonomic support chair. We used a subjective measure of time to fatigue and pain for the neck and back as well as objective readings from a surface electromyogram (sEMG).

Results: Surgeon experience (years) was correlated with the time (sec) to fatigue at the neck ($R = 0.91$, $p < 0.001$) and back ($R = 0.76$, $p = 0.01$) as well as time to pain at the neck ($R = 0.74$, $p = 0.01$) and back ($R = 0.78$, $p < 0.01$) when the standard chair was used. Group mean time to onset of neck fatigue was 348s, neck pain was 846s, back fatigue was around 502s and back pain was 821s. The prototype ergonomic support chair significantly delayed the sensation of neck fatigue ($+672 \pm 520s$, $p < 0.01$) and neck pain ($+427 \pm 467s$, $p = 0.017$) and also eliminated the

difference seen amongst the varying seniority of clinicians. These findings were corroborated by the sEMG readings.

Conclusions: ENT surgeons who perform prolonged microscopic work are at risk of musculoskeletal pain, which correlates with surgical experience suggesting an element of postural adaptation. Our prototype ergonomic support system can help delay the sensations of postural strain.

doi:10.1017/S002221511600270X

Free Papers (F712)

ID: 712.2

Endoscopic management of cholesteatoma with Khan's Endoholder

Presenting Author: **Mubarak Khan**

Mubarak Khan

Mimer medical college

Learning Objectives: Endoscopic ear surgery provides a minimally invasive approach to the middle ear. The disadvantage of endoscopic ear surgery is that it is a single-handed surgical technique. The nondominant hand of the surgeon is utilized for holding and manipulating the endoscope. This necessitated the need for the development of an endoscope holder that would allow both hands to be free for surgical manipulation. The aim of this article is to report our preliminary experience using our newly designed and developed endoscope holder, which allowed us to perform cholesteatoma surgery utilizing both hands for surgery.

Study Design: Retrospective nonrandomized clinical study.

Methods: The endoscope holder was designed and developed to aid in endoscopic cholesteatoma surgery and to overcome the disadvantage of single-handed endoscopic surgery. The design of the endoscope holder is described in detail, along with instructions on how it can be used. A total of 87 endoscope holder-assisted cholesteatoma surgeries were performed to evaluate the feasibility of a two-handed technique and to evaluate the results of surgery.

Results: Out of 87 Endoholder assisted cholesteatoma surgeries, 82 surgeries were performed exclusively with Endoholder and 5 needed combined approach (endoscope + microscope) suggesting 94% success in using exclusive Endoholder for endoscopic management of cholesteatoma.

The endoscope holder eliminates the disadvantages of single-handed surgery and is a good option for those who wish to perform endoscopic cholesteatoma surgery using both hands.

Conclusion: The study reports the successful application and use of the endoscope holder in a two-handed technique of endoscopic cholesteatoma management.

doi:10.1017/S0022215116002711

Free Papers (F712)

ID: 712.3

Long term hearing outcomes with the shape memory Nitinol stapes prosthesis: 10 year results

Presenting Author: **Rebecca Heywood**

Rebecca Heywood¹, Mark Quick², Marcus Atlas³

¹Ng Teng Fong General Hospital, ²Sir Charles Gairdner Hospital, ³Ear Science Institute Australia

Learning objectives:

1. Understand the variability that ensues during crimping of stapes prostheses
2. Understand the benefits conferred by self-crimping shape memory prostheses
3. Learn about long term stability of hearing outcomes using self-crimping shape memory prostheses

Introduction: Self-crimping stapes pistons were introduced to remove the manual component of the crimping process during stapedectomy with a view to producing stable long term hearing improvement in a reproducible manner and reducing trauma to the middle and inner ear. The objective of this study was to assess the long term clinical hearing outcomes and their stability following stapedectomy using a self-crimping shape memory Nitinol prosthesis over a 10 year period.

Methods: Retrospective case review was performed in a tertiary referral centre. Thirteen adult patients underwent fourteen stapedectomy procedures using a self-crimping shape memory Nitinol prosthesis between November 2003 and February 2005. Pure tone audiometry was performed preoperatively, at three monthly intervals up to two years and at five and ten years postoperatively.

Results: Mean postoperative air conduction (0.5, 1, 2 and 3kHz) was 24.4 dB (standard deviation 8.3) at 1 year and 29.6 dB (11.2) at 10 years. Mean postoperative bone conduction (0.5, 1, 2 and 3kHz) was 18.6 (8.0) at 1 year and 25.0 (12.0) at 10 years. Mean postoperative air bone gap (0.5, 1, 2 and 3kHz) was 5.5 dB (3.0) at 1 year and 4.8 dB (3.9) at 10 years. Mean air bone gap closure was 23.3 (12.6) at 1 year and 24.2 (9.9) at 10 years. Mean change in high tone bone conduction level (1, 2 and 4kHz) was 5.4 dB (6.0) at 1 year and -0.2 dB (7.0) at 10 years, a mean deterioration of 5.6 dB (0.6 dB per year).

Conclusions: Excellent closure of the air bone gap is demonstrated and it remains stable over at least ten years. There is no evidence that circumferential firm fixation of the prosthesis hook around the long process of incus has a detrimental effect in the long term.

doi:10.1017/S0022215116002723

Free Papers (F712)**ID: 712.4****Ossicular chain reconstruction during primary cholesteatoma surgery or during staged surgery?**Presenting Author: **Mark Heukensfeldt Jansen**

Mark Heukensfeldt Jansen, P. Merkus, F.R.K. Sanders, C.F. Smit, E.f. Hensen
VUmc Amsterdam

Learning Objectives: To learn if different strategies for ossicular chain reconstruction in cholesteatoma surgery have effect on the hearing results.

Background: Diffusion-weighted MRI imaging lowers the need for second-look surgery to evaluate the presence of residual disease. This strategy will increase the need to perform the best hearing restoration within the primary surgery to avoid a second surgery. It is unknown if single-stage management of cholesteatoma will achieve equal or better hearing results than a staged procedure.

Objective: To analyze the hearing results in ossicular chain reconstruction (OCR) during primary surgery compared to staged OCR in canal wall up mastoidectomy for cholesteatoma.

Study design: Retrospective comparative cohort study.

Patients: All patients with canal wall up mastoidectomy for cholesteatoma from 2003 to 2015 were consecutively selected. Patients who underwent OCR and met the inclusion criteria were divided in two groups: 45 patients with OCR during primary surgery and 46 patients with OCR during staged surgery.

Main outcome measure: Air-bone gap (ABG) improvement.

Results: Overall hearing results showed 56% of the patients achieving an ABG primary surgery OCR versus 7.6 dB for the staged OCR. The outcome measures were corrected for the confounders (age, type of OCR, destruction of malleus/incus/stapes). Only destruction of the stapes proved to be of significant influence. After correction for stapes destruction, the found difference in ABG improvement could not be assigned to the performance of primary or staged OCR.

Conclusion: There is no difference in ABG improvement after OCR during primary surgery compared to OCR during staged surgery.

doi:10.1017/S0022215116002735

Free Papers (F712)**ID: 712.5****TORP Ossiculoplasty Outcomes With and Without a Stapes Footplate Prosthesis**Presenting Author: **Matthew Cox**

Matthew Cox, James Russell, John Dornhoffer
University of Arkansas for Medical Sciences

Learning Objectives: Compare hearing outcomes with and without the use of a footplate prosthesis as a method of optimizing ossicular coupling during TORP ossiculoplasty.

Objective: The titanium stapes footplate prosthesis (FPP) was designed to ensure a stable connection of a total ossicular replacement prosthesis (TORP) to the stapes footplate and optimize acoustic coupling by centering the footplate on the oval window. Our goal was to assess the impact of the FPP on TORP ossiculoplasty outcomes.

Study Design: Case series with chart review.

Setting: Tertiary care center.

Subjects: Adult patients undergoing TORP ossiculoplasty with (n = 53) or without (n = 108) a stapes FPP.

Methods: Rate of prosthesis displacement and audiologic outcomes were tabulated for statistical analysis.

Results: A lower rate of prosthesis displacement and statistically better audiologic outcomes were seen in FPP patients. The pure-tone average air-bone gap (PTA-ABG) was closed to ± 11.7 dB (standard deviation, SD) and 12.6 dB ± 11.0 dB (SD) in the study and control groups, respectively (p = 0.0012).

Conclusions: Use of the titanium stapes FPP during TORP ossiculoplasty provides a significant advantage in short-term PTA-ABG closure and a higher rate of successful rehabilitation of conductive hearing loss. Further studies are necessary to assess any long-term advantages a FPP may offer.

doi:10.1017/S0022215116002747

Free Papers (F712)**ID: 712.6****New Prostheses for Tympanoplasty: Assessment in Cadaveric Temporal Bones**Presenting Author: **Mansour Alshamani**

Mansour Alshamani¹, Jaehoon Sim²,
 Michail Chatzimichalis³, Christof Rössli²,
 Alexander M Huber², Ivo Dobrev²

¹Zurich University hospital, ²University of Zürich, University Hospital Zürich, Department of Otorhinolaryngology, Head and Neck Surgery, Frauenklinikstr. 24, CH- 8091 Zürich, Switzerland, ³Dorset County Hospital NHS Foundation Trust, ENT Department, Williams Avenue, Dorchester, DT12JY, United Kingdom, michail.chatzimichalis@dchft.nhs.uk

Learning Objectives: The experimental assessments of the new prostheses (PORP and TORP) in cadaveric temporal measurements provide objective ways to predict their functional outcomes and benefits prior to their clinical application.

The middle-ear in human ear converts and transmits acoustically-induced sound stimuli to the inner ear. The middle-ear structures can be damaged by various middle-ear pathologies. The damaged middle-ear structures are frequently reconstructed by surgical procedures to rearrange or to replace the impaired middle-ear structures with an implantable prosthesis. Especially, the partial ossicular reconstruction prosthesis (PORP) and total ossicular reconstruction prosthesis (TORP) are used to provide direct connection between the tympanic membrane and the stapes. While such tympanoplasty surgeries are common these days, stable positioning of the prosthesis and reliable connection between the prosthesis and the remaining ossicular structure are still difficult to achieve.

In this study, four newly-introduced prostheses for tympanoplasty were assessed in cadaveric temporal bones; two PORPs with a ball joint and a notch for placement under the malleus and two supplemental devices for TORP, Omega Connector and TotalOption Connector. All the prostheses were implanted to the temporal bones in sequence, and time for implantation was measured for each of the prostheses.

With each of the prostheses implanted, motion of the stapes footplate and the volume displacement at the round window membrane were measured using a laser Doppler vibrometer (LDV).

The measured quantities were assessed as the functional outcomes of the surgical reconstruction with the corresponding prosthesis, in comparison with sound transmission in normal ears. Preliminary results indicate that middle-ear reconstructions with the newly-developed prostheses resulted in surgical outcomes comparative to normal middle-ear. Further, they provide relatively easy handling of the prostheses during the surgeries and relatively secure connection between the prostheses and the remaining middle-ear structures and thus relatively small risk of post-operative dislocation compared to current prostheses for tympanoplasty.

doi:10.1017/S0022215116002759

Difficult Situations in Cholesteatoma Surgery (N713)

ID: 713.1

Current trends in managing complications of chronic otitis media with cholesteatoma

Presenting Author: **Jyoti Dabholkar**

Jyoti Dabholkar, Arpit Sharma, Jaini Lodha, Nitish Virmani, Shruti Bansal

King Edward Memorial Hospital

Learning Objectives: 1. Complications secondary to cholesteatoma still remain a formidable challenge in developing countries. A high index of suspicion is necessary to prevent significant morbidity and mortality. 2. CT scan

plays a pivotal role in diagnosis of both intracranial and extracranial complications. 3. While the initial management may differ, canal wall down mastoidectomy remains the most reliable surgical procedure in these patients.

Introduction: Complications secondary to cholesteatoma are associated with significant morbidity and mortality. Despite a significant decline in the incidence of these complications in developed countries, they still pose a considerable challenge in developing countries. The present study has been conducted to outline our experience in managing complications of cholesteatoma.

Materials and Methods: This study was a retrospective review at KEM Hospital, India of clinical charts of patients with cholesteatoma who had presented with clinical or radiological evidence of complications and had undergone surgical interventions between 2008 and 2013. Patient demographics, clinical course, investigations, management and postoperative outcomes were analyzed.

Results: Of the 469 patients that underwent surgery for cholesteatoma, complications were observed in 86 patients (18.33%). Intracranial complications included meningitis 1.06%, brain abscess 3.2%, sigmoid sinus thrombophlebitis 1.9% and subdural empyema 1.06%. Extracranial complications included labyrinthine fistula 4.6%, facial paralysis 2.9%, zygomatic abscess 0.4%, post-auricular abscess 6.39%, neck abscess 1.2% and labyrinthitis 0.2%. HRCT temporal bone and CT Brain with contrast was done to establish the diagnosis of these complications. With combined neurosurgical intervention for intracranial complications and canal wall down (CWD) mastoidectomy as the definitive procedure, complete eradication of cholesteatoma was achieved.

Conclusions: Complications secondary to cholesteatoma still remain a formidable challenge in developing countries. A high index of suspicion is necessary to prevent significant morbidity and mortality. CT scan plays a pivotal role in diagnosis of both intracranial and extracranial complications. While the initial management may differ, canal wall down mastoidectomy remains the most reliable surgical procedure in these patients.

doi:10.1017/S0022215116002760

Difficult Situations in Cholesteatoma Surgery (N713)

ID: 713.2

The Evolution of Bone Anchored Hearing Aids (BAHA) in the Indian Subcontinent

Presenting Author: **Sunil Narayan Dutt**
Sunil Narayan Dutt¹, Apurv Kumar²

¹*Apollo International Hospitals Group,*

²*Ashadeep ENT Centre, Chief Audiologist*

Learning Objectives: 1. to understand the prevalence and incidence of partial deafness and the various indications for candidacy for BAHA in India 2. to comprehend issues

related to awareness, training of professionals and the deterrents for developing a hearing implant technology such as BAHA in a developing country such as India.

Introduction: The introduction of hearing implants in the Indian subcontinent started around the late 1980s in Mumbai. Many cochlear implant (CI) companies worked towards establishing comprehensive CI centres in India in the 90s and to date, more than 120 CI centres are established in the subcontinent offering hearing implants to its patients. While CI work has made good strides across the country (nearly 30,000 implants in 25 years is the estimate), other surgically implantable hearing devices including the BAHA have taken time to find application.

Material and Methods: The databases of all CI centres in India that offer BAHA to their patients were reviewed retrospectively. The general databases that were maintained by mentor surgeons that supported BAHA surgeries across the continent were referred to. CI and BAHA surgeons were interviewed regarding candidacy awareness, surgery, postoperative issues and any cost related deterrents.

Results: Of the 120 centres offering cochlear implants to patients, only about 40 have performed BAHA (Cochlear BAHA) surgeries in the past decade with or without mentor surgeons. A total of 248 BAHA implants have been performed including about 26 BAHA Attract surgeries. About 30 children are using BAHA processors on soft bands awaiting BAHA surgery (when they are five years of age). Fixture failures in the paediatric population is about 6% while wound related skin/soft tissue reactions have occurred in 20% of patients (Holger grades 1 and 2) and 8% of patients (Holger grades 3 and 4). Longer abutments have been used to address some of the soft tissue hypertrophy issues in about 8 patients. The conventional technique of skin graft and generous soft tissue reductions (about 60% of the cohort) saw more soft tissue issues compared to the linear incision and minimal soft tissue reduction technique. Personal hygiene issues, tropical climate and scarring properties are perhaps some reasons for a higher rate of soft tissue reactions. More recently, with the advent of the transcutaneous BAHA 4 Attract systems, there have been no healing related issues thus far (26 patients).

Discussion: The impact of partial deafness that would make the majority of candidacy for BAHA is much less compared to profound deafness (bilateral). Awareness regarding bone conduction implants (BCI) despite a number of educational activities across the country leaves a lot to be desired amongst not just the potential candidates (and parents) but also hearing healthcare professionals. Many families of children that are candidates (bilateral microtia, for example) from the semiurban and rural population, are unwilling to go the extra mile to collect the funding for what is perceived as a minor handicap. Cost is most definitely a deterrent and there are no Government schemes that have included BAHA in their coverage list of devices, while there are at least eight states in the country that have a state funded cochlear implant programme. With increasing awareness, reductions in the costs and the development of the transcutaneous bone conduction devices, it is envisaged that

this form of surgical hearing re/habilitation would have a better acceptance and penetration in the subcontinent in the years to come.

doi:10.1017/S0022215116002772

Difficult Situations in Cholesteatoma Surgery (N713)

ID: 713.3

Facial Nerve in Cholesteatoma Surgery- Handling damage and avoiding injury

Presenting Author: **Manoj M P**

M P Manoj
Mesiarc

Learning Objectives: To help the evolving surgeon to handle the facial nerve with confidence in extensive cholesteatoma, tips to preserve function and methods of handling injury.

Introduction: The facial nerve passes through the middle ear in its bony canal that is sometimes eroded in cholesteatoma, exposing the nerve trunk to injury during instrumentation. There are a few surgical tips to avoid injury and to repair after injury has happened.

Methods: In MESIARC, a tertiary otologic center, various cases of facial nerve palsy secondary to cholesteatoma, or attempted cholesteatoma surgery are handled. By careful understanding of anatomy, use of good magnification, proper instrumentation and meticulous care, we have been able to preserve facial nerve in most of the cases where it has been affected by disease or surgery. In rare cases where this could not be done, a variety of techniques have been used to correct the cosmetic effect of facial paralysis

Results: We have had 18 cases of facial nerve palsy secondary to cholesteatoma extension, six cases of surgical damage to the facial nerve during cholesteatoma surgery. Most of the cases of primary facial palsy due to disease were decompressed with near total recovery of function. Of the post surgical injury, two were managed with cable grafting, one with cross facial anastomosis, one with temporalis swing and the rest were decompressed with reasonable return to function.

Conclusions: A structured approach to the facial nerve helped with radiologic planning is of paramount importance in preservation of facial nerve function after injury either due to disease or previous surgery. A variety of techniques must be available in our armamentarium as no two patients are the same.

Learning Objectives: This presentation gives important tips to assess the facial nerve from a three dimensional view point, study of radiology of the facial nerve and the array of techniques at our disposal for preservation and repair.

doi:10.1017/S0022215116002784

Difficult Situations in Cholesteatoma Surgery (N713)

ID: 713.4

Difficult Situations in Cholesteatoma Surgery

Presenting Author: **Mohan Kameswaran**

Mohan Kameswaran

Madras ENT Research Foundation (P) LTD

Learning Objectives: In the Indian subcontinent, the otologist faces several challenges in cholesteatoma surgery due to the high prevalence of the disease and late presentation with advanced disease. Cholesteatoma extending into the oval / round windows, semicircular canal, or the internal auditory meatus are encountered. Revision surgery can be particularly challenging. This presentation will focus on these difficult situations in cholesteatoma surgery.

In the Indian subcontinent, the otologist faces several challenges in cholesteatoma surgery due to the high prevalence of the disease and late presentation with advanced disease. Cholesteatoma extending into the oval / round windows, semicircular canal, or the internal auditory meatus are encountered. Revision surgery can be particularly challenging. This presentation will focus on these difficult situations in cholesteatoma surgery.

doi:10.1017/S0022215116002796

Middle ear Implants – indications (R714)

ID: 714.1

BCI or AMEI: how to select the right patient with chronic middle ear disease

Presenting Author: **Maurizio Barbara**Maurizio Barbara¹, Simonetta Monini², Chiara Filippi², Francesca Atturo³¹*Sapienza University Rome*, ²*Sapienza University, NESMOS Department, Rome, Italy*,³*Sapienza University, NESMO Department, Rome, Italy*

Learning Objectives: To give some hint of the principles that should drive for an appropriate selection of the correct auditory implantable device in case of chronic middle ear disease.

Background: Bone Conductive Implants (BCI) are widely used since several decades for the auditory rehabilitation of conductive and mixed hearing loss as well as for Single-sided Deafness (SSD). In mixed hearing loss, the role of Active Middle Ear Implants (AMEI) has recently been emphasised, with application and direct driving of the remnants of the ossicular chain or on the round window membrane. The present study aims to identify the best

candidature on the ground of pre-operative personalised headband test.

Material and Methods: At the Implanting Center of Rome La Sapienza, Sant'Andrea Hospital, a consecutive series of subjects were evaluated for an auditory rehabilitation involving the use of electronic, surgically-implanted devices. A thorough audiometric evaluation was performed under the unaided condition and when wearing a simulation device, such as with the headband, personalised according to the individual subject's performances. The clinical conditions related to the ear pathology or to an eventual surgical sequel were also taken into account.

Results: A BCI was indicated in all cases with conductive hearing loss and in the mixed cases when the BC threshold was not measured beyond 40 dB at all the tested frequencies. When the BC threshold was beyond this threshold limit but not beyond 65 dB especially at the high frequencies, an AMEI was advised. Considering that these advanced mixed cases were often present as a sequel of open tympanoplasty for cholesteatoma, a round window coupling of the AMEI was advised.

Discussion: A thorough, individualised pre-operative test represents the best approach for the choice of the rehabilitative device, especially in absence of precise guidelines. From our experience, a round window application could always be indicated in stable, open tympanoplasty sequel and a concomitant advanced form of mixed hearing loss.

doi:10.1017/S0022215116002802

Cholesteatoma in Children (N715)

ID: 715.1

Management of Congenital Cholesteatoma

Presenting Author: **Levent Sennaroglu**

Levent Sennaroglu

Hacettepe University School of Medicine

Learning Objectives: In this presentation different forms of congenital cholesteatomas will be presented together with management strategies.

Between 2003–2016 author performed 817 tympanoplasties. 318 of these had cholesteatoma. 38 of these are classified as congenital cholesteatoma. 29 are primary cases and remaining 9 are revision cases. While three of the revision cases belong to the author, in remaining cases original operation had been performed in another center.

Youngest patient operated was 7 months old diagnosed with hearing screening.

Congenital cholesteatomas confined to the middle ear are usually attached to the neck of the malleus necessitating the removal of the neck and head of the malleus for complete removal. This can be managed without damaging the tympanic membrane. Ossicular chain is reconstructed with bone cement.

Larger cholesteatomas necessitate mastoidectomy with or without open cavity.

There is a group of congenital cholesteatoma extending into petrous bone. Resulting cavity can be managed by blind sac closure of the ear canal with subtotal petrosectomy.

These cases usually expose carotid artery, jugular vein dura and have a high rate of recurrence.

Videos will be provided for each pathology showing the technique of removal and hearing reconstruction.

doi:10.1017/S0022215116002814

Cholesteatoma in Children (N715)

ID: 715.2

Long term results of total ossiculoplasty in pediatric cholesteatoma surgery

Presenting Author: **Francoise Denoyelle**

Francoise Denoyelle¹, Jerome Nevoux², Pierre Chauvin³, Noël Garabédian¹

¹Necker Children's Hospital, APHP and Paris Descartes University, Paris France, ²Hopitel de Bicêtre et Université Paris XI, ³Department of Public Health, Saint Antoine Hospital ans Paris VI University

Learning Objectives: To evaluate the long-term results and predictive factors of a good outcome with the use of a total ossicular replacement prosthesis in pediatric cholesteatoma surgery.

Objective: To evaluate the long-term results and predictive factors of a good outcome with the use of a total ossicular replacement prosthesis in pediatric cholesteatoma surgery.

Design and setting: Retrospective case review in a tertiary referral center.

Patients: The study included 114 children (116 ears).

Interventions: A total of 116 ears underwent total ossicular chain reconstruction with a titanium prosthesis. Cartilage was always used for tympanic membrane reconstruction.

Main Outcome Measures: Audiological results were evaluated according to the guidelines of the American Academy of Otolaryngology–Head and Neck Surgery. Predictive factors of audiological results were determined. Logistic regression and X2 tests were used for statistical analysis.

Results: The mean age at surgery was 9.8 years. Ossiculoplasty was performed during second-look surgery in 91 ears (78.4%) and during another stage in 25 ears (21.6%). The first-stage procedure was always performed for cholesteatoma. Audiometric results were available for 116 ears at 1 year, for 89 ears (76.7%) at 2 years, and for 42 ears (36.2%) at 5 years. Closure of the average air-bone gap (ABG) to within 20 dB was achieved in 65 ears (56%) at 1 year. The mean (SD) preoperative and postoperative (at 1 year) ABGs were 41.0 (9.5) dB and 22.4 (12.6) dB, respectively. There were no cases of extrusion, but 17 luxations of the prosthesis were confirmed by computed tomography. Luxation occurred on average at 31.4 months. Three 4000-Hz degradations of bone conduction were reported, with no dead ears. We examined 3 predictive factors of

auditory results: preoperative ABG, footplate status, and postoperative otoscopic findings.

Conclusions: Total ossiculoplasty is a reliable technique in children. Long-term hearing outcomes are stable and satisfactory, but luxation can occur at any time. Preoperative ABG and footplate status are negative predictive factors of auditory results.

doi:10.1017/S0022215116002826

Ventilation and Gas exchange in middle ear (R716)

ID: 716.1

Middle ear pressure maintenance: 1) a concert played by many instruments. 2) Pathology as compensation.

Presenting Author: **Udi Cinamon**

Udi Cinamon
Wolfson Medical Center

Learning Objectives: Middle ear pressure maintenance: 1) a concert played by many instruments. 2) Pathology as compensation.

It is crucial that the pressure in the middle ear (ME) will be kept circa to ambient pressure. As a physiological system that needs to confront constant intrinsic and extrinsic changes (e.g., cardiovascular system, respiratory system, etc.) the ME requires to possess special capabilities to maintain a physiological steady state. This ME pressure homeostasis is a concert played by several mechanisms, i.e., pressure regulators meant to neutralize or minimize pressure changes. Adjusting the amount of gas, its flow and diffusion, as well as the volume of the middle ear cleft, temperature all mechanism that follow the law of gases [PV = nRT]:

Volume: Size matters, the mastoid and the tympanic membrane (TM) being a “pressure buffers”.

Surface matters: The “radiator” effect of the ME cleft regarding gas exchange, temperature, moisture (number of molecules, Temperature). The Eustachian tube (ET) being a conduit possessing a pumping effect. Nerves and pressure receptors may control ventilation by opening the ET. When one or more of these mechanisms fails a “disorder” may kick-in. Therefore, developing a chronic ME insufficiency is accepted as the patho-physiological setting for developing chronic ME disease, clinically presented as otitis media with effusion, atelectasis of the TM or associated with developing cholesteatoma.

These chronic changes can be addressed as compensatory mechanisms (e.g., heart hypertrophy to keep-up with perfusion having a failing heart). Edema of the mucosa, engorgement of vessels and transudate will diminish the volume and influence gaseous content in the ME elevating pressure. TM atelectasis changes the ME volume being a pressure buffer.

Failure to confront a prompt and significant pressure change, a situation in which the ME pressure needs to be elevated instantly, will be presented as barotrauma. The consequence would be transudate, hemorrhage, and TM perforation all means “trying” to compensate.