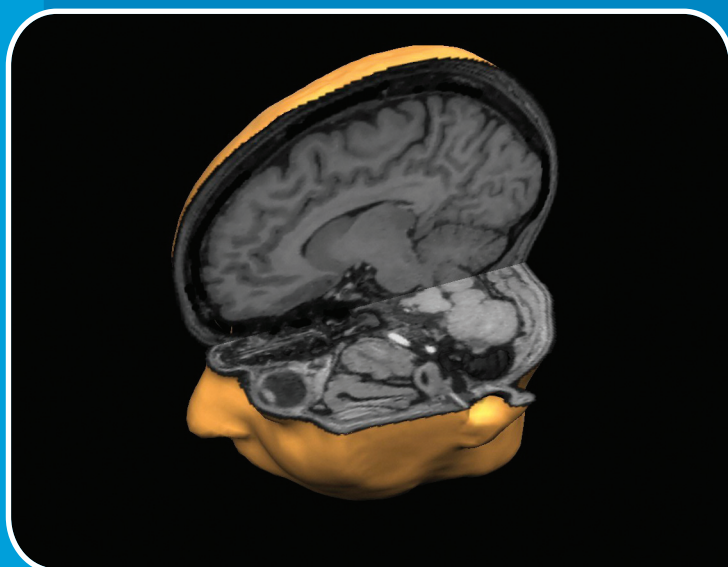


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Only a very brief summary of the submission requirements is presented here: when preparing their manuscripts, authors must consult and comply with the full Instructions for Authors on the JLO website at <http://www.jlo.co.uk/docs/submittingarticles.htm>. Adherence to these will speed up the editorial process.

All contributions are considered for publication on the understanding that they have been submitted solely to the JLO and that they have not previously been published. Contributions in the following categories will be considered: Main Articles (reporting clinical research or audit), Review Articles, Historical Articles, Short Communications (including 'How I do it'), Clinical Records (case reports), Radiology/Pathology/Oncology in Focus, and Letters to the Editors.

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Eustachian tube patulous vs obstruction (R611)

ID: 611.1

Interactions between the middle ear and the eustachian tube in causing symptoms of patulous ET

Presenting Author: **Manohar Bance**

Manohar Bance, Amoako-Tuffour Yaw
Dalhousie University

Learning Objectives: 1. Understand the relationship between PET symptoms and the transfer function of the middle ear 2. Review methods to test ET function 3. Review interventions that might be used at the middle ear level to treat symptoms of PET.

The eustachian tube can cause a variety of distortions in hearing, and the middle ear. At one end, failure of opening can result in negative middle ear pressure, which initially affects the low-frequencies, and may cause symptoms suggestive of fullness in the ear. At the other end, a ET that is open all the time can cause autophony, and also a sensation of fullness. In between are syndromes where the ET transmits sound more than normal, and if the ear is able to respond to these, then they might cause symptoms of autophony. Particularly, this is so with ears that have “floppy segments” in the TM. There is a complex interaction between which comes first, the autophony, which then causes various behavioural changes such as sniffing, to attenuate the response of the middle ear, and which then cause the eardrum to loose rigidity, or whether the eardrum loss of rigidity comes first, perhaps from childhood infections, which then causes autophony and behavioural responses such as sniffing.

We will review our experience with testing for abnormal transmission of sound through the ET, and our experiences with manipulation of the TM to reduce the symptoms of PET, as well as other middle ear interventions.

doi:10.1017/S0022215116001262

Eustachian tube patulous vs obstruction (R611)

ID: 611.2

Patulous Eustachian tube (PET) and the failure of the Eustachian tube to open (FETTO): diagnosis and management

Presenting Author: **Toshimitsu Kobayashi**

Toshimitsu Kobayashi¹, Ryoukichi Ikeda²,
Hidetoshi Oshima³, Hiromitsu Miyazaki²,
Toshiaki Kikuchi³, Tetsuaki Kawase³, Yukio Katori³,
Phawana Asawapittayanont⁴

¹Sen-en Rifu Otological Surgery Center,

²Sen-en Rifu Otological Surgery Center,
Miyagi, Japan, ³Tohoku University School of
Medicine, Sendai, Japan, ⁴Pattani hospital,
Pattani, Thailand

Learning Objectives: Round Table (PET vs FETTO)

Introduction: The importance of PET in otology has long been underestimated. We have achieved some contributions on PET as follows.

Methods and Results:

1. We have developed a new technique to diagnose PET using the sitting CT (Kikuchi T, et al. Otol Neurotol, 2007; 28:199–203; Kikuchi T, et al. ORL J Otorhinolaryngol Relat Spec. 2009; 71:312-6.).
2. Development of a specially designed silicon plug (Kobayashi Plug) for intractable cases (Sato T, et al. Acta Otolaryngol 2005; 125:1158-63). It is introduced from the myringotomy site, and was effective for about 80% of the 250 ears in which other treatments were unsuccessful (Kikuchi T, et al. in preparation)
3. High incidence in middle ear cholesteatomas: Patulous condition of the Eustachian tube is identifiable in about 30% of middle ear cholesteatomas (Magnuson:1978, Kobayashi:1996, Ohta:2009) and the incidence is higher than 50% if tested after optional myringostomy. The interview on sniffing habit is very important but not enough to pick up all the cases with patulous condition of the ET. In addition to thorough questionnaires, sniff test with optional myringostomy is useful for preoperative diagnosis of PET or Eustachian tube closing failure (Asawapittayanont P, et al. submitted).
4. ‘Masked Patulous Eustachian Tube’: We have proposed the concept of ‘masked patulous Eustachian tube’ (Masked PET) (Kobayashi T et al: Tohoku J Exp Med. 2009; 218:317-24) frequently found in middle ear diseases causing conductive hearing loss, such as cholesteatomas, otosclerosis, and perforations of the tympanic membrane, etc. In this condition, symptoms of PET are concealed due to the hearing loss and appears after improvement of hearing by surgery (Hasegawa J, et al.: Acta Otolaryngol. 2006; 126:577-80; Kawase T, et al: Otol Neurotol. 2006; 27:600-3; Hori Y, et al:Otol Neurotol. 2006; 27:596-9).

Discussion: I will discuss the topics of this session, differentiation between PET and FETTO, based on the above mentioned personal experience.

doi:10.1017/S0022215116001274

Eustachian tube patulous vs obstruction (R611)

ID: 611.3

Obstructed vs Patulous Eustachian Tube. How to Avoid Treating the Wrong One and Making it Worse

Presenting Author: **Cuneyt Alper**

Cuneyt Alper

Children’s Hospital of Pittsburgh of UPMC,
University of Pittsburgh

Learning Objectives: Symptoms of ETD may be confusing to the patient and the physician evaluating the condition. Obstructed ET may have symptoms of aural pressure, otalgia, popping, snapping, hearing loss, tinnitus, disequilibrium, and even vertigo. Patients with patulous ET may complain of aural pressure, otalgia, fullness, autophony of breathing or voice and habitual sniffing. Although there is a certain degree of overlap of the symptoms, a careful history taking should be able to differentiate these two conditions. However the main and absolute difference is in the findings in examination and testing. While continuously patulous ET has pretty straightforward symptoms and findings, the semi-patulous ET, with a very low ET opening pressure and closing pressure, or the ET that intermittently becomes patulous may be more difficult to diagnose and differentiate from the obstructed ET.

There are exciting new developments regarding the examination, testing and treatment of ETD. More recently, a number of new surgical procedures to improve the ETD are described. Naturally, the surgical treatment methods for obstructed versus patulous ET are different, while former aims widening the ET lumen, the latter needs to tighten it. If the type of ETD is not accurately diagnosed, there is greater chance for a diagnostic error. If a treatment for reducing the ET resistance is applied to a patulous or semi-patulous ET, the condition will worsen. Although less likely, if a procedure to increase the ET resistance is applied to an ET with obstruction, condition will get worse.

Differentiation of patulous versus obstructed ETD can be made with otoscopy, otomicroscopy, otoendoscopy, Valsalva, Toynbee, sniffing, tympanometry, 9-step test, inflation and deflation test, sonotubometry, forced response test, tubomanometry and pressure chamber tests. Tests can accurately differentiate patulous ET and ET obstruction, risk of worsening of the patulous or obstructive ETD with surgical interventions may be prevented.

doi:10.1017/S0022215116001286

Eustachian tube patulous vs obstruction (R611)

ID: 611.4

Endoscopic Repair of Patulous Eustachian Tube

Presenting Author: **Brian Rotenberg**

Brian Rotenberg
Western University

Learning Objectives: At the end of this presentation the audience will understand the various methods available to repair a patulous Eustachian tube via endoscopic techniques.

Patulous Eustachian tube remains a vexing problem for both patients and surgeons. The degree of impairment patients have can severely impact their quality of life. In this presentation I will review transnasal endoscopic repair techniques that have been developed to treat PET, including an in depth discussion of surgical steps and a critical analysis of the results. Some

promising new potential therapies will also be reviewed. In collaboration with other panelists we will present both interesting and representative cases, and encourage audience interaction.

doi:10.1017/S0022215116001298

Free Papers (F612)

ID: 612.1

Surgical management of congenital middle ear cholesteatoma

Presenting Author: **Zhaomin Fan**

Zhaomin Fan, Yuechen Han, Dong Chen, Li Li, Pengcheng Sun, Haibo wang

Eye & Ear Infirmary of Shandong Provincial Hospital Group

Learning Objectives:

Objectives: To analyze the clinical features and surgical findings in 29 cases of congenital cholesteatoma of the middle ear.

Methods: 29 patients (30 ears) who underwent surgery for congenital cholesteatoma between September 2012 and January 2016 were involved in this retrospective study. The otoscope examination, HRCT and audiogram were routinely done before surgery. The location and type of cholesteatoma, the surgical procedures, and the results were evaluated. Patient who had prior middle ear diseases were excluded.

Results: Of these 29 patients, the median age was 12 years (ranged from 3 to 54 years old). Hearing loss was complained of as a main symptom, and conductive hearing loss was found in 26 cases with the AB-gap were about 35.8 dB HL pre-operation. Two of these patients were misdiagnosed as secret otitis media in other hospital. Nine (30%) patients had closed-type cystic masses, while other 21 (70%) had open-type lesions. Canal wall down technique was performed in 20 cases, while Canal wall up in 1 cases, and Trans-canal approach was applied in 9 cases of which the lesion was limited in the mesotympanum. The erosion of the ossicular chain was found in 28 cases during the surgery. Ossicular chain reconstruction were done in 21 cases (TORP13, PORP 3, Cartilage 5), and the hearing thresholds were improved satisfied after more than 1 year follow up.

Conclusions: Congenital cholesteatoma of middle ear was a rare disease and usually delayed to be diagnosed in clinical practice. Conductive hearing loss was the most common symptom of these patients. There were different clinical features between the open-type and the closed-type lesion, which reflect a distinct pathogenesis. Surgery was the best choice when the middle ear congenital cholesteatoma was identified.

doi:10.1017/S0022215116001304

Free Papers (F612)**ID: 612.2****Predictive parameters in hearing improvement after tympanoplasty for primary acquired cholesteatoma**Presenting Author: **Yasuhiro Arai**Yasuhiro Arai¹, Masahiro Takahashi¹, Ryohei Yaguchi¹, Naoko Sakuma², Nobuhiko Oridate¹¹*Yokohama City University School of Medicine,*²*Kaagawa Children's Medical Center**Learning Objectives:*

Introduction: The cholesteatoma classification and staging system were proposed by the Japan Otological Society in 2010. The criteria classifies cholesteatoma into three stages (I, II, and III), and mastoid development and status of the stapes were categorized into four stages (MC0-3 and S0-3). The aim of this study was to elucidate whether these parameters were associated with hearing improvement after tympanoplasty for primary acquired cholesteatoma.

Methods: One hundred eight patients with acquired middle ear cholesteatoma (116 ears) underwent tympanoplasty at the Yokohama City University Hospital from 2003 to 2014. The present retrospective study included 37 patients (38 ears) who underwent a single-staged canal wall down type III tympanoplasty with canal wall reconstruction in order to minimize the effect of surgical method on postoperative hearing level. We analyzed association between parameters such as cholesteatoma staging, mastoid development, status of the stapes, and material used in canal reconstruction and postoperative hearing improvement. Hearing improvement was evaluated according to the guidelines of the Japan Otological Society. Categorical and continuous variables were compared using the χ^2 and Wilcoxon rank-sum tests, respectively.

Results: Hearing improvement was achieved in 76.3% of the study ears (29 of 38). A significantly higher grade in the preoperative mastoid development was observed in the ears with improvement than those without ($P = 0.013$). There was no significant difference in other factors between the two groups. The mean postoperative volume of tympanic cavity in the ears with improvement ($n = 7$) and those without ($n = 4$) was 0.357 mL and 0.142 mL, respectively. The more developed preoperative mastoid seemed to be associated with the more aerated postoperative tympanic cavity.

Conclusions: Mastoid development was a predictive parameter in hearing improvement after tympanoplasty for primary acquired middle ear cholesteatoma.

doi:10.1017/S0022215116001316

Free Papers (F612)**ID: 612.3****Dura involvement and lateral skull base reconstruction in cholesteatoma surgery: a retrospective study**Presenting Author: **Andreas Anagnostos**Andreas Anagnostos¹, David Schwarz², Sami Shabli², Antoniu-Oreste Gostian², Karl-Bernd Hüttenbrink²¹*Nicosia General Hospital & Larnaca General Hospital, Cyprus | University Hospital Of Cologne, Germany,* ²*University Hospital of Cologne, Germany*

Learning Objectives: - Dura involvement in cholesteatoma surgery is rare but possible. - Reconstruction of the lateral skull base can be performed using a variety of materials. - No intracranial complications are expected when dura involvement is recognized and treated properly.

Introduction: Due to its anatomical proximity to the tympanic cavity and the mastoid cells, the dura of the middle cranial fossa is occasionally involved in middle ear and mastoid surgery. This study investigates the frequency of dura involvement during cholesteatoma surgery in children and adult population.

Methods: A retrospective chart review of cholesteatoma surgeries between 2004 and 2015 at an academic tertiary care center was performed. Any kind of dura involvement, as well as the reconstruction techniques and long-term complications were documented.

Results: From 1291 cholesteatoma surgeries performed in the study period, a total of 97 (7.5 %) surgeries with dura involvement were identified. In the majority of these cases ($n = 74$, 5.7 %) the bone to the middle cranial fossa was missing and the otherwise intact dura was exposed. The dura was additionally damaged and cerebrospinal fluid leak was seen in six surgeries (0.5 %). In three cases (0.2 %) iatrogenic dura injury was reported, whereas in 9 surgeries (0.7 %) cholesteatoma came up to and infiltrated the dura. Reconstruction of the lateral skull base was performed using cartilage ($n = 24$, 1.9 %), polydioxanone (PDS)-foil ($n = 14$, 1.1 %), bone pate ($n = 8$, 0.6 %) and fibrin glue ($n = 5$, 0.4%). In 11 cases (0.9 %) a combination of autologous materials - such as cartilage, bone pate, muscle and connective tissue - was used, whereas in 33 surgeries (2.6 %) no reconstruction of the lateral skull base was performed. In a follow-up time period of 19.7 months (range 1 day - 104 months) no intracranial complications were reported.

Conclusions: The involvement of the dura of the middle cranial fossa is a rare but possible phenomenon during cholesteatoma surgery. A variety of reconstruction materials are available for the sufficient reconstruction of the skull base in such cases. When recognized and treated properly, no intracranial complications are expected, even in long term time period.

doi:10.1017/S0022215116001328

Free Papers (F612)**ID: 612.4****A paradigm shift in the management of petrous temporal bone cholesteatoma?**Presenting Author: **Shami Acharya**Shami Acharya, Harry Powell, Sherif Khalil, Shakeel Saeed
The Royal National Throat Nose and Ear Hospital

Learning Objectives:

Introduction: Petrous temporal bone cholesteatoma (PTBC) poses a significant management challenge. The location and nature of the disease as well as surgery carry risks to vital anatomical structures with potential impact on quality of life. Traditionally an aggressive surgical approach has been used. We present our series of PTBC; their classification, management, hearing and facial nerve outcomes.

Method: A retrospective case note review was carried out for all petrous cholesteatomas managed by the senior authors from 2008–2016. The study was an analysis of service provision and therefore formal ethical approval was not required.

Results: 15 patients were included in the study (mean age 42y 6 m; 10 males). Using Sanna et al.'s classification there were: 4 supralabyrinthine (Class I), 3 infralabyrinthine (II), 4 labyrinthine-apical (III), 4 massive labyrinthine (IV) and 1 apical (V). Hearing loss was a presenting symptom in 80% of patients, four of which were dead ears and 40% had a degree of facial nerve palsy. Mean follow-up was 1391 days. 5/15 patients underwent otic capsule sparing surgery. Recurrence occurred in 8 patients (53%), who all underwent further surgery and are currently disease free. Post operatively 20% had worse hearing (all requiring a labyrinthectomy or transotic approach). Four patients had new or worse facial weakness post operatively and three of these have had subsequent facial reanimation surgery.

Conclusion: The aim in PTBC management is total exenteration of disease while minimizing complications. Compared to other series in the literature we have a higher residual/recurrence rate due to a more conservative surgical approach in recent years. Advances in diffusion-weighted magnetic resonance imaging enable a less aggressive initial approach and directed second stage surgery in cases with residual disease.

Learning points: Long term outcomes will determine whether a less aggressive initial surgical approach is acceptable (for managing PTBC).

doi:10.1017/S002221511600133X

Free Papers (F612)**ID: 612.5****A novel cartilage slicer and its performance tests**

Presenting Author: **Onur Ergun**

Onur Ergun, Munir Demir Bajin, Levent Sennaroglu
Hacettepe University School of Medicine

Learning Objectives:

Objective: This study investigates the performance and benefits of a novel cartilage slicer device, which we refer to as “Hacettepe cartilage slicer” for otological procedures.

Method: 41 conchal and tragal cartilage pieces were harvested using a standard surgical method from 8 fresh

frozen human ears and their initial thicknesses were measured using a high accuracy digital micrometer. The harvested cartilages were then randomly sliced in 4 thickness levels using 2 different types of surgical blades. Then the thicknesses of the slices and remaining cartilages were measured. Scanning electron microscopy was utilized to determine the surface smoothness of the slices.

Results: Hacettepe cartilage slicer provided consistent results with each thickness setting and blade type. The results showed a proportional increase with the increasing thickness level with a clustering within a 0.1 millimeter distribution of the median value. The thicknesses of the slices and remaining cartilages provided evidence that our design slices the cartilage without any damage or squashing. Although both blades provided comparable satisfying results, scanning electron microscopy revealed that the slices cut with single bevel “chisel type” blade were superior regarding surface smoothness.

Conclusion: We believe that a reliable, surgical tool to slice autologous cartilage into undamaged, smooth slices at any desired thickness is major advantage for otologists. To our knowledge this study is the first to evaluate the performance of a cartilage slicer device. On the basis of this study, our novel cartilage slicer proved itself as a superior tool that is ready for human trials. A “razor sharp” disposable single bevel blade would offer the best results and slice thickness accuracy, precisely matching the desired thickness with a margin of error less than 0.1 mm.

doi:10.1017/S0022215116001341

Free Papers (F612)**ID: 612.6****Incidence, recurrence rate and prognostic factors for cholesteatoma**

Presenting Author: **Anders Britze**

Anders Britze, Marie Møller, Therese Ovesen
Aarhus University Hospital

Learning Objectives:

Purpose: The purpose of this study was to calculate long term recurrence rates of cholesteatoma and to identify significant independent prognostic factors for the recurrence.

Materials and Methods: 147 children and adults operated for debuting cholesteatoma, primarily by CWU (canal wall up) mastoidectomy, at Aarhus University Hospital in the period 2001–2005 were included. Five- and ten-year Kaplan-Meier cumulative recurrence rates were calculated and significant prognostic factors were identified by Cox multivariate regression analyses. One year pre to post-operative hearing outcomes were assessed.

Results: Five and ten year recidivism rates (with confidence intervals) were 0.38 (0.31–0.46) and 0.44 (0.37–0.53) respectively. The same estimates from purely CWU with single-stage ossiculoplasties were 0.39 (0.3–0.51) and 0.49 (0.39–0.60) respectively. Independent significant prognostic

factors were: Age below 15 years, extension of cholesteatoma into the mastoid, erosion of the incus, and erosion of the stapes. Overall, there was a significant pre- to post-operative air-bone gap (ABG) improvement of 4.05 dB (1.0–7.1).

Conclusions: Long term recurrence rates and prognostic factors of CWU mastoidectomy help decision making in surgical approach and risk stratification of patients. Especially children with large cholesteatomas extending into the mastoid and with concomitant bone erosions should be carefully followed up.

doi:10.1017/S0022215116001353

How do we approach cholesteatoma (N613)

ID: 613.1

Modified Bondy technique: indications and technique

Presenting Author: **Anna Lisa Giannuzzi**

Anna Lisa Giannuzzi¹, Enrico Piccirillo², Mario Sanna²

¹Gruppo Otorologico, Piacenza, ²Gruppo Otorologico

Learning Objectives:

Introduction: Modified Bondy technique is indicated in patients with epitympanic cholesteatoma, good hearing and intact pars tensa and ossicular chain. It permits to eradicate the disease with a single stage procedure. This presentation evaluates the short- (6 mo) and long-term (5 yr) outcomes of modified Bondy technique, with particular reference to hearing results.

Methods: Four hundred eight ears were operated on, using a modified Bondy technique between 1983 and 2013. All patients had primary acquired epitympanic cholesteatomas with intact pars tensa and intact ossicular chain in normal or good-hearing ear. Preoperative audiometric results revealed a mean air conduction pure-tone average of 27.7 ± 9.6 dB (range, 10–65 dB) and a mean bone conduction pure-tone average of 14.2 ± 6.4 dB (range, 5–50 dB). The mean preoperative air-bone gap was 13.5 ± 6.7 dB (range, 0–25 dB). The average length of follow-up was 7.8 years (range, 5–16 yr).

Results: There was no recurrent cholesteatoma in the present series. A pearl-like residual cholesteatoma was found in the cavity in 7.4% of ears; 0.8% developed stenosis of meatoplasty, 1.3% exhibited retraction pockets extending to the attic. Postoperative discharging ear was observed in 3% of cases and was successfully treated with topical drops. At the long-term follow-up, the air-bone gap was unchanged or improved from the preoperative level in 88% of cases. The mean postoperative short- and long-term air-bone gaps were 14.6 ± 8.5 dB (range, 0–55 dB) and 14.1 ± 8.2 dB (range, 0–50 dB), respectively. Postoperative high-frequency sensorineural hearing loss was observed in 1.7%. No dead ears were encountered postoperatively.

Conclusion: A modified Bondy operation is recommended in selected cases of epitympanic cholesteatoma in normal or good-hearing ear with an intact pars tensa and ossicular

chain. Modified Bondy technique ensures complete eradication of disease while preserving a good preoperative hearing in 1-stage operation.

doi:10.1017/S0022215116001365

How do we approach cholesteatoma (N613)

ID: 613.2

How to perform a good canal wall up mastoidectomy

Presenting Author: **Gianluca Piras**

Gianluca Piras, Alessandra Russo, Enrico Piccirillo, Flavia D’Orazio, Sampath Chandra Prasad Rao, Mario Sanna
Gruppo Otorologico

Learning Objectives: How to perform a good canal wall up mastoidectomy.

Various techniques for cholesteatoma surgery have been developed, practiced, criticized, and favored by different otologists. The current dilemma regarding the choice of technique reflects differences of opinion between various schools of thinking in Otolaryngology. However, both the open and closed techniques have now been individualized, and the choice of procedure can be made in accordance with certain indications in order to optimize the results. In the 1960s Bill House popularized Canal Wall Up (CWU) mastoidectomies; since then CWU mastoidectomy has remained the ideal surgical treatment for pediatric cholesteatoma. This technique allows preservation of the hearing function without aesthetic modification of the external ear. The limit of this technique is the increased risk of cholesteatoma recurrence or residual; for this reason, a two-stages procedure is preferred. Indications for CWU mastoidectomy are cholesteatoma in pneumatized mastoids, children, limited epitympanic erosion, mesotympanic cholesteatoma, limited congenital cholesteatoma. Contraindications are a widespread disease, bony destruction and poor hearing. The aim of our presentation is to show technical refinements of this technique, focusing on surgical cases and results in pediatric population.

doi:10.1017/S0022215116001377

How do we approach cholesteatoma (N613)

ID: 613.3

Subtotal Petrossectomy in the management of difficult cases of cholesteatoma

Presenting Author: **Sampath Chandra Prasad**

Sampath Chandra Prasad, Valeria Roustan, Enrico Piccirillo, Annalisa Giannuzzi, Mario Sanna
Gruppo Otorologico

Learning Objectives:

Objectives: The purpose of this study was to review the indications for subtotal petrossectomy in difficult cases of cholesteatoma, report our management of complications, as

well as review those technical factors that are critical for successful outcomes.

Methods: Patients (n = 240) that underwent subtotal petrosectomy with closure of the external auditory canal and obliteration of the cavity with abdominal fat for various presentations of cholesteatoma were analyzed.

Results: The most frequent indication for subtotal petrosectomy was in recurrent disease, previous radical cavities, in petrous bone cholesteatomas and in meningoencephalic herniations. Recurrence of cholesteatoma was seen in only 4 (1.7%) cases. Other minor postoperative complications like wound dehiscence and infection of fat in the cavity etc occurred in 13 patients (11.83%).

Conclusions: Subtotal petrosectomy permits obtaining a cavity isolated from the external environment, and when needed, it improves the access and visibility during the surgical procedure. Subtotal petrosectomy is a safe technique, with a low rate of complications.

doi:10.1017/S0022215116001389

How do we approach cholesteatoma (N613)

ID: 613.4

Tips and tricks in Open Tympanoplasties

Presenting Author: **Enrico Piccirillo**

Enrico Piccirillo, Melissa Laus, Annalisa Giannuzzi, Mario Sanna

Gruppo Otologico

Learning Objectives: To evaluate the outcomes of open tympanoplasties (canal wall down mastoidectomies) for cholesteatomas.

Study Design: Retrospective study.

Setting: Gruppo Otologico, a quaternary referral center for Otology and Skull Base Surgery in Italy.

Methods: 1324 cases with a minimum of 2-years follow-up that were operated for middle ear and mastoid cholesteatoma using the open technique were included in the study. The outcomes of were analyzed and the results were compared with a literature review.

Results: The mean follow up was 46.43 months. The mean pre-operative air bone gap was 37 ± 7 dB. Simultaneous ossicular reconstruction was performed in 32% of the cases. A second stage reconstruction was performed in 42% of the cases. Recurrent cholesteatomas were seen in 6% of cases in our series. 1% patients developed stenosis of the meatoplasty. Postoperative ear discharge was observed in 4% cases.

Conclusion: The open (canal wall down) technique is a tried and tested procedure in recurrent and large cholesteatoma with considerable pre-operative hearing loss.

doi:10.1017/S0022215116001390

Evidence based practice in Cholesteatoma Surgery (R614)

ID: 614.1

What do we do in the absence of evidence?

Presenting Author: **Iain Swan**

Iain Swan

Glasgow Royal Infirmary

Modern medical practice should be based on evidence, but often in surgery we have little evidence for our surgical practice. Traditionally surgeons have relied on what they have been taught by their trainers or read in textbooks. The main source of information nowadays is the published literature but, in surgery, this is usually case series which is level 5 evidence. This raises several questions:

Are my patients comparable?

Do I have the skills to achieve these outcomes?

Has the surgeon included all the patients in the results?

The only results that you can rely on are your own. But human memory is selective and we tend to forget our poor results and remember the good ones. To reliably assess our own results requires audit. All surgeons should prospectively audit their own results. Using an established audit database is the most practical way to do this as others have already decided the most useful data to collect. Your data should be reviewed regularly, and results of your audit should be reported each year at your annual appraisal.

Auditing your own results allows you to compare your outcomes with those of other surgeons and tells you what is working and what needs improving.

doi:10.1017/S0022215116001407

Evidence based practice in Cholesteatoma Surgery (R614)

ID: 614.2

Canal wall up versus canal wall down mastoidectomy for acquired cholesteatoma; a systematic review on disease recurrence rates

Presenting Author: **Jef Mulder**

Jef Mulder¹, Franco Abes², Casper Tax¹

¹Radboud University Medical Center,

²University of Santo Tomas Hospital, Manilla, Philippines

Learning Objectives: The aim of this study is to compare the proportion of disease recurrences in patients with acquired cholesteatoma, 5 years after Canal Wall Up or Canal Wall Down mastoidectomy.

Introduction: Cholesteatoma is a destructive ear disease. Therapy consists of surgical removal by mainly the canal

wall down (CWD) or canal wall up (CWU) technique. Despite a lot of research in the past decades, the question which technique is best is still unanswered.

The aim of this study is to compare the proportion of disease recurrences in patients with acquired cholesteatoma, 5 years after Canal Wall Up or Canal Wall Down mastoidectomy.

Methods: We systematically searched Pubmed, CINAHL, Embase and PiCarta from inception up to January 2015 for cohort studies published in English with otoscopically confirmed acquired cholesteatoma patients that received either canal wall up, or down mastoidectomy, and in whom disease free status was confirmed with either otoscopy, second look surgery or DWI MRI scan. Risk of bias was critically appraised by 2 different investigators using the Quality in Prognostic Studies (QUIPS) tool. We extracted data on patients and disease status, disease recurrence rates, and diagnostic techniques used for follow-up.

Results: Eight studies on CWD (1092 patients) and CWU (1685 patients) mastoidectomy were included in this review. Risk of bias assessment showed that the decision for CWU or CWD surgical technique was dependent on the extent and location of the pathology in 100% of the studies. The follow up period was insufficient, no distinction was made between residual and recurrent disease, age of the patients was not mentioned or the procedures to detect residuals were not standardized in 50%, 38%, 38% and 100% respectively.

Conclusions: We were unable to compare the disease recurrence rates after the CWU or CWD technique without bias, as the extent and location of the pathology was related to both the choice of surgical approach as well as the outcome. To provide a valid comparison between CWU and CWD, either a randomized clinical trial or standardized prospective registry for cholesteatoma patients is warranted.

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Important clinical research in otology (N615)

ID: 615.1

Electrical auditory brainstem responses during cochlear implantation

Presenting Author: **Karin Lundin**

Karin Lundin¹, Fredrik Stillesjö², Helge Rask-Andersen²

¹University Hospital Uppsala, ²ENT/University Hospital Uppsala

Objectives: The aim of this study was to investigate whether electrical auditory brainstem responses (eABR) obtained during cochlear implantation (CI) can predict CI outcomes. We also aimed to assess whether eABR can be used to select patients for auditory brainstem implantation (ABI).

Methods: The study was retrospective. The latencies and quality of the eABR waveforms from adult patients implanted with CI in Uppsala from 2011 to 2013 (n = 74) and four children with severe cochlear abnormalities were analyzed. Speech perception was assessed by postoperative

monosyllabic word (MS-word) recognition. A score was constructed for each patient based on wave II, III and V patency.

Results: Wave V for the mid- and low-frequency regions on the implant was the most robust. eABR latencies increased towards base stimulation of the cochlea. Significant latency shifts occurred in wave V from the low- to high-frequency regions on the implant ($P^{**} < 0.01$) and from the mid- to high-frequency regions on the implant ($P^{**} < 0.01$). No correlations were found between wave V latency, wave V-III interval, waveform score, and MS-word scores. A negative eABR always predicted a negative outcome. Among the patients with negative outcomes, 75% had eABRs.

Conclusions: Implant electrical auditory brainstem recordings can be used (eABRs wave V) to predict a negative functional outcome. Low-frequency wave V was observed in all patients with successful CI outcomes. Patients for whom eABR waveforms were completely absent had unsuccessful CI outcomes.

doi:10.1017/S0022215116001420

Important clinical research in otology (N615)

ID: 615.2

Cochlear implantation in the elderly

Presenting Author: **Karin Lundin**

Karin Lundin, Andreas Näsval, Susanne Köbler, Göran Linde, Helge Rask-Andersen

University Hospital Uppsala

Learning Objectives: To analyse complications and outcome of cochlear implant (CI) treatment in seniors receiving CIs during a 10-year period.

Introduction: The elderly population in Sweden is growing, particularly in those over 80 years of age (Statistics Sweden Demographic reports, 2009). This has led to an increasing incidence of age-related hearing loss and it is expected that this group will represent an important cohort to treat with cochlear implants (CIs).

Methods: A total of 28 patients, 79 years or older (mean age 81.6 years), were evaluated and compared with a younger group of 76 patients, 20–60 years old (mean age 48.9 years). A retrospective study of the patients' records was performed. Data on per- and post-operative complications, pre- and post-operative speech perception, estimated cognitive skills, and social situation was extracted. A subjective score was assessed and correlated with post-operative performance.

Results: No severe per- or post-operative surgical complications were noted. Speech perception improved significantly after surgery ($P < 0.001$). The younger age group showed better results post-operatively for monosyllabic words ($P < 0.01$) compared with the older group with no difference seen for bi-syllabic words. In both the groups, there were no significant differences between patients living with or without social support.

Conclusion: CI surgery for patients 79 years or older was well tolerated. Patients benefited greatly from the device with improved hearing. CI should not be denied older individuals who are otherwise in good health. Non-use in the elderly was associated with post-operative vertigo and tinnitus, severe disease and limited social support.

doi:10.1017/S0022215116001432

Important clinical research in otology (N615)

ID: 615.3

Human Cochlear Morphology and how it relates to Cochlear Implantation

Presenting Author: **Karin Strömbäck**

Karin Strömbäck, Elsa Erixon, Helge Rask-Andersen
University Hospital Uppsala

Learning Objectives: The ability to preoperatively estimate the insertion depth in a particular patient may influence the results in hearing preservation CI surgery.

Introduction: Modern cochlear implant (CI) surgery also purposes to preserve and maintain residual hearing and intra-cochlear structures. The rich variations in design and dimensions of the human cochlea may influence surgical trajectories and functional outcome. Here, we present anatomical data and experiences from hearing preservation CI-surgery.

Material and Methods: The sampled cochleae originated from unidentified autopsy materials and collection of inner ear mould created in Uppsala during the 70th. No information regarding gender, age or hearing was present. Data were collected from 73 plastic inner ear moulds. Reference points were constructed from photographic reproductions taken at different angles. Hearing preservation technique was performed in 21 patients and the dimensions of the cochlea were studied pre- and postoperatively.

Results: The length of the first turn represented approximately 53% of the total cochlear length. The width of various turns differed greatly between individuals and the height varied by as much as 1.4 mm, representing one third of the total height. The electrode configurations in each of the 21 cases were shown in insets and its relation to the round window. Hearing was conserved in all patients after one year.

Conclusions: The human cochlea displays wide and individual anatomic variation. These variations can influence the trajectory chosen by the surgeon and also the possibilities to preserve microstructures and residual hearing. Some variations may even explain difficulties experienced by surgeons to reach full insertion, even in normal cochleae.

doi:10.1017/S0022215116001444

Important clinical research in otology (N615)

ID: 615.4

Mastoiditis in Sweden, a large pilot for future studies

Presenting Author: **Frida Enoksson**

Frida Enoksson¹, Ann Hermansson²
¹Helsingborg hospital, ²Lund university

Learning Objectives: Descriptive studies are needed to define good comparative studies on the most important issues in a clinical disorder. The findings in this large pilot study can direct future prospective studies on how to treat acute mastoiditis in an era with efficient antibiotics and in a possible post-antibiotic era.

Introduction: Since the year 2007, the largest study on acute mastoiditis, so far, has been performed in Sweden. The main reason for performing it was to evaluate how reduced antibiotic treatment of acute otitis media affected its most common complication.

Methods: Most of the published results in the study “Mastoiditis in Sweden” were based on interpretation of medical records. This poses special challenges regarding definition and interpretation of the results and if antibiotic resistance has affected the results.

Results: More than 1300 cases have been included but still the findings are mainly descriptive. The typical patient with acute mastoiditis has been well defined, an otherwise healthy toddler without previous ear problems.

Conclusions: Some patients are difficult to fit into a pre-formed definition which might lead to an unfortunate exclusion of “odd cases” that should be part of the diversified group of patients suffering from complications of AOM.

doi:10.1017/S0022215116001456

Epidemiology aspects of CSOM (R616)

ID: 616.1

Health check up system for hearing and congenital cholesteatoma

Presenting Author: **Taeko Okuno**

Taeko Okuno¹, Yasutaka Kojima², Go Inokuchi³, Yu Matsumoto⁴, Katsuhiko Tsutsumiuchi⁴, Yuko Hata¹, Yoko Yamazaki¹

¹Mitsui Memorial Hospital, ²Nishikobe Medical Center, ³Kobe University, ⁴University of Tokyo

Learning Objectives:

Introduction: At 6th Cholesteatoma and ear surgery meeting held at Canne, France in 2000, we had the discussion about the figure of congenital cholesteatoma in Japanese patients and in the patients of other countries. In the nineties most of the children with congenital cholesteatoma belonged to the severe cases. At the initial operation, cholesteatoma extended not only in the tympanic cavity, but to the mastoid in most of the Japanese children.

Recently the figure of the congenital cholesteatoma has changed. Introducing the endoscope and microscope into the ordinary tools of ENT office contributed to make diagnosis of congenital cholesteatoma in early stage. The hearing

check up system was also useful to detect congenital cholesteatoma in Japan.

We present the recent congenital cholesteatoma cases in our hospital and describe the check up system for hearing from newborns to infant in Japan.

Study design: retrospective chart analysis of consecutive patients with congenital cholesteatoma.

Patients: Between September 2004 and August 2015 conclusive 47 patients underwent primary procedure.

Intervention: The diagnosis of congenital cholesteatoma with Potsic staging system and the therapeutic operation were performed.

Main outcome measures: The chance of detecting the congenital cholesteatoma, the patient age, the stage of the disease, the pathology of the ossicles and the hearing result of the surgery were studied.

Results: Twenty two percent of the patients belonged to the Stage I and II without ossicular involvement. They showed normal hearing. Eighty eight percent of the patients belonged to the Stage III or IV and 76% of the patients showed good hearing result postoperatively. Thirty percent of the patients had diagnosed by the hearing check up and 32 % of the patients had found accidentally with microscopic examination at the ENT office.

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Epidemiology aspects of CSOM (R616)

ID: 616.2

Condition of the contralateral ear in patients with cholesteatoma

Presenting Author: **Alma Maniu**

Alma Maniu¹, Violeta Necula², Marcel Cosgarea²

¹Iuliu Hațieganu University of Medicine and Pharmacy, ²Otorhinolaryngology Department, Iuliu Hațieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania

Learning Objectives: 1. Anatomical variants of tympanic compartments and their aeration patterns are one of the relevant pathogenetic factors involved in type of cholesteatoma occurrence. 2. The isthmus blockage theory could be a condition for the epitympanic type while tubal dysfunction is mandatory for mesotympanic type of cholesteatoma since the contralateral ear abnormalities are more frequent in the last one.

Introduction: In the recent years the incidence of chronic otitis media with cholesteatoma has decreased but remain a major challenge for surgeons due to the destructive characteristic of the disease. Although the pathophysiology of the acquired cholesteatoma remains to be clearly elucidated, it is presumed to be multifactorial, as many theories have been proposed and investigated. Anatomical variants of tympanic compartments and their aeration patterns are one of the contributing factors. Retraction pocket theory is the

most widely accepted but the contralateral ear in patients with cholesteatoma is less studied. The purpose of this study was to evaluate the contralateral ear in patients with cholesteatoma and to determine whether the characteristics of it differ according cholesteatoma growth patterns.

Methods: The charts of 924 operations for cholesteatoma performed from January 2000 to December 2013 at the Department of Otorhinolaryngology-Head and Neck Surgery, Iuliu Hațieganu University of Medicine and Pharmacy, Cluj-Napoca were analyzed retrospectively. Otomicroscopy was performed on both the affected and the contralateral ear. Cholesteatoma extension was noted during surgery.

Results: The age average for patients included in the study was of 41 ± 6.5 years (95%CI [39.32–42.85]). The frequency of significant changes in the contralateral ear was 49.2 %. 6.5% of patients presented with bilateral cholesteatoma. Other abnormalities were retraction pockets (32%), perforations of the tympanic membrane (25%), serous otitis media (5%). Contralateral ear modifications were more frequent in the posterior mesotympanic type of cholesteatoma cases.

Conclusions: Lower damage of contralateral ear in posterior epitympanic type of cholesteatoma supports the isthmus blockage theory for epitympanic cholesteatoma occurrence. Long-term follow-up of the condition of contralateral ear in cholesteatoma patients is mandatory for early intervention in order to prevent progression of the disease.

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Epidemiology aspects of CSOM (R616)

ID: 616.3

Similarities and Differences in the Diagnosis and Treatment of Necrotizing Otitis Externa and Diabetic Foot Osteomyelitis

Presenting Author: **Daniel Kaplan**

Daniel Kaplan, Chilaf Peled
Soroka University Medical Center

Learning Objectives: Understand the similarities and differences between DFO and NOE

Background: Necrotizing otitis externa (NOE) is a severe inflammatory process effecting both soft tissue and bone. This disease is strongly associated with diabetic patients and, to a lesser extent, immunocompromised conditions. Diabetic patients are also at risk for the development of diabetic foot osteomyelitis (DFO), another inflammatory condition effecting soft tissue and bone.

Objective: compare NOE with DFO.

Methods: clinical review.

Results: Patient's characteristics and co-morbidities are similar in both entities. Similar to NOE, Pseudomonas A. is associated with DFO, particularly in warm climates. Unlike NOE, there is no role for superficial swab cultures in DFO and deep bone biopsies are recommended for the

diagnosis of the offending pathogen. MRI is reported to have a higher sensitivity and specificity compared to nuclear imaging in the diagnosis of DFO and is considered to be the imaging modality of choice for final diagnosis. Recommended treatment duration is similar in both entities, however surgery is usually performed early in the course of DFO and only in a minority of cases of NOE. Repeated nuclear imaging for the evaluation of treatment response is not performed in DFO and follow up consists of physical evaluation and repeated measurements of inflammatory markers.

Conclusion: Appreciation of the similarities and differences between NOE and DFO may prove valuable in improving our understanding of NOE and advancing diagnosis and management.

doi:10.1017/S0022215116001481

Epidemiology aspects of CSOM (R616)

ID: 616.4

Prevalence and Associated Factors of Chronic Suppurative Otitis Media: Data from the KNHANES 2009–2012

Presenting Author: **Yang-Sun Cho**

Yang-Sun Cho¹, Jae Ho Chung², Seung Hwan Lee²

¹*Sungkyunkwan University, Samsung Medical Center,* ²*Department of Otorhinolaryngology, Hanyang University, College of Medicine, Seoul, Korea*

Learning Objectives: 1. To investigate the prevalence of CSOM (Tympanic membrane perforation, Retraction pocket, and cholesteatoma) in South Korea 2. To investigate factors associated with CSOM.

Chronic suppurative otitis media (CSOM) is a common infectious condition that can cause hearing loss and persistent otorrhea. The prevalence rates of CSOM in developed countries is typically <1%, while developing countries or some racial groups showed higher prevalence rates exceeding 4%.

The Korean Society of Otorhinolaryngology-Head and Neck Surgery participated in the Korea National Health and Nutrition Examination Surveys (KNHANES), which is a cross-sectional analysis of a nationwide health survey. In the survey, physical examination, interview and laboratory test were performed by the field survey team including an otolaryngologist. Data obtained in 2009–2012 were included in this analysis.

Among the population over 4-years-of-age ($n = 25,147$), the prevalence of CSOM was 3.13% (95% confidence interval [CI], 3.07–3.92). Specifically, the prevalence of tympanic membrane perforation, retraction pocket and obvious cholesteatoma was 1.78 % (95% CI, 1.51–2.00), 1.21% (95% CI, 1.02–1.40) and 0.34% (95% CI, 0.24–0.44), respectively. The prevalence of CSOM increased with age ($P < .001$) and had a female predominance ($P = .014$). In a multivariable analysis of associated factors in 14,396 participants over 19-years-of-age, hearing threshold, the presence

of tinnitus, diabetes, drinking alcohol, residence in a row house and education level of the mother were significantly associated with CSOM ($P < .05$).

Understanding of epidemiologic data and associated factors might contribute to the better management of CSOM and reducing the social burden.

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Epidemiology aspects of CSOM (R616)

ID: 616.5

Epidemiology Aspects and Management of Chronic Suppurative Otitis Media in Viet Nam

Presenting Author: **Tan Huynh Ba**

Tan Huynh Ba

Danang Ear and Hearing Center

Background: Chronic Suppurative Otitis Media (CSOM) is an unresolved inflammatory process of the middle ear and mastoid, usually associated with tympanic membrane perforation, otorrhea from the middle ear for over than 12 weeks and hearing loss. CSOM can occur with or without cholesteatoma.

Method: Prospective study at 3 ENT hospitals in Hanoi, Danang and Ho Chi Minh city, Viet Nam that estimate the yearly incidence of CSOM to be 50 cases per 100,000 persons in children and adolescents aged 15 years and younger and 20 cases per 100,000 persons in 16–60 aged.

Results: Otorrhea, malodorous associated with cholesteatoma, hearing loss. Air conduction threshold is within 40 dB means Tympanic membrane (TM) perforation with intact ossicular chain, if air-bone gap is more than 40 dB is associated with discontinuity of ossicular chain.

Physical findings: defect in the pars tensa of TM or the pars flaccida or both atelectatic lesions in tensa or flaccida pars squamous epithelial invasion may invade middle ear granulomas, polyps, tympanosclerotic plaques in middle ear. Complications such as facial paralysis, labyrinthitis, cerebral abscess...When central nervous system involvement is suspected, MRI should be considered, Coronal CT scan is preferred.

Medical treatment goals: Infection control, stabilization of process, prevention of irreversible damage and development of serious complications.

Surgical treatment goals: Safe ear; dry ear; hearing ear.

Conclusion: The incidence of CSOM in Viet Nam: 4–6%.

Complications can be life-threatening: 32.03%. A good result in # 80% of the cases after surgery, hearing gained post-operation: 20–30 dB. Vietnamese Bioceramics is very good for ossicular chain reconstructive in tympanoplasty surgery.

doi:10.1017/S002221511600150X

Hearing reconstruction: How I do it (1) (V617)**ID: 617.1****Use of Hydroxyapatite (HA) Cement for Ossicular Reconstruction**Presenting Author: **Joel Goebel**

Joel Goebel

Washington University School of Medicine

Learning Objectives: 1. Understand the indications for use of HA cement for ossicular reconstruction. 2. Appreciate the surgical tips for successful application of HA cement to the ossicular chain.

Panel Discussion: Use of Hydroxyapatite (HA) Bone Cement for Ossicular Reconstruction

Abstract: Reconstruction of the ossicular chain in chronic ear disease and cholesteatoma depends on many factors including ossicular chain remnant, state of middle ear aeration and Eustachian tube function and ability to eradicate middle ear mucosal disease. In select cases, use of hydroxyapatite (HA) bone cement to re-establish ossicular chain continuity is a viable method of reconstruction. In this panel, various methods of reconstruction will be addressed and the role of HA cement will be discussed including video demonstration of practical surgical tips for application of HA cement to the ossicular chain remnant for reconstruction.

doi:10.1017/S0022215116001511

Hearing reconstruction: How I do it (1) (V617)**ID: 617.2****Hydroxyapatite cement for ossiculoplasty**Presenting Author: **Stefan Delrue**

Stefan Delrue, Joost van Dinther, Andrzej Zarowski, Thomas Somers, Erwin Offeciers

European Insitute for ORL - Antwerp

Learning Objectives: To overcome the impedance mismatch between the tympanic membrane and cochlear fluids, the normal ossicular chain functions as a lever system.

Several surgical techniques are available to restore its continuity in case of interruption. Biocements are one of the latest innovations and allow maintaining the normal tri-ossicular structure, which results in a more physiologic energy transfer. Hydroxyapatite is an inorganic mineral and natural component of the human bone. It can be easily prepared by mixing a powder and liquid component, which subsequently forms a paste that slowly hardens. Compared to ionomeric cement, hydroxyapatite does not provoke any inflammatory reaction when in contact with the soft tissues of the middle ear. This workshop shows the application of hydroxyapatite cement in bridging incudostapedial discontinuity as well as other ossicular interruptions in a faster and easier way. Moreover hydroxyapatite cement can be used to stabilize ossicular

protheses. Based on retrospective case series the functional results with cement are initially similar to standard ossiculoplasty techniques but better over time.

doi:10.1017/S0022215116001523

Keratinocyte in health and disease (K623)**ID: 623.1****The keratinocyte in health and disease**Presenting Author: **Irene Leigh**

Irene Leigh

University of Dundee

Learning Objectives: To understand the processes involved differentiation of normal stratified squamous epithelia To understand the changes in keratinocyte hyperproliferation, dysplasia and structural genodermatoses.

The biology of the keratinocyte has been greatly enlightened by the ability to culture keratinocytes from the epidermis and mucosal stratified squamous epithelia in the laboratory, developed in 1975 by the use of a feeder layer and added growth factors. Subsequently the processes regulating keratinocyte stratification and differentiation have been characterised, in particular the changes in keratin expression, as a cell migrates from the stem cell compartment within the basal layer into suprabasal layers, and the formation of the cornified envelope. Normal site specific differentiation is heavily dependent on both permissive and directive signals from the underlying dermis. During hyperplasia, as seen in the skin during psoriasis and wound healing, the keratinocyte undergoes an alternative pathway of differentiation with alterations in keratin expression particularly keratins 6 and 16 and additional effects on terminal differentiation. In dysplasia and malignancy, markers of keratinocyte differentiation tend to remain but additional expression of simple epithelial markers is associated with tumour invasion. Many genetically inherited skin diseases and associated syndromes, such as sensorineural deafness, are associated with point mutations in structural proteins including keratins, and junctional complexes. Patients with atopic eczema has been found the have a very rate of mutations in filaggrin: a filament aggregating protein critical for formation of a normal stratum corneum and these mutations result in significant impairment of barrier function, a hallmark of atopic eczema. Understanding keratinocyte differentiation and alterations in disease can give insights into the pathology of other stratified squamous epithelia including cholesteatoma.

doi:10.1017/S0022215116001535

The role of persistent infection in the pathogenesis of cholesteatoma (K625)**ID: 625.1****The Role of Persistent Infection in the Pathogenesis of Cholesteatoma**Presenting Author: **Richard Chole**

Richard Chole

Washington University in St. Louis School of Medicine

Learning Objectives: To understand the significance of chronic, recalcitrant infections in cholesteatomas. Processes including biofilm formation and bacterial persistence.

Acquired and sometimes congenital cholesteatomas, often become chronically infected. The most common organisms associated with infected cholesteatomas are *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Other gram negatives are common associated pathogens, such as *Klebsiella*, *Proteus* and *E.coli*. Infected cholesteatomas are more aggressive and destructive than uninfected cholesteatomas as evidenced by clinical observation and studies in experimental models of cholesteatoma.

The eradication of bacterial infections within cholesteatomas has proven difficult. Treatment with systemic and topical antibiotics often fails to eradicate the infection even though the involved organisms are sensitive to the antibiotics used. The mechanisms of bacterial resistance intolerance in cholesteatomas are complex. There are several possible mechanisms for the tolerance of chronic clinically bacteria in chronically infected cholesteatomas. These include: 1) sequestration of the cholesteatoma matrix from the general circulation; 2) ineffective penetration of topically applied antimicrobials; 3) formation of microbial biofilms within the cholesteatoma with the resultant change in phenotype to be tolerant to host defenses and antibiotics; and 4) formation of persister cells in bacterial colonies. These cells while viable at a very low metabolic rate and low levels of replication. This change makes this persister cell type highly resistant to antimicrobials.

Strategies to eradicate biofilm infections and the presence of persister cells will be discussed.

doi:10.1017/S0022215116001547

Petrous Cholesteatoma (R631)

ID: 631.1

Cholesteatoma of the Petrous Apex: Facial Nerve Management

Presenting Author: **Richard Irving**

Richard Irving

Queen Elizabeth Hospital

Learning Objectives: Both congenital and acquired cholesteatomas are found in the petrous temporal bone, with the latter being more common. Congenital cholesteatomas arising in the apex erode from the medial aspect involving the facial nerve more frequently in its IAC and labyrinthine segments. Congenital middle ear cholesteatomas tend to present earlier with a conductive hearing loss and if left untreated can erode along the facial nerve superior to the cochlea involving the geniculate ganglion and labyrinthine segments. Acquired cholesteatomas involving the apex in

contrast all arise in the tympanomastoid region and extend medially. These extensive acquired cholesteatomas can involve multiple segments of the intratemporal nerve from IAC to stylomastoid foramen. In the authors experience 50% of cases of apical cholesteatoma had facial nerve involvement at presentation.

The management of apical disease remains contentious. While the aim of surgery should be complete excision of disease, this should be balanced against achieving a good neurological outcome for the patient. Complete excision is often complicated by limitations in access and the tight adherence of cholesteatoma matrix to key structures such as the facial nerve, internal carotid artery and dura. The author would typically not sacrifice a functioning facial nerve in order to improve the chance of complete excision of disease. Using this approach long-term disease control and good facial motor function can be achieved in both congenital and acquired apical cholesteatoma.

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Petrous Cholesteatoma (R631)

ID: 631.2

The role of the Transotic approach in cases of Petrous Bone Cholesteatoma

Presenting Author: **Miguel Arístegui**

Miguel Arístegui

Hospital General Universitario Gregorio Marañón Madrid Spain

Learning Objectives: We will show the benefit of the transonic approach as a safe procedure to preserve facial nerve function, to achieve total resection and to prevent complications, in cases of Petrous Bone Cholesteatoma.

Petrous Bone Cholesteatoma is a life threatening condition. Acquired or congenital in origin, is one of the most challenging intratemporal lesions.

Deeply located inside the petrous portion of the temporal bone the difficulty to manage this lesions is conditioned by the involvement of structures like the otic capsule, the facial nerve, the dura, the internal auditory canal, the sigmoid sinus, the jugular bulb or the internal carotid artery.

Techniques that include subtotal petrosectomy are commonly associated to prevent future infections. Preservation of hearing is not a reasonable objective in many cases if total resection should be accomplished. The transonic approach with elimination of the anterior and posterior otic capsule leaving the facial nerve in place, adapts to some of this challenging lesions.

We report on a series of 60 Petrous Bone Cholesteatoma A Modified Sanna Classification is used to define the location and extension of the lesions.

We will report on hearing function, facial nerve function and complications.

We will focus on those cases in which we have used the transonic approach to preserve anatomically and functionally the facial nerve.

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Petrous Cholesteatoma (R631)**ID: 631.3****Diagnosis, classification and surgical management of Petrous Bone Cholesteatomas: Gruppo Otologico experience of 200 consecutive patients**Presenting Author: **Mario Sanna**

Mario Sanna, Sampath Chandra Prasad Rao, Gianluca Piras, Enrico Piccirillo

Gruppo Otologico

Diagnosis, classification and surgical management of Petrous Bone Cholesteatomas: Gruppo Otologico experience of 200 consecutive patients.

Objective: To review the classification and management of Petrous Bone Cholesteatomas (PBCs) at our center and the outcomes of facial nerve (FN) management in these lesions.*Study Design:* Retrospective study.*Setting:* A quaternary referral center in Italy for Skull Base pathology.*Patients:* 200 patients with 201 PBCs were included in the study.*Interventions:* All patients diagnosed radiologically to have PBCs were classified according to the Sanna Classification. All patients were surgically treated and followed up with radiology.*Main Outcome Measures:* Classification of PBCs, surgical approach used, disease control and FN outcomes were analysed.*Results:* Supralabyrinthine PBCs were the most common type with 92 (45.8%) cases followed by the Massive PBCs with 72 (35.8%) cases. Preservation of pre-operative facial nerve function was highest in the Infralabyrinthine (72.2%) and Infralabyrinthine-apical (73.3%) types. The Transotic Approach was used in 66 (32.8%) cases in this series. The MTCA – Type A was applied in 55 (27.3%) of the cases. An active management of the nerve (re-routing, anastomosis or grafting) was required in 53 (26.4%) cases. Post-operatively, of the 116 cases with FN HB Grade I and II, 107 (92.2%) cases retained the same grade or improved. Recurrence was seen in seven (3.5%) cases.

doi:10.1017/S0022215116001572

Free Papers (F632)**ID: 632.1****Mastoid obliteration with cryopreserved homologous bone graft**Presenting Author: **Anna Carolina Fonseca**Anna Carolina Fonseca¹, José Celso Rodrigues de Souza², Eloisa Maria Mello Santiago Gebrim³, Luiz Augusto Ubirajara Santos⁴, Ricardo Ferreira Bento²¹University of São Paulo School of Medicine,²Otolaryngology Department University of São Paulo School of Medicine, ³RadiologyDepartment University of São Paulo School of Medicine, ⁴Institute of Orthopedics and Traumatology University of São Paulo School of Medicine*Learning Objectives:* Demonstrate that homologous bone graft from a bone bank can be a nonexpensive and easy-to-use filler material for mastoid obliteration.*Introduction:* Mastoid obliteration was introduced to eliminate canal wall down (CWD) mastoidectomy-related problems, and is currently the treatment of choice for chronic discharging mastoid cavities. The aim of this study was to assess the control of suppuration after revision surgery with mastoid obliteration for chronic otitis media (COM) using cryopreserved homologous particulated bone graft (CHPBG), a low-cost filler material obtained from a tissue bank.*Methods:* Prospective interventional case series in a tertiary referral hospital. The study population (10 adults) was selected from among patients who had undergone CWD or canal wall up (CWU) mastoidectomy for COM with or without cholesteatoma, and had an indication for revision surgery. Revision mastoidectomy with obliteration of the open cavity was performed with CHPBG. Our main outcome measure was the control of suppuration. Secondary outcome measures included CHPBG integration in the mastoid cavity, hearing outcomes, presence of recurrent or residual cholesteatoma, and postoperative complications.*Results:* Mean age at surgery was 35.2 years. Mean follow-up was 28 months. Seven patients achieved a dry ear at a mean of 8 weeks postoperatively. Three patients developed bone graft exposure followed by infection and extrusion through the ear canal. Mean bone density was 755.35 Hounsfield units measured at the obliteration site at a mean of 31 months postoperatively. Percentage of mastoid volume obliterated was between 75% and 100% in 6 cases and between 50% and 75% in 1 case. In all 7 patients, there was an increase in bone density postoperatively.*Conclusions:* This study demonstrated that CHPBG may be used to achieve a dry mastoid cavity with satisfactory bone graft osteointegration and density maintenance.

doi:10.1017/S0022215116001584

Free Papers (F632)**ID: 632.2****Canal Wall Down Mastoidectomy With And Without Autologous Bone Obliteration: a Comparison of Results in Adults**Presenting Author: **Francesco Mancini**

Luca Oscar Redaelli de Zinis, Francesco Mancini,
Tommaso Sorrentino, Daniela Tonni

Spedali Civili di Brescia

Learning Objectives: Safety and efficacy of mastoid obliteration with autologous bone.

Introduction: Canal wall down (CWD) mastoidectomy is credited to low cholesteatoma recidivism, however drainage and infection of the mastoid bowl is sometimes a complication of surgery. Obliteration with autologous bone of the mastoid cortex can avoid the disadvantages of the CWD approach by combining the benefits of a smaller cavity less prone to infections. The aim of the study was to compare anatomical and functional results of “non-obliterated CWD mastoidectomy” (NO) and “obliterated CWD mastoidectomy” (O).

Methods: Consecutive CWD mastoidectomy from 1994 to 2014 have been reevaluated to analyze incidence of post-operative synechiae and recurrent infections of the mastoid bowl, retraction pocket and perforation of the neotympanum, recurrence of cholesteatoma, and hearing threshold change (more than 10 dB in average 0.5–3 kHz).

Results: The study group included 317 adult patients (149 males and 168 females). Mastoid obliteration was performed in 88 patients (28%). There were 217 primary surgeries and 100 treatments for a recurrence (33% NO and 27% O) ($P = 0.3$). The cholesteatoma involved the middle ear in 71 patients, 246 had also a mastoid extension (76% in NO and 81% in O) ($P = 0.4$).

Dry synechiae developed in 11% (25/229) of NO and 16% (14/88) of O ($P = 0.2$). Recurrent discharge were observed in 8% (18/229) of NO and 3% (3/88) of O ($P = 0.1$). Dry retractions developed in 14% (32/229) of NO and 11% (10/88) of O ($P = 0.7$). Perforations were observed in 2.5% (6/229) of NO and 3% (3/88) of O ($P = 0.7$). Cholesteatoma recurred in 2% (4/229) of the NO and in none of O ($P = 0.6$). Hearing threshold improvement was observed in 28% (59/214) of NO and in 61% (38/62) of O ($P = 0.001$), impairment was observed in 12% (26/214) of NO vs. 13% (8/62) of O ($P = 0.9$).

Conclusions: Postoperative complication and anatomical results were comparable between NO and O, while functional results were superior in O.

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Free Papers (F632)

ID: 632.3

Life table analysis of results of staged intact canal cholesteatoma surgery using bone pate to reconstruct the lateral attic wall

Presenting Author: **Maryam Nowghani**

John Hamilton, Maryam Nowghani, John Cutajar
Gloucestershire Hospitals NHS Trust

Introduction: An insidious problem hampering treatment of cholesteatoma is the propensity of the disease to recur; this is considered to be a particular problem after intact canal surgery.

We continue to perform intact canal surgery for cholesteatoma, because this allows preservation of the ossicular chain, which has been shown to provide the best hearing after cholesteatoma surgery.

We review a technique developed in our institution thirty years ago to minimise recurrence of cholesteatoma after intact canal cholesteatoma surgery.

Method: Inclusion criteria: ears with attic cholesteatoma that underwent reconstruction of the lateral attic wall at primary surgery using bone pate.

Patients underwent second look procedures to exclude residual disease. This afforded an opportunity to further strengthen the lateral attic wall, if needed.

Patients were reviewed annually until five years after their original surgery.

The primary outcome was the need for further surgery for recurrent cholesteatoma.

Life table analysis was used to take account of patients lost to follow up before five years.

Results: 150 ears were included.

Ninety six per cent of the ears survived to five years without need for further surgery due to recurrent cholesteatoma.

Conclusion: Reconstruction of the lateral attic wall in staged intact canal cholesteatoma surgery with bone pate reduced the risk of recurrent cholesteatoma to levels similar to those seen in the best alternative techniques.

Learning Point: Surgery aimed at maintaining the best hearing after cholesteatoma surgery need not be associated with high rates of recurrent cholesteatoma.

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Free Papers (F632)

ID: 632.4

The use of S53P4 bioactive glass for mastoid obliteration in cholesteatoma surgery

Presenting Author: **Jasper Quak**

Pieter de Veij Mestdagh, David Colnot, Pepijn Borggreven,
Jasper Quak

Diakonessenhuis Utrecht

Learning Objectives: To inform about the results of the use of S53P4 bioactive glass for obliteration of the mastoid cavity in cholesteatoma surgery. To demonstrate the advantages and limitations of the technique.

Introduction: Mastoid obliteration has been reported to reduce the number of recurrences and improve the quality of life in both canal wall up (CWU) and canal wall down (CWD) procedures, in the treatment of cholesteatoma. Confronted with a rather high recurrence rate after CWU surgery without obliteration, we implemented the use of S53P4 bioactive glass (BonAlive). Our choice was made

due to the unlimited availability and the alleged antibacterial, osteoconductive and osteopromotive properties. Here we report on the safety and efficacy of the use of S53P4 as obliteration material in cholesteatoma surgery.

Methods: Retrospective cohort study carried out in a secondary referral center. All patients were treated for cholesteatoma with tympanomastoidectomy and mastoid cavity obliteration using S53P4 granules between 2012 and 2015. Main outcome measures were procedure safety, cholesteatoma recurrence, and functional outcome (hearing levels and incidence of otorrhea).

Results: One hundred eleven patients (111 ears) were included. Mean age was 36 years (range 7–80). Eighteen patients were treated with canal wall up tympanoplasty. Ninety-three patients underwent a canal wall down procedure. Mean follow-up was 12.6 months. No wound infections occurred. Cholesteatoma recurrence was 9% (CWU: 17%, primary CWD: 8%, revision CWD: 0%). A dry ear was achieved in 96% of patients. No cases of perceptible hearing loss were encountered. Preparing and implanting the S53P4 granules was technically feasible.

Conclusions: S53P4 bioactive glass granules are safe and easy to use as a filler material in mastoid obliteration. Obliteration of the mastoid cavity with S53P4 granules resulted in less recurrences as compared to our previous results without obliteration

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Free Papers (F632)

ID: 632.5

Subtotal petrosectomy performed between 2005 and 2015 in a tertiary referral centre in the Netherlands: indications, outcome and follow-up

Presenting Author: **Tom Crins**

Tom Crins, Mick Metselaar, Anne van Linge, Robert Jan Pauw

Erasmus MC

Learning Objectives: Subtotal petrosectomy is a 'last resort' type of surgery where complex anatomy in pathologic ears makes surgery difficult. In case of cholesteatoma, residual disease remains an issue, but as long as patients lack any complaints, follow-up with diffusion-weighted MRI may be acceptable.

Introduction: In chronic otitis media (COM) (with or without cholesteatoma) a subtotal petrosectomy can be a 'last resort' surgical treatment after multiple prior surgeries. Subtotal petrosectomy can also be used as part of a lateral skull base procedure or as a first stage preparation before cochlear implantation. This study describes the results of subtotal petrosectomies performed in our center between 2005 and 2015, mainly focussed on COM.

Methods: All patients who underwent a subtotal petrosectomy in our centre between 01-01-2005 and 01-03-2015 were included in this retrospective chart review. Patient

characteristics, pre-operative complaints and indications for surgery were noted. The main outcome measure for COM patients was complete eradication of the disease and resolution of otorrhea. Complications and number of necessary revision surgeries were noted.

Results: A total of 56 patients (57 ears) were identified. Indications for subtotal petrosectomy were chronic otitis media (COM) with cholesteatoma (n = 28), COM without cholesteatoma (n = 12), prior to cochlear implantation (n = 4), oncology (n = 7) and 'other' (including 2 cases of liquorrhea) (n = 6). Of all COM cases (n = 40) 30 patients had otorrhea prior to surgery. After surgery otorrhea resolved in all 30 ears. In three out of four revisions residual cholesteatoma was found. Another 5 cases show a lesion with diffusion restriction on diffusion weighted MRI and are followed with sequential MRI's. Reported complications were transient infection (n = 7) and vertigo (n = 6). The median follow-up for all 40 COM cases was 18 months (0–106).

Conclusions: This study gives an insight into the results of subtotal petrosectomy in a tertiary referral centre in the Netherlands. Subtotal petrosectomy in patients with otorrhea resulted in a dry ear in all 30 cases. Residual cholesteatoma was proven in 3 out of 28 cases.

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Free Papers (F632)

ID: 632.6

Mastoid Cavity Obliteration Using BonAlive Bioactive Glass

Presenting Author: **Mark Adams**

Mark Adams, Ekembar Reddy, Ted McNaboe

Craigavon Area Hospital

Learning Objectives: To review the rationale, technique & outcomes in mastoid cavity obliteration.

Introduction: Canal wall down (CWD) surgery is associated with lower rates of residual/recurrent disease. CWD surgery followed by mastoid cavity obliteration is one potential method of reducing the burden of managing the open cavity. We present our results using BonAlive® Granules for mastoid cavity obliteration.

Methods: Retrospective chart review and telephone survey.

Results: Between 2012–2015 we used this technique in a cohort of 20 patients; 16 male and 4 female. Mean age was 46 (median 47, range 32–67). Mean follow up was 19 months (median 15, range 7–46). Recurrence rate was 5% (1/20) of patients. In this case a small attic pearl was noted and this was managed on an out-patient basis. 10% (2/20) patients reported occasional discharge whereas in the remaining 90% (18/20) the ears were completely dry. We also conducted a telephone survey of patients using the Glasgow Benefit Inventory (GBI) with 18/20 patients responding. Mean GBI score was 63 (median 65, range 49–67). 16/18 patients responding to the GBI survey reported a net benefit from their procedure.

In 10% (2/20) patients the operated ear had a profound loss/dead ear pre-operatively. Audiological outcomes consisting of averaged thresholds at 0.5, 1, 2 & 4kHz were available for 15/18 of the remaining patients. Mean change in air conduction thresholds was 0db (median 0, range -25 - +25). Mean change in bone conduction thresholds was -2db (median -2, range -16- +15).

Conclusions: Mastoid cavity obliteration in our experience has been associated with excellent outcomes in terms of dry-ear rate and recurrence rate at median follow up of 15 months.

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Basic and translational research in cholesteatoma and ear surgery (N633)

ID: 633.1

Cholesteatoma among school-age children and adults - hearing screening program and surgical possibilities

Presenting Author: **Piotr Skarzynski**

Piotr Skarzynski¹, Krzysztof Kochanek², Henryk Skarzynski²

¹*Institute of Physiology and Pathology of Hearing, ²World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/ Warsaw, Poland*

Learning Objectives:

Introduction: Restoration of hearing in patients with hearing impairment due to cholesteatoma (and CWU or CWD surgery) with lack of the ossicles, after modified radical operations could be done with direct stimulation of the round window membrane or bone conductive solutions.

Congenital cholesteatoma may occur in different age groups. It can be located in many sites including the cerebellopontine angle, the inner ear, the mastoid, the petrosus apex, the middle ear, the tympanic membrane, the external auditory canal. From the clinical point of view it is very important to detect it as early as possible. Hearing screening in school-age children was performed in Poland and other countries from 2008 to 2015. The program was focused on children at the age of 7–12 years old. The main aim of the program was to detect hearing disorders, which were not observed by the parents or teachers.

The objective of that presentation is analysis hearing results obtained after surgical application of different implants in treatment of hearing impairment patients with chronic inflammation of the middle ear, especially after radical modified operations. Another objective is to present results of cholesteatoma detection in different screening programs among school children around the world.

Material and Methods: The selected group of patients were children and adults with chronic inflammation of the middle ear, after radical modified operations with destruction of the elements of the middle ear - tympanic membrane and ossicles. Group of patient analyzed in tht study was 29312.

We discussed the indications, contraindications and limitations of use of Vibrant Soundbridge in this group of patients.

Results and conclusions: Early detection, especially congenital cholesteatoma, is essential for very good results. There is many possibilities in reconstructive technique for hearing restoration. Each patient should be analyzed individually to different surgical way.

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Basic and translational research in cholesteatoma and ear surgery (N633)

ID: 633.2

Imaging follow-up of patients after cholesteatoma surgery

Presenting Author: **Marcin Szymanski**
Marcin Szymanski

Medical University of Lublin, Poland

Learning Objectives: There are various techniques of cholesteatoma surgery but all of them carry the risk of residual or recurrent cholesteatoma development. Thus all the patients after cholesteatoma surgery require thorough follow-up and some patients a second look surgery. While open cavity surgery enables otoscopic recognition of cholesteatoma, the use of closed technique, obliteration of mastoid cavity or subtotal petrosectomy reduces the role of clinical examination in follow-up. Imaging modalities including HRCT and non-EP DWI MR is discussed in patients subjected to open or closed techniques, obliteration of the mastoid cavity or subtotal petrosectomy for removal of congenital and acquired cholesteatoma.

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Basic and translational research in cholesteatoma and ear surgery (N633)

ID: 633.3

Combined model of intraoperative monitoring of ossiculoplasty efficiency by laser-Doppler vibrometry and auditory evoked potentials

Presenting Author: **Krzysztof Morawski**

Krzysztof Morawski¹, Kazimierz Niemczyk¹, Rafael E Delgado²

¹*Medical University of Warsaw, ²Department of Biomedical Engineering, University of Miami, FL, USA*

Learning Objectives:

Objective: To assess utility of combined electrophysiological and laser-Doppler Vibrometry (LDV) technique for intraoperative monitoring (IM) of air-bone gap closure (ABGC)

during ossiculoplasty. A new strategy of IM of hearing threshold (HT) evaluation was developed by a team of engineers and surgeons on the basis of previously performed researches.

Subjects and Methods: Patients (n = 25) underwent two-stage canal wall-up tympanoplasty due to chronic otitis media with cholesteatoma. During the second look surgery performed 12 months later ossiculoplasty was monitored intraoperatively by LDV and round window electrocochleography (RW-ECoChG). Both measures were performed via an enlarged posterior tympanotomy. LDV and RW-ECoChG intraoperative tests recorded simultaneously for the same stimulation set. Intraoperative HT was defined automatically in auditory steady state response (ASSR) option as well as prosthesis vibration by LDV. Using both intraoperative techniques various configurations of prosthesis placement were tested. On the basis of the preoperative tonal audiometry and post-ossiculoplasty RW-ECoChG & LDV thresholds a mini-software calculated an optimal ABGC. Prosthesis moveability tested simultaneously by LDV was showed and correlated with RW-ECoChG thresholds.

Results: Postop ABG closure ranged between 15 to 45 dB. HT improvement evaluated intraoperatively correlated with postop ABGC ($r > 0.5$; $p < 0.05$). Various prosthesis configurations and placements resulted in measurable changes in the RW-ECoChG thresholds. LDV appeared sensitive mostly to prosthesis position changes manifesting by movability improvement at 0.5- and 1.0kHz.

Conclusions: RW-ECoChG measured in ASSR option was found to be an objective and sensitive technique for IM of HT improvement significantly corresponding with postop ABG-C. LDV showed their usefulness to control prosthesis position changes by confirming better acoustic energy transfer through the reconstructed ossicular chain.

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Basic and translational research in cholesteatoma and ear surgery (N633)

ID: 633.4

Preliminary Analysis of Genetic Alterations in Cholesteatoma

Presenting Author: **Krzysztof Szyfter**

Krzysztof Szyfter¹, Malgorzata Jarmuz-Szymczak², Maciej Giefing², Kinga Bednarek², Wojciech Gawęcki³, Witold Szyfter⁴

¹Institute of Human Genetics, Polish Academy of Sciences, ²Institute of Human Genetics, Polish Academy of Sciences, ³ENT Clinic, Poznań University of Medical Sciences, ⁴ENT Clinic, Poznań University of Medical Sciences

Learning Objectives:

The Clinic is operating annually over 100 cholesteatomas (655 operations in the years 2010 -2015). Because of a

common bacterial infection a bacteriologic analysis indicates for *Pseudomonas aeruginosa*, *Proteus mirabilis* and *Staphylococcus aureus* as the most commonly detected in middle ear infection.

Having in mind a literature suggestion of a partial analogy between oncogenesis and cholesteatoma formation and own experience in identification of oncogenes and tumor suppressor genes modulating progression of laryngeal cancer we have undertaken a molecular analysis targeting for an identification of genetic background of cholesteatoma. Array-CGH scanning of a genome indicated for frequent gains and losses of gene copy number in the genome. The results will be further analyzed to identify amplified regions potentially indicating location of oncogenes and homozygous deletions covering loci of tumor suppressor genes involved in cholesteatoma.

Independently a molecular cytogenetic technique was applied to analyze 8q24 chromosome region to estimate an amplification and potential rearrangement(s) of c-Myc oncogene. Fluorescent in situ Hybridization (FISH) with the use of specific DNA probes (regular fluorescent, break a part) is being applied.

The results will be presented during the meeting.

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Basic and translational research in cholesteatoma and ear surgery (N633)

ID: 633.5

Inflammatory pathways in middle ear cholesteatoma

Presenting Author: **Ewa Olszewska**

Ewa Olszewska¹, Marek Rogowski², Mirosław Szczepanski³

¹Medical University of Białystok, ²Medical University of Białystok, Poland, ³Czerniakowski Hospital, Warsaw, Poland

Learning Objectives:

Introduction: Middle ear cholesteatoma (MEC), accompanied by chronic inflammatory response is characterized by invasive growth and osteolytic activity.

Aim: Present the cellular and inflammatory pathways in the pathogenesis of cholesteatoma and adjacent tissues.

Material and methods: Congenital, acquired MEC (study groups) and retroauricular skin specimens (control group, CS) were investigated for markers of inflammation using various immunohistochemistry, Western Blot, cell culture and flow cytometry techniques. Studied markers included proliferation and apoptosis of keratinocytes (PCNA, Ki67, p53, p21, APO2.7), angiogenesis and inflammation (TGF- α), proteasomal degradation pathway (low-molecular mass polypeptide-7 subunit of the immunoproteasome (LMP7), and selected molecular signalling (the DNA-binding high-mobility box 1 (HMGB1) in the protein advanced glycation endproducts (RAGE) axis.

Results: The significantly more intense expression of LMP7 and p21-positive cells was seen in MEC. The LMP7(+) cells

were observed in MEC matrix and perimatrix. There was no meaningful difference between congenital and acquired MEC with respect to p21 contrary to p53. A statistical significance was obtained for APO2.7-positive cells in MEC epithelium ($43.23 \pm 4.8\%$) as compared to CS ($29.89 \pm 6.2\%$).

More extensive positive immunohistochemical reaction with anti-TGF-alpha, Ki67 and PCNA was observed in MEC matrix and perimatrix compared with CS.

RAGE expression levels was present in all cholesteatoma tissues (strong in 86 %) vs skin 25% (weak) respectively ($p < 0.0001$).

Conclusion: Selected markers of apoptosis, proliferation, angiogenesis and inflammatory response are associated with cholesteatoma development. The co-expression of HMGB1 and RAGE in MEC may result in activation of the intracellular signaling pathways. This process may be responsible for faster accumulation of keratin debris, more invasive process, and affect the clinical course and the treatment outcome.

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Congenital Cholesteatoma (R634)

ID: 634.1

Congenital cholesteatoma of the middle ear: a report of 62 cases

Presenting Author: **Katsumi Doi**

Katsumi Doi

Kinki University

Introduction: Congenital cholesteatoma (CC) of the middle ear is a rare clinical entity that classically presents as a white mass situated in the anterior-superior quadrant of the middle ear behind an intact tympanic membrane (TM). Derlacki and Clemis established the diagnostic criteria for CC: 1) A pearly white mass medial to an intact TM, 2) Normal Pars Tensa and Pars Flaccida, 3) No history of otorrhea, perforation or previous otologic procedures. CC is seen far more frequently in children, but House and Sheehy remarked adult patients with cholesteatoma behind an intact TM.

Materials and Methods: A retrospective analysis was conducted of the clinical charts of all patients with CC in both children ($n = 56$) and adults ($n = 6$) from 1992 to 2015. CCs of the petrous apex ($n = 15$) were excluded. 1445 cases of acquired and congenital cholesteatomas were treated, therefore, the prevalence of CC should be 4.3% ($62/1445$).

Results: Based on the staging system by Potsic 54 patients were classified into stage1–4 according to the surgical findings: 11 cases in stage1, 7 in stage 2, 24 in stage3, and 20 in stage4. It was suggested that most CCs could be derived from the epidermoid formation (EF) in 53 cases. A planned two-staged surgery was conducted in 54 cases (87%), while one-stage surgery was adopted in 8 cases. The residual cholesteatoma at the time of second stage surgery was detected in 19 out of 48 cases (40%). The most common residual sites were at oval window ($n = 7$). Hearing assessment was

done in 55 cases: success in 46 cases (84%), moderate in 8 cases, and failure in one.

Discussion: As the stage of CC advanced, the area of its invasion could be enlarged, which should result in a higher risk of CC residual. Considering that CC is usually discovered in its advanced stages (stage 3–4), the establishment of a screening program including otoscopic and CT examinations and hearing tests for early CC diagnosis should be required.

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Back to the future: the evolution of cholesteatoma diagnosis and management (N635)

ID: 635.1

Back to the Future: The Evolution of Cholesteatoma Diagnosis and Management

Presenting Author: **John McElveen**

John McElveen

Carolina Ear & Hearing Clinic | Carolina Ear Research Institute | Camp Woodbine

Confucius once said, “Study the past if you would define the future.” As an introduction to the 10th International Conference on Cholesteatoma and Ear Surgery, the American Neurotology Society has assembled panelists (Mr. David Moffat (Addenbrooks Hospital), Dr. Jack Lane (Mayo Clinic), Dr. Clough Shelton (U. of Utah), Dr. Moises Arriaga (LSU) and Dr. Dennis Poe (Harvard) to discuss the evolution of cholesteatoma diagnosis and management. Dr. John McElveen (Carolina Ear Research Institute) will moderate the panel.

Mr. Moffat will trace the history of the diagnosis of cholesteatoma from ancient times to the present. Based on the research in 1967 by McKenzie and Brothwell, the existence of chronic suppurative otitis media in prehistoric times has been clearly documented. It was the French anatomist Joseph-Guichard Du Verney who in 1683 first described a temporal bone tumour which was probably a cholesteatoma. However, the term, “cholesteatoma”, was first used by Johannes Peter Muller in 1838. Although a misnomer, it has continued to be used to describe “keratomas” involving the temporal bone and skull base. Abramson *et al* in 1977 provided a more detailed definition of cholesteatomas at the First International Conference on Cholesteatoma.

The classification of cholesteatoma into congenital and acquired and the latter’s subdivision into primary and secondary acquired was the natural sequel of refinements in diagnostic capability which accompanied the use of the microscope both in histopathology and in the clinical examination of the ear (Nylen, 1921).

Since the dawn of medical imaging, radiographic examination of the temporal bone has been used in the evaluation and management of cholesteatoma. X-ray modalities have evolved from plain radiographs (1900–1940s) to polytomography (1950–60s) to single slice Computed Tomography (CT) acquired separately in the axial and coronal planes (1970–1980s) to multislice CT with multiplanar

reconstruction (1990–2010s). MR with diffusion-weighted imaging (DWI) (1990–2000s) has been employed most effectively in the detection of recurrent cholesteatoma, particularly in the setting of canal wall up procedures. In some centers, DWI MR has obviated the need for many second look procedures. Dr. Lane will explore the evolution of these radiographic techniques and discuss recent advances in temporal bone imaging, including Photon Counting CT and high field MR (3 T and 7 T). These imaging modalities are anticipated to achieve greater degrees of resolution and sensitivity in the detection of acquired and congenital cholesteatomas involving the temporal bone.

Just as imaging techniques have continued to evolve, so have the surgical techniques used to manage cholesteatomas. However, surgical management of cholesteatomas involving the temporal bone continues to be a source of some controversy. Some advocate a one stage procedure with revision of the failures. Others promote modern techniques for post-operative surveillance by employing imaging or endoscopic inspection. Dr. Shelton will discuss the surgical options currently used and review the rationale, controversy and history of the two stage strategy as advocated by the late Jim Sheehy.

Skull base cholesteatomas can be particularly destructive and potentially life threatening. Dr. Arriaga will discuss the traditional and modified versions of skull base neurotologic approaches such as Middle Cranial Fossa, Middle Fossa Transpetrous (extended middle fossa), Retrolabyrinthine, Retrosigmoid and Translabyrinthine approaches. In addition, he will explore the use of four-hand skull base surgery techniques, fallopian bridge strategies and simultaneous application of the endoscope to microscopic visualization to deal with challenging skull base cholesteatomas.

Dr. Poe will bring us “Back to the Future” with an update on the current understanding and treatment of Eustachian tube dysfunction as it relates to chronic otitis media. His focus will be on tubal dilatory dysfunction which typically involves the cartilaginous portion of the Eustachian tube. He will explore the use of Eustachian tuboplasty to treat tubal dysfunction and discuss its potential role in standard tympanoplastic and tympanomastoid procedures.

following dilation. It is affected by all of the same pathophysiological processes as the nose and other sinuses.

The net effect of the middle ear gas exchange is to cause a constant absorption of gases from the middle ear air space into the venous blood system, creating an ongoing tendency toward developing negative pressure compared to ambient atmospheric pressure. When appropriate, the ET should dilate, typically with a swallow or yawn for about 400 msec, to restore the middle ear pressure toward ambient, optimizing the function of the tympanic membrane. If the dilatory effort is consistently insufficient to adequately aerate the middle ear, ET dilatory dysfunction results with the possible consequences of negative middle ear pressure, retraction of the tympanic membrane, otitis media with effusion, tympanic membrane perforation, conductive hearing loss, fixation of retraction pockets and ultimately cholesteatoma.

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. A careful assessment of the dynamics of the ET by endoscopy can be very effective in determining the etiology, location and severity of dilatory and patulous dysfunction within the functional valve in the cartilaginous portion. Vocalizing “K-K-K” demonstrates isolated excursions of the Levator Veli Palatini (LVP) muscle. Swallows start with elevation of the LVP that acts as a scaffold upon which the additional contraction of the Tensor Veli Palatini muscle should be seen to dilate the valve open under normal circumstances. Yawns or vocalizing “Ahhh” can demonstrate a maximal dilatory effort. Disorders of dilation may be observed and classified. 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. When the medical causes have been optimally treated, but ET dilatory dysfunction persists, possibly due to irreversibly injured mucosa, biofilms or other pathology, tympanostomy tubes are usually recommended. When tubes fail to resolve the problem, treatment of the underlying pathology with surgery can be offered. Surgery may involve turbinate reduction, sinus surgery, adenoidectomy, or balloon dilation of the ET. All of these procedures are designed to remove irreversibly injured tissue and provide a fresh start, assuming the underlying medical conditions are adequately controlled. Failure to control the medical problems can lead to recurrence of inflammatory disease.

Failure of the functional valve to close results in patulous dysfunction. Once thought to be rare, it is now clear that the diagnosis is frequently missed. It can be related to weight loss, chronic illnesses (especially rheumatologic), but it often occurs after long-standing inflammatory dilatory dysfunction with atrophy and decreased mucus production. This may occur particularly with chronic allergic rhinitis. Patients develop frequent sniffing strategies to minimize their symptoms, despite negative middle ear pressure or effusions, raising suspicion that dilatory dysfunction has transitioned to patulous dysfunction. Examination of the tympanic membrane by otoscopy or tympanometry for excursions with ipsilateral nasal breathing can be diagnostic and endoscopy of the ET will reveal a defect in the functional valve, usually within

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Back to the future: the evolution of cholesteatoma diagnosis and management (N635)

ID: 635.2

Evaluation of Eustachian tube Function and Practical Physiology for Surgeons

Presenting Author: **Dennis Poe**

Dennis Poe

Boston Children's Hospital

The Eustachian tube (ET) bridges the realm of the nasal cavity and upper aerodigestive tract with the ear and serves to optimize its special sensory role of hearing. The middle ear and mastoid system behaves as an auxiliary sinus and the ET can be thought of as a long, dynamic ostium with a functional valve located within the cartilaginous portion. Failure of the “valve” to function properly can occur if it dilates insufficiently to adequately aerate the middle ear or if it fails to close

the antero-lateral wall. Conservative management is usually successful, but surgical correction is sometimes indicated.

This presentation will show some practical aspects of ET physiology that are relevant to surgeons, methods for evaluating ET function and a systematic approach for diagnosing pathology. Accurate diagnosis of ET disorders will lead to successful management and when appropriate, surgical indications will be clear.

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Pathogenesis of Cholesteatoma (R636)

ID: 636.1

Pathogenesis of the cholesteatoma: changing old concepts

Presenting Author: **Leticia Rosito**

Leticia Rosito

Hospital de Clinicas de Porto Alegre

Learning Objectives: 1. To define and classify the cholesteatomas and the spreading routes followed by the disease.; 2. to understand a novel model of pathogenesis with special emphasis on the key role of tympanic membrane retractions; 3. to employ an algorithm to aid the decision making process to maximize surgical results.

Cholesteatoma is a very intriguing condition and still poses a challenge to the otologist. Since it was first described by Duverney in 1683 it has been extensively studied but there are still many pending questions about its development, natural history and prognosis. In 2015 our group proposed a new and embracing classification system for acquired cholesteatomas based on pathogenesis. Our recent studies have shown differences in cholesteatoma growth patterns between children and adults and demonstrated the effect of the disease in the inner ear in both groups. Our contralateral ear studies have also confirmed the essential role of tympanic membrane retractions in the pathogenesis of cholesteatoma.

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Pathogenesis of Cholesteatoma (R636)

ID: 636.2

Congenital Cholesteatoma: Clinical and ethiopatogenetic aspects

Presenting Author: **Dragoslava Djeric**

Dragoslava Djeric

Medical Faculty University of Belgrade

Learning Objectives: To present the features of congenital cholesteatoma.

Design: Case series

Patients and Methods: Ten patients were included in the study. The diagnosis of congenital cholesteatoma was

based on previous history that excluded tympanic membrane perforation, otorrhea, or otologic procedure, an intact tympanic membrane on otomicroscopic examination and a identified cholesteatoma at the time of surgical procedures (tympanotomy, atticotomy, tympanomastoidectomy).

Results: Six of the 10 patients had lesions isolated to the anterosuperior quadrant of the tympanum, the other had more extensive cholesteatoma that involve posterior part of the tympanic cavity and mastoid. Three of the patients underwent surgery for recidivism (none were from isolated anterior lesions). One of these patients was referred at the time of recurrence, one had known residual cholesteatoma, and one had recurrence.

Conclusion: Clinical and surgical findings suggest that congenital cholesteatoma showed various characteristics depending on the location and stage of development.

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Pathogenesis of Cholesteatoma (R636)

ID: 636.3

The Pathogenesis of Cholesteatoma - Experimental Evidence (R636) 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 understand the scientific basis for the etiology of aural cholesteatoma.

Over the last century, a number of theories have been proposed to explain the pathogenesis of acquired cholesteatomas. Several of these theories have experimental evidence in animal studies.

Support for the *retraction pocket invagination* theory is seen in Eustachian tube obstruction models in Mongolian gerbils. When Eustachian tubes of gerbils are ligated in middle ear (bulla) fills with fluid, then over time the pars flaccida retracts, accumulates keratin and forms cholesteatomas.

Support for the *epithelial ingrowth* theory had been documented in a number of animal models. When toxic materials are applied to the tympanic membrane, destruction of the tympanic membrane and ingrowth of keratinizing epithelium occurs. In infected gerbils cholesteatomas often rupture leading to epithelial ingrowth. Human temporal bone studies have also supported this theory.

The *squamous metaplasia* theory is not support by experimental evidence. The only demonstration of squamous metaplasia has been seen in vitamin A deficiency. When rats are deprived of dietary vitamin A, the middle ear mucosa changes to a multilayered squamous epithelium, but cholesteatomas have never been seen in this model.

Basal cell hyperplasia and ingrowth through the basal lamina has been observed in human temporal bones for many years. Ruedi first described this phenomenon. It has been observed in human temporal bone section and occurs in spontaneous in induced cholesteatomas and Mongolian gerbils.

The pathogenesis of cholesteatoma is complex and cholesteatomas may arise from various simultaneous mechanisms.

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Mastoidectomy: How I do it (1) (V637)

ID: 637.1

How to do scutumplasty after cortical mastoidectomy or atticotomy

Presenting Author: **Masafumi Sakagami**

Masafumi Sakagami
Hyogo College of Medicine

Learning Objectives: To learn how to do scutumplasty for intact canal wall tympanoplasty and atticotomy/antrotomy in the video session

Introduction: Postoperative retraction of the ear drum sometimes occurs after cortical mastoidectomy or atticotomy for attic cholesteatoma. One of the most important points to protect retraction is to firmly reconstruct the scutum with a sliced cartilage.

Surgical procedures: After the tympanomeatal flap is elevated anteriorly beyond the scutum, cholesteatoma matrix was removed with canal wall up method or atticotomy. Concha cartilage was thinned by 0.5 mm or less with a cartilage slicer. The most important point for the scutumplasty is to firmly pile up a thinly sliced cartilage on the anterior bony edge of the scutum bone defect. When a cartilage size is not enough to cover the posterior bony edge, a piece of cartilage is added to cover the posterior site. The inferior edge of the cartilage is placed on the malleus neck.

Subjects and Methods: Between 2006 and 2011, 138 ears with primary acquired cholesteatoma were operated on with atticotomy/scutumplasty (28 ears), canal wall up method (87 ears), and canal wall down and reconstruction (23 ears). One-stage operation was 49 ears and two-stage operation was 89 ears. The mean follow-up time was 44.1 months (9–100 months).

Results: Postoperative recurrence due to the ear drum retraction was 17.0% using Kaplan-Meier analysis. Successful hearing outcomes (A-B gap 20 dB or less) was 83/124 (66.9%) according to the AAO-HNS criteria in 1995.

Conclusion: To reconstruct the scutum bone defect firmly is a key point to succeed canal wall up method and atticotomy for attic cholesteatoma. At the presentation, surgical videos and slides will be presented.

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Mastoidectomy: How I do it (1) (V637)

ID: 637.2

Cochlear Implantation after Subtotal Petrosectomy in Chronic Otitis Media

Presenting Author: **Gianluca Piras**

Gianluca Piras, Sampath Chandra Prasad, Mario Sanna
Gruppo Otologico

Learning Objectives: Subtotal petrosectomy combined with cochlear implantation is a procedure required in specific situations and lowers the risk of repetitive ear infections, CSF leakage, and meningitis by closing off all connection with the external environment. Additionally, it gives excellent visibility and access in difficult anatomy or in drill-out procedures. Here we demonstrate the usefulness of Subtotal Petrosectomy in a case of recurrent chronic otitis media with sensorineural hearing loss in the only hearing ear, where it was possible to perform a simultaneous cochlear implantation.

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Emerging Technologies (1) (R641)

ID: 641.1

Codacs as new treatment option for patients with severe and profound mixed hearing loss including cases with chronic otitis and cholesteatoma

Presenting Author: **Thomas Lenarz**

Thomas Lenarz
Medical University Hannover

Learning Objectives: Use of Codacs

Objective: Implantable hearing aids have become a valid option for the therapy of various forms of hearing loss. Codacs Direct Acoustic Cochlear Implant System is the first vibratory implant available for patients with MHL. By directly coupling sound energy into the perilymph, a very high maximum power output (MPO) is achieved over a broad frequency range. Via a conventional stapedotomy, the vibratory energy of the electromagnetic actuator is transferred directly to the perilymph through the oval window.

Patients and Methods: Patients with different etiologies of MHL were implanted:

Otosclerosis: n = 29

Tympanosclerosis: n = 4 (1 with subtotal petrosectomy)

Chronic otitis media: n = 15 (12 with subtotal petrosectomy)

In cases with intact posterior canal wall the implantation was done through the posterior tympanotomy. Stapes footplate was perforated and the stapes prosthesis was fixed at the long process of the incus. In cases with canal wall down and chronic otitis media there was a two-step procedure with subtotal petrosectomy and optimal fat obliteration followed by Codacs implantation six month afterwards. Pre- and postoperative bone and air conduction thresholds and word recognition scores were recorded preoperatively with fitted hearing aid (only 32 of the reported patients were able to use a hearing aid before implantation or subtotal petrosectomy) and postoperatively over time.

Results: Bone conduction thresholds showed no significant change over all in the implanted group. In few patients with mobile footplate some loss of bone conduction was observed. The mean free field thresholds were 43 \pm 7 dB (0.5–4 kHz) and the monosyllabic word score was 67 % at 65 dB presentation level compared to conventional hearing aids with 24 %. Speech intelligibility in noise was 2.1 dB SNR in the OLSA Matrix test (S0N0) three month after activation.

Conclusion: Codacs provides an effective treatment for patients with MHL.

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Emerging Technologies (1) (R641)

ID: 641.2

Fully Implantable Hearing Aids

Presenting Author: **Philippe Lefebvre**

Philippe Lefebvre, Sébastien Barriat

University of Liège

Learning Objectives: 30% of the population over 65 years of age is hearing impaired, corresponding to 7% of the general population. At the present time, this frequent handicap can only be reduced by the use of hearing aids allowing to deliver higher sound energy to the inner ear. These prostheses have undergone tremendous improvement over the last few years in particular on the electronic and aesthetic aspects. In this presentation, we will review the progresses which have been made on implantable hearing devices transmitting the sound energy directly to the ossicular chain in the middle ear.

Semi implantable devices are composed of an external part containing the microphone, the battery and the electronic transferring the information transcutaneously to the internal receiver which activates the transducer attached to the ossicular chain.

In the fully Implantable Hearing Device, the subcutaneous microphone picks up ambient sounds, converts them into an electrical signal, amplifies the signal according to the wearer's needs, and sends it to an electro-mechanical transducer. The transducer tip is mounted in a laser-drilled hole in the body of the incus and translates the electrical signal into a mechanical motion that directly stimulates the ossicles and enables the wearer to perceive sound. The implanted battery is recharged daily via an external charger and the wearer can turn the implant on and off with a hand held remote control.

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Emerging Technologies (1) (R641)

ID: 641.3

Implants in chronic ear disease – new advances

Presenting Author: **James Ramsden**

James Ramsden

University of Oxford

Learning Objectives: Chronic ear disease poses a challenge to hearing restoration. There is often a tension between

controlling the disease and restoring hearing. Outcomes of CSOM surgery in the long run have mixed hearing results and patients often must be phlegmatic about their hearing deficits. New technologies in hearing and vestibular devices can alleviate the deficits but are sometimes difficult to apply to patients with disordered anatomy from chronic ear disease. Hearing aids, BAHA and middle ear implants are the mainstay of hearing rehabilitation, but new options include totally implantable middle ear implants, active stapedectomy devices (CODACS) and vestibular implants. In this session I will discuss where the newer devices fit in to the treatment options, and Prof Lenarz, Prof Lefebvre and Mr Donnolly will outline in more detail specific emerging technologies.

Implants in chronic ear disease – new advances.

Chronic ear disease poses a challenge to hearing restoration. There is often a tension between controlling the disease and restoring hearing. Outcomes of CSOM surgery in the long run have mixed hearing results and patients often must be phlegmatic about their hearing deficits.

New technologies in hearing and vestibular devices can alleviate the deficits but are sometimes difficult to apply to patients with disordered anatomy from chronic ear disease. Hearing aids, BAHA and middle ear implants are the mainstay of hearing rehabilitation, but new options include totally implantable middle ear implants, active stapedectomy devices (CODACS) and vestibular implants.

In this session I will discuss where the newer devices fit in to the treatment options, before the co-presenters will outline in more detail specific emerging technologies.

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Emerging Technologies (1) (R641)

ID: 641.4

Surgical aspects of vestibular implantation

Presenting Author: **Neil Donnelly**

Neil Donnelly¹, James Johnston¹, James Tysome¹, Patrick Axon¹, Yu Chuen Tam¹, Richard Knight¹, Ross Deas²

¹Cambridge University Hospitals, ²Med-El

Learning Objectives: Implantable vestibular prostheses are currently being developed in order to restore balance to patients with severe bilateral vestibular hypofunction. This presentation will examine the key research findings to date and examine on going challenges.

Implantable vestibular prostheses are being developed with a view to restoring balance to patients with severe bilateral vestibular impairment that are not responsive to currently available treatments. Electrical stimulation of nerve fibres in the vestibular system in animal and human experiments has been shown to evoke eye movements which mimic the vestibular ocular reflex (VOR).

An important technical issue faced in implanting a vestibular prosthesis is ensuring optimal positioning to provide electrical stimulation to the nerve fibres. The ideal test of this would be performed intra-operatively at the time of implantation to allow precise placement, and adjustment if required.

The aims of this clinical trial were to systematically record both the ECAPs and electrically evoked eye movements obtained by electrical stimulation of the semicircular canals in

patients under a general anaesthetic for translabyrinthine resection of vestibular schwannoma. This was to ascertain whether the ECAPs and eye movements are reproducible, reliable and correlated, and to allow characterisation of the ECAPs. A new implant array and surgical approach to vestibular implantation were developed. Auditory Brainstem Responses were also recorded to try and confirm preservation of hearing post. Patients were selected if they had recordable balance function and hearing in the tumour ear prior to surgery. Six patients were studied.

It was possible to demonstrate that the amplitude growth and nerve recovery functions were very similar to those observed in cochlear ECAPs but that the latency between stimulation and response was longer confirming that these are vestibular responses. Evoked eye movements under general anaesthesia were observed three out of six test cases and from more than one SCC: these eye movements are not affected by the level of anaesthesia. To date it has not been possible to demonstrate hearing preservation.

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Free Papers (F642)

ID: 642.1

Long-term effects of Eustachian tube balloon dilatation on patient symptoms and satisfaction

Saku Sinkkonen¹, Veera Luukkainen¹, Matej Vnencak², Antti Aarnisalo¹, Jussi Jero¹

¹Helsinki University Hospital, ²Turku University Hospital

Learning Objectives: Long-term effects of Eustachian tube dilatation

Eustachian tube balloon dilation (BET) has been proven to be safe and effective in short-term but more information on its long-term effects are needed. We studied the long-term effects of BET on Eustachian tube dysfunction with a symptom questionnaire (modified ETDQ-7) in 46 consecutive patients (71 ears) treated in our department from 2011 to 2013. 34 (74 %) patients responded to the survey with a mean follow-up of 3.14 years (range 1.83–4.58 years). 77 % of the responders felt that their overall ear symptoms had improved compared to the preoperative situation, and the remaining symptoms were usually mild. Anyhow, the effect varied depending on the symptom. The most common preoperative symptoms were feeling that ears were “clogged”, muffled hearing, ear symptoms during a cold, crackling or popping sounds in the ears, and feeling of pressure in the ears. BET clearly alleviated these symptoms as at least 70 % of the affected patients reported improvement after long-term follow-up. On the other hand, ringing in the ears and the ability to release pressure in the ears by swallowing were improved only in about 40 % of the symptomatic patients. Overall patient satisfaction on BET was good and 79 % of the patients would choose to undergo BET again if their ear symptoms returned to the preoperative level. These results show that BET has significant subjective long-term benefits to the patients.

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Free Papers (F642)

ID: 642.2

Tests of Eustachian Tube Function: The effects of different patient manoeuvres when testing healthy ears

Presenting Author: **Matthew E. Smith**

Matthew E. Smith, James R. Tysome
Cambridge University Hospitals NHS
Foundation Trust

Learning Objectives: To better understand the available tests of Eustachian tube function, and how to optimise the techniques for clinical use.

Introduction: Obstructive Eustachian tube dysfunction is a common disorder for which there is no validated or well-characterised clinical test. To identify opening of the Eustachian tube, numerous tests have been developed which require a patient to perform a Valsalva, Toynbee or sniff manoeuvre, or to swallow on demand. These measures have not previously been compared, or technically refined in healthy individuals.

Methods: We compared six tests of Eustachian tube function in 75 ears from 42 participants, determining the most effective patient manoeuvre for each, and our own normative data.

Results: The highest detected opening rates in normal ears were: Patient reported opening 79%; Observed tympanic membrane movement 78%; Tubo-tympano-aerodynamic-graphy (TTAG) 76%; Continuous impedance 88%; Sonotubometry 94%; nine-step test inflation/deflation 93/94%. Valsalva manoeuvres were most effective at opening the Eustachian tube. Toynbee manoeuvres were most effective when the swallow was performed without water. For Valsalva and sniff manoeuvres, there was a significant correlation between the peak nasopharyngeal pressure generated and Eustachian tube opening.

Conclusions: A number of clinical tests are able to record Eustachian tube opening. The choice of patient manoeuvre applied within each test has a significant effect on detected Eustachian tube opening rates, and our results facilitate refinement of the evolving testing techniques. Further studies are required to explore the association between the test technique and results in ears with Eustachian tube dysfunction.

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Free Papers (F642)

ID: 642.3

Open MET surgery in Children: still an option?

Presenting Author: **Tatiana Matos**
Tatiana Matos, Christoph Schlegel, Thomas Linder
Luzerner Kantonsspital

Learning Objectives:

Objective: To present the result of a 5 year follow up study in a pediatric population (www.innoforce.ch) Intervention: Patients presented with acquired cholesteatoma underwent an OMET by two experienced surgeons. Results: 37 children (38 ears) underwent OMET cholesteatoma surgery with a follow-up of at least 5 years. Thirty-two primary surgeries and 6 revision operations of referred patients were included. There was a slight right ear dominance of 55%. Eighteen percent had a pathologic middle ear on the other side as well. Half of all patients had an ossiculoplasty at the time of first surgery, whereas no attempt or a staged reconstruction was planned in the other half of our patients. Overall 4 (10%) patients developed a recurrent and 3 (7%) had a residual cholesteatoma necessitating further surgery. Four patients developed recurrent disease 3 and 7,5 years after the first surgery. All patients had a dry and water-resistant ear at last follow-up.

Conclusion: Our results on recurrent/residual cholesteatoma in the pediatric population (17%) are higher than in our adult population (9%). There are a lot of conflicting data in the literature. The comparison appears difficult, since most publications do not present long-term follow-up of 5 years or longer in children. Our results compare favorably with the 10year follow-up of Fisch as we are using the same technique. Our presentation will also balance our results with recent data from bony obliterations techniques and add to the ongoing debate.

doi:10.1017/S0022215116001961

Free Papers (F642)**ID: 642.4****Middle ear aeration in staged canal wall up tympanoplasty combined with mastoid cortex plasty or bony mastoid obliteration**

Presenting Author: **Masahiro Komori**

Masahiro Komori¹, Naoaki Yanagihara², Jun Hyodo², Yasuyuki Hinohira³, Ryosei Minoda⁴, Taisuke Kobayashi¹, Masamitsu Hyodo¹

¹Kochi University, School of Medicine, ²Takanoko Hospital, Matsuyama, Ehime, Japan, ³Kamio Memorial Hospital, Tokyo, Japan, ⁴Kumamoto University, School of Medicine, Kumamoto, Japan

Learning Objectives:

Introduction: If poor postoperative aeration can be accurately predicted, canal wall down tympanoplasty or obliteration technique is preferable to canal wall up tympanoplasty (CWUT) is described, however, little is known about the dynamics of middle ear aeration. We sought to determine how the aeration levels changed during the first- and second-stage operations (1stSOP and 2ndSOP), and the most recent CT examinations (recent CT).

Methods: Our study was included 50 ears which had a cholesteatoma extending into the antrum or mastoid cavity involving the ossicular chain with varying degrees of scutum defect.

Middle ear aeration was assessed during 1stSOP and 2ndSOP, and recent CT which was performed at least 5 years subsequent to the 2ndSOP. Middle ear aeration was graded using the following scale: 0, no aeration in the middle ear; 1, only the meso-tympanum is aerated; 2, the entire tympanic cavity, including the attic, is aerated; and 3, the tympanic and mastoid cavities are aerated. The staged CWUT with mastoid cortex plasty was selected for 23 ears with grade 3 aeration (well-aerated ears group) during 2ndSOP, the staged CWUT with bony mastoid obliteration for 27 ears with grade 0~2 aeration (poorly-aerated ears group).

Results: Aeration between 1stSOP and 2ndSOP was improved in 70% of all. Then, by mastoid cortex plasty, 91% of grade 3 ears during 2ndSOP maintained that level up to recent CT. By bony mastoid obliteration, 69% of grade 2 ears and 90% of grade 1 ears maintained their aerations. A deep pocket formation occurred in 0% of grade 3 and 2 ears, 20% of grade 1 ears and 33% of grade 0 ears. There was no significant group difference in aeration level during 1stSOP, and the proportion of the two groups during 2ndSOP was 48% vs. 47%.

Conclusions: Staging is instructive for understanding long-term changes in aeration status. The selection of mastoid cortex plasty or bony mastoid obliteration is suitable and reliable for stabilizing postoperative aeration levels.

doi:10.1017/S0022215116001973

Free Papers (F642)**ID: 642.5****Chronic otitis media were cleared and tympanic cavity forming 120 cases of clinical experience**

Presenting Author: **Long Gang Gong**

Long Gang Gong

Red Cross hospital affiliated to xi 'an jiaotong university

Learning Objectives: Otitis media is the most common otology diseases, with the development of imaging and ear microsurgery, the close type - keep plane wall of mastoid tympanic cavity forming or open - removal of the external auditory canal mastoid lesions cleared a parallel tympanic cavity forming period tympanoplasty, eventually reach function reconstruction, restore hearing. We have between January 2011 and January 2011, 120 cases of surgical observation data integrity is coming back reports as follows.

1 data and methods**1.1 clinical data**

Group, 120 cases of patients, aged 15 to 71 years old, the average age of 34, 73 cases of male, female 47 cases, 68 cases of simple type chronic otitis media and cholesteatoma otitis media 52 cases.

1.2 operation method

The closed type - keep plane wall of mastoid tympanoplasty 102 cases, many options open mastoid area lesion - removed

concha mastoid tympanoplasty 18 cases, add apare keratoplasty, small tympanic cavity forming technique.

2 the results

This group of patients after 1 year to 3 years back, the close type-keep plane wall of mastoid tympanoplasty 102 cases, hearing had no obvious change in 62 cases (51%); , people with hearing improve 13 cases (11%), apparent decline in hearing in 2 cases, accounting for 1%. Hearing a reformer, 41 cases hearing improve 29 cases, accounted for 70.73%, hearing no change of 12 cases, accounted for 29.26%, open - removed concha mastoid tympanoplasty 18 cases, hearing had no obvious changes in 4 cases (22.2%); The improvement in 1 case, 5.6%, the hearing in 13 cases, accounting for 72.2%.

3 discuss

Decided to operation method, according to the scope of the lesions in patients with closed type - keep plane wall of mastoid tympanic cavity forming and open - removed concha mastoid tympanic cavity forming each have advantages and disadvantages. Don't repeat here.

Again is eustachian tube dysfunction, eustachian tube and middle ear cavity infection causal, intraoperative careful cleaning lesions, strengthening postoperative follow-up, curative effect is exact middle ear surgery.

doi:10.1017/S0022215116001985

Free Papers (F642)

ID: 642.6

Studies by Nature of “Eustachian Tube Dysfunction”: A Preliminary Report

Presenting Author: **Udi Cinamon**

Udi Cinamon¹, Hussein Amer², Avraham Lazary², Dov Albukrek², Tal Marom³

¹Wolfson Medical Center, ²Reuth Medical and Rehabilitation Center, Tel Aviv, Israel,

³Department of Otolaryngology, Head and Neck Surgery, Assaf Harofe Medical Center, Zerifin, Israel

Learning Objectives: Challenge the concept of Eustachian tube dysfunction. A study of the middle ear in unconscious, tracheotomized patients with severe brain damage who were unable to swallow, i.e., severely diminished ability to actively open the ET. Therapeutically Thoughts.

Background and Objective: The Eustachian tube (ET) is a conduit communicating the middle ear (ME) with the nasopharynx. The ET is usually passively collapsed, whereas its opening is an active process. The intermittent, transient ET opening is accepted as critical for maintaining ME pressure circa ambient pressure, i.e., keeping the normal ME function. Interference of fluid passage through the ET was termed “ET dysfunction”, implying the pathophysiology of chronic ME diseases, such as otitis media with effusion (OME), tympanic membrane atelectasis or development of cholesteatoma. Our objective was to study a unique group of patients with severely diminished ability to actively open the ET.

Patients and Methods: Unconscious, tracheotomized patients with severe brain damage who were unable to swallow, produce valsalva or yawn, and fed by gastric tubes were enrolled after obtaining an informed consent from the authorized guardian(s). Each patient underwent otoscopic examination, tympanometry, nasopharyngoscopy and evaluation of gag reflex and soft palate movement. Some patients underwent fiberoptic endoscopic evaluation of swallowing with sensory testing (FEESST).

Results: Of the 14 patients recruited, 11 were eligible and fully evaluated: nine males and 2 females, aged 18–79 years (average 53). The period of tube feeding and mechanical ventilation was 3–84 months (average 28). None had prior known or recorded otogenic illness. All patients lacked a gag reflex or palatal movement. Otoscopy of 22 ears revealed 10 with OME (45%, 5 patients) and 12 normal ears (55%, 6 patients). Tympanometry type B was documented in 11 ears, type As in 3 and A in 8.

Conclusion: Despite that all ears tested apparently had a dysfunctional ET, about half had a normal ME. This strongly reveals that the ET is an important but not the only factor maintaining and regulating ME pressure.

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Chronic otitis media in indigenous (N643)

ID: 643.1

Australian Aboriginal & Torres Strait Islander Chronic Ear Disease

Presenting Author: **Francis Lannigan**

Francis Lannigan

The University of Western Australia

Learning Objectives: Australia's Indigenous population has the highest rate of chronic ear disease of any Indigenous people on the planet. The World Health Organisation recognises any population with a rate of chronic ear disease greater than 4% to have a public health crisis. In remote Aboriginal & Torres Strait Islander Communities the incidence of chronic ear disease can be as high as 70%. Affected children usually have their initial suppurative infection with otorrhoea in the first six weeks of life. The impact of associated hearing loss at critical times of language development and early education has life-long individual and community adverse outcomes. The ‘tyranny of distance’ is not a significant causative factor (although it is very significant with respect to service provision), as there is a similarly high rate of disease in urban Aboriginal communities.

The disease pattern is predominantly tubo-tympanic; however, cholesteatoma does occur. Unfortunately, in this population, cholesteatoma often presents with a complication or as an incidental finding during reconstructive surgery. Outcomes are generally worse than those reported in non-Aboriginal populations. The poorer outcomes are considered to be multi-factorial in origin.

This presentation will explore the otologist's role in helping to manage the burden of this disease. It will describe the Ear Health Teams and how they function in Western Australia. It will also discuss how telemedicine has influenced management.

doi:10.1017/S0022215116002000

Chronic otitis media in indigenous (N643)**ID: 643.2****Management of Indigenous Chronic Middle Ear Disease in North Queensland, Australia**Presenting Author: **Shane Anderson**

Shane Anderson

The Townsville Hospital

Learning Objectives: The author will describe his experience with dealing with Indigenous Chronic Middle Ear disease in Northern Queensland, Australia. The management of this condition is co-ordinated with the collaboration of the “Deadly Ears” Program. “Deadly Ears” is an outreach program where otolaryngologists and supporting staff travel to rural and remote communities to provide primary intervention and screening. Most of the surgical management in the community involves adenoidectomy and myringotomy with or without ventilation tube insertion. Some simple tympanoplasties are performed in the community. A recent audit has found the repair rates are only 50%. The Authors practice involves providing a dedicated tertiary referral center and subspecialist Otologist support for the more at risk cases that are not treated in the community. By developing a non traditional public health frame work for referral and management, we have been able to achieve a 90% attendance rate for surgical management. Considering the amount of chronic middle ear disease that we see, cholesteatoma is relatively rare. The majority of cholesteatoma disease is mesotympanic in nature with adhesive otitis media a rare finding. The majority of disease that is treated in this setting is Chronic Suppurative Otitis Media with dense granulation. This may be due to the active management that the “Deadly Ears” program provides that may change the nature of pathology. The Author treats all these cases aggressively with cartilage techniques as the mainstay of treatment. Age, air travel back to remote communities and active discharge in this setting has not made a difference to anatomical closure of disease. The author has developed a method of closure and packing that is simple for the local health care workers to manage in their remote community and allows for water exposure.

doi:10.1017/S0022215116002012

Chronic otitis media in indigenous (N643)**ID: 643.3****Innovation, Excellence and Pragmatism: The Challenges in the management of Chronic Suppurative Otitis Media in Aboriginal people of Northern Australia**Presenting Author: **Hemi Patel**

Hemi Patel, Graeme Crossland, Rohana O’Connell

*Royal Darwin Hospital**Learning Objectives:*

- The prevalence of Otitis Media in Aboriginal people, and the reasons for it.
- The Surgical and non Surgical challenges of Managing Otitis Media in Aboriginal people.
- Historical Data on Surgical interventions in Aboriginal Ear disease.

Introduction: Aboriginal people of northern Australia have the highest rates of Chronic Suppurative Otitis Media globally, and of pandemic proportions, yet good evidence to guide our treatment in this population is limited. We present the challenges, some innovative solutions, and our experience.

Methods: Prospective cohort study.

Results: We present 5 years of prospectively collected data pertaining to Tympanoplasty, Mastoid surgery and TeleOtology in Aboriginal patients of the Northern Territory of Australia.

Conclusion: Tympano-mastoid surgery in Aboriginal Australians can achieve similar outcomes (intact graft, recurrence rates, hearing) to traditionally studied cohorts. We emphasise the importance of close pre and post operative follow up, and a standardised intraoperative technique applicable to the unique challenges of the Aboriginal Ear.

doi:10.1017/S0022215116002024

CI in chronic ears (R644)**ID: 644.1****Cochlear implantation in chronic otitis**Presenting Author: **Milan Profant**Milan Profant¹, Milan Profant², Miguel Aristegui³, Bernard Frayssé⁴, Joachim Mueller⁵¹*Comenius University Medical Faculty,*²*Comenius University, Medical Faculty, Dept**ORL HNS, ³Univ. Madrid, ⁴Univ Toulouse,*⁵*Univ Munich*

Learning Objectives: This panel will deal with different situations in chronic otitis patients requiring cochlear implantation. Authors will discuss the principles of implantation in cholesteatoma patients doing staging or non-staging procedure. Principles of subtotal petrosectomy with ear canal closure will be discussed as another possibility how to manage these patients. Group of patients with wide open cavity is another problem to be solved in the discussion. Authors will present also changing opinion in surgery in the only hearing ear with possibility to manage unexpected deafness by cochlear implantation. Special case reports will be the subject of discussion after short communication presented by the panel members

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doi:10.1017/S0022215116002036

CI in chronic ears (R644)

ID: 644.2

Subtotal Petrosectomy for cochlear implantation in cases of Chronic Otitis Media

Presenting Author: **Miguel Arístegui**

Miguel Arístegui

Hospital General Universitario Gregorio Marañón Madrid Spain

Learning Objectives: We will show the safety of subtotal petrosectomy applied to cochlear implantation in cases chronic otitis media, to prevent future infections that might compromise the implant

Expanding indications for cochlear implantation require adaptation of surgical techniques in special cases.

The presence of chronic otitis media (relapsing acute otitis media, chronic suppurative otitis media or cholesteatoma) require special protection in cases of cochlear implantation.

Subtotal petrosectomy offers the best protection option against future infection in these cases.

Cul di sac closure of the external auditory canal, sealing of the Eustachian tube orifice and elimination of middle ear mucosa provides a secure scenario to avoid infections and risk cochlear implant explantation in the future.

Out of 41 cases in which we have used this technique we have 17 cases that were applied to chronic otitis media of the above mentioned categories. We will report on rationale, technique and complications.

Follow up is made with MRI techniques adapted to the type of implant.

doi:10.1017/S0022215116002048

New diagnostic method in otology (N645)

ID: 645.1

Trends in genetic diagnostics of hereditary hearing loss

Presenting Author: **Ronald Pennings**

Ronald Pennings¹, Celia Zazo Seco², Mieke Wesdorp², Ilse Feenstra², Hannie Kremer², Lies Hoefsloot², Margit Schraders², Helger G. Yntema²

¹Radboudumc, ²Radboud university medical center

Introduction: Over the past decades, many deafness genes have been identified to cause hereditary hearing impairment (HI). It therefore, has become possible to screen for these

genes in the out-patient clinic. The importance of genetic screening of HI is that patients can be counseled about the cause and prognosis of their hearing loss and effects of rehabilitation.

Hearing impairment is genetically heterogeneous and testing of several single HI-related genes is laborious and expensive. This study evaluates the diagnostic utility of whole exome sequencing (WES) targeting a panel of HI-related genes.

Methods: Two hundred index patients, mostly of Dutch origin, with presumed hereditary HI underwent WES followed by targeted analysis of an HI gene panel of approximately 100 genes. 206 additional patients underwent single gene testing guided by phenotype analyses.

Results: We found causative variants underlying the HI in 67 of 200 patients (33.5%). Eight of these patients have a large homozygous deletion involving a known HI gene, which could only be identified by copy number variation detection. Variants of uncertain significance were found in 11 patients (5.5%). In the remaining 122 cases no potentially causative variants were detected (61%). The diagnostic yield of single gene testing in the 206 additional patients was 7.6%.

Conclusion: The diagnostic yield for HI using WES targeting a HI gene panel is higher (33.5%) than targeted sequencing of single genes (7.6%). In our patient cohort, causative variants in *GJB2*, *USH2A*, *MYO15A*, *STRC*, and in *MYO6* were the leading causes for autosomal recessive and dominant HI, respectively. Segregation analysis of variants of uncertain significance will further increase the diagnostic yield of WES. A practical workflow for genetic testing of hereditary HI for screening in the out-patient clinic will be presented.

doi:10.1017/S002221511600205X

New diagnostic method in otology (N645)

ID: 645.2

N645 session : A review of automated audiometry devices and portable smartphone or tablet-based hearing testing systems in otology

Presenting Author: **Allan Ho**

Allan Ho

University of Alberta

Learning Objectives: Recent advances in portable and automated hearing testing systems has enabled testing to occur outside the traditional sound treated booths. This has far reaching implications for otologists and the patients they treat. It expands the utility of these devices in the community and in the developing world where diagnostic audiology services are scarce. We aim to review automated hearing testing systems which do not require testing in traditional sound treated booths. We will discuss the evidence supporting portable automated hearing testing systems which are available on the web and those that are independent applications for smartphones or tablet computers.

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doi:10.1017/S0022215116002061

New diagnostic method in otology (N645)

ID: 645.3

High Frequency Ultrasound and Optical Coherence Imaging in the Ear: The Future of Otologic Imaging?

Presenting Author: **Manohar Bance**

Manohar Bance¹, Rob Adamson¹, Jeremy Brown¹, Tom Landry¹, Dan MacDougall¹, Josh Farrell²

¹Dalhousie University, ²Dalhousie University

Learning Objectives: 1. To review limitations in current imaging 2. To review the principles of high frequency ultrasound 3. To review the principles of optical coherence imaging 4. To illustrate uses of these technologies in otology.

Current imaging tools for the ear are limited in their resolution, and also have significant downsides, such as radiation, or interaction with metallic objects.

We have been developing new technologies based on very high frequency ultrasound (>40Mhz), and optical coherence tomography (OCT). These technologies have been developed in-house in our labs. We will present the present capacity of these devices, including in-vitro temporal bone measurements of anatomy, simulated pathology, and vibration measurements, as well as tracking cochlear implants during insertion. We also have in-vivo measurements using the OCT device. We will present possible uses, both in the middle ear, and in the cochlea and inner ear.

doi:10.1017/S0022215116002073

Hearing reconstruction in chronic ears (R646)

ID: 646.1

Using cements for ossiculoplasty

Presenting Author: **Levent Sennaroglu**

Levent Sennaroglu

Hacettepe University School of Medicine

Learning Objectives: Since 2004 we have been using glass ionomer cement during ossiculoplasty. In the beginning we were using cement only for incus defects between incus and stapes but later on cements are used in many other situations as well. Recently we compared ossiculoplasty results in different situations: 1-incus to stapes 2- malleus to stapes 3-incudoplasty + stapedotomy 4-malleus to incus In this presentation short video clips of each situation will be provided together with audiological outcome.

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doi:10.1017/S0022215116002085

Hearing reconstruction in chronic ears (R646)

ID: 646.2

Ten cases of cholesteatoma with labyrinthine destruction, skull base involvement and intracranial extension: management and long-term follow-up

Presenting Author: **Douglas Backous**

Christina Cobb, Douglas Backous

Swedish Neuroscience Institute

Learning Objectives:

Objectives: We analyze the clinical presentation, imaging findings, and surgical treatment of 10 patients with acquired cholesteatoma with labyrinthine destruction, skull base erosion, or intracranial extension.

Study Design: A retrospective case series at a tertiary referral center.

Methods: From 1997 to 2015, 6 males and 4 females, age 12 to 73 (mean, 42.3), years were treated for acquired cholesteatoma with skull base or labyrinthine invasion. Two patients had no prior surgery while 8 had an average of two prior procedures. All 10 complained of hearing loss, 3 had otorrhea, 3 had acute facial palsy, 3 had otalgia and 2 presented with progressive imbalance. Follow-up ranged from 8 to 216 (mean, 76.6) months. Audiometric, CT and MRI findings are compared to intraoperative outcomes.

Results: At surgical exploration, 2 patients had cholesteatoma with destruction of the cochlea, 4 had skull base invasion and 4 had intracranial involvement. Five patients required temporal bone obliteration, 2 had radical cavities with exteriorization of the petrous apex, and 3 required modified radical cavities. One patient with VII palsy recovered to HB grade III. One patient with labyrinthine destruction maintained residual hearing post op. No patients had additional complications from their definitive surgical procedures.

Conclusions: Acquired cholesteatoma with labyrinthine destruction, skull base extension, and intracranial involvement can have surprisingly subtle presentations. Balancing disease exteriorization with preserving labyrinthine function requires prudent radiological workup and surgical planning. Disease eradication is often not possible. Long-term clinical follow-up with periodic imaging and aggressive debridement is often necessary for disease control.

doi:10.1017/S0022215116002097

Big Cholesteatoma: how to do it (1) (V647)**ID: 647.1****Combined Transotic – Infratemporal Fossa Approach type B for petrous bone cholesteatoma**Presenting Author: **Enrico Piccirillo**Enrico Piccirillo, Annalisa Giannuzzi, Mario Sanna
Gruppo Otologico

Learning Objectives: Petrous Bone Cholesteatomas are very challenging lesions and require a thorough knowledge of skull base anatomy and surgical techniques for their management. Here we describe a unique case of a 44 year old male patient with a Massive Petrous Bone Cholesteatoma (according to the Sanna classification) encircling the petrous Internal Carotid Artery. This was excised using a Combined Transotic and Infratemporal Fossa Approach type B Approach to expose the anteromedial portions of the vertical tracts of the carotid. The cavity was closed by abdominal fat with a blind sac closure of the external auditory canal. The patient is free of disease after a 4 year follow-up.

doi:10.1017/S0022215116002103

Big Cholesteatoma: how to do it (1) (V647)**ID: 647.2****Modified Transcochlear Approach for Petrous Bone Cholesteatoma with sphenoid sinus extension**Presenting Author: **Sampath Chandra Prasad**Sampath Chandra Prasad, Enrico Piccirillo, Gianluca Piras, Mario Sanna
Gruppo Otologico

Learning Objectives: Petrous Bone Cholesteatomas with extensions to the sphenoid sinus are rare and pose a surgical challenge. Here we describe a unique case of a 54 year old male patient with a Massive Petrous Bone Cholesteatoma (according to the Sanna classification) extending upto the sphenoid sinus. This was excised using a Modified Transcochlear Approach (with posterior re-routing of the facial nerve) and the cavity was closed by abdominal fat with a blind sac closure of the external auditory canal. The patient is free of disease after a 4 year follow-up.

doi:10.1017/S0022215116002115

Big Cholesteatoma: how to do it (1) (V647)**ID: 647.3****Closed tympanoplasty in pediatric patient**Presenting Author: **Anna Lisa Giannuzzi**Anna Lisa Giannuzzi¹, Gianluca Piras², Mario Sanna²
¹*Gruppo Otologico, Piacenza*, ²*Gruppo Otologico*

Learning Objectives: Surgery for cholesteatoma is especially challenging in a pediatric population because of the need for hearing preservation. Hence canal wall up mastoidectomy in a single or two stages should be the approach of choice in the pediatric population. Here we describe the steps of canal wall up mastoidectomy in a difficult case of far anterior epitympanic cholesteatoma in a pediatric patient. The result was a complete removal of the disease and preservation of the ossicular chain. The patient is disease free 10 years on follow-up.

doi:10.1017/S0022215116002127

Embryology of the tympanic membrane and middle ear mucosa and its clinical relevance (K653)**ID: 653.1****Embryonic origin of the middle ear and its impact on function**Presenting Author: **Abigail Tucker**Abigail Tucker, Jennifer Fuchs, Hannah Thompson
King's College London

Learning Objectives: The lining of the middle ear is of dual origin formed from the neural crest and endoderm in different parts of the cavity. The pars flaccida is not formed from endoderm but neural crest and ectoderm. The different tissues of the ear respond differently to ear infection. Lineage tracing experiments in the mouse can shed light on the origin of cholesteatomas.

The mammalian middle ear is a complex air-filled space housing the three middle ear ossicles, which transfer sound from the ear-drum to the inner ear. Recent lineage tracing experiments in the mouse have shown that during development this air filled space is created by the neural crest mesenchyme around the ossicles retracting back and transforming into an epithelium lining the roof (attic) and side (promontory) of the newly formed cavity. The rest of the cavity (hypotympanum) is lined by endoderm, continuous with the oral cavity via the Eustachian tube. The endoderm-derived epithelium is covered in a thick lawn of cilia, while the neural crest derived epithelial cells have a much simpler morphology. This dual origin extends to the tympanic membrane, where lineage tracing of the pars flaccida shows no endodermal contribution. This dual origin appears to be unique to mammals, evolving with the three ossicle middle ear. Defects in the cavitation process lead to defective barrier formation, leaving the middle ear susceptible to the development of middle ear problems such as otitis media and Cholesteatoma. In mice with otitis media the neural crest epithelium breaks down while the endodermally derived epithelium undergoes hyperplasia but retains much of its barrier function. We are interested in using our knowledge of the development of the ear using transgenic mice to try and identify the origins of high susceptibility to middle ear disease.

doi:10.1017/S0022215116002139

Middle ear inflammation, mucin gene expression and hearing loss: bench to bedside (K655)

ID: 655.1

Middle ear inflammation, mucin gene expression and hearing loss: bench to bedside

Presenting Author: **Joseph Kerschner**

Joseph Kerschner

Medical College of Wisconsin

Otitis media (OM) remains one of the most important and common diseases of childhood. With decreased effectiveness of antimicrobial therapy our laboratory has spent the past 2 decades elucidating the mechanisms surrounding the pathophysiology of OM in hopes of identifying novel methods of intervention. Through this work, substantive advances in the understanding of the pathogenesis, management and treatment of OM continue to develop. This presentation will highlight the most substantive of these developments in the areas of middle ear inflammation, mucin gene expression, biofilm formation and hearing loss associated with OM. It will provide the clinician and researcher with a platform to: 1) facilitate discussion of new concepts with patients and colleagues, 2) allow for incorporation of new modalities into their practice and 3) remain up-to-date regarding clinical and research developments that have the potential to provide new technologies and treatment possibilities.

doi:10.1017/S0022215116002140

Emerging Technologies (2) (R661)

ID: 661.1

Stereotactic robotic system for ear surgery

Presenting Author: **Thomas Lenarz**

Thomas Lenarz¹, Omid Majdani¹, Samuel John²

¹Medical University Hannover, ²HörSys GmbH

Learning Objectives: Robot assisted cochlear implantation.

Background: Cochlear implantation has become the treatment of choice for patients with severe to profound sensory hearing loss. An increasing percentage of patients show up with residual hearing which should be preserved during and after surgery. In order to improve the precision of electrode insertion with respect to individual cochlear anatomy and existing hearing loss, an advanced concept of robot assisted cochlear implantation has been developed.

Method: The stereotactic frame robotic system has been developed to allow for minimal invasive high precision cochlear implantation. Using preoperative CT data and a tripod stereotactic frame it is possible to calculate precisely the

optimal trajectory from the surface of the mastoid to the inner ear. This path can then be drilled with help of a disposable drilling jig that, which has been individualized to the planned trajectory with an intraoperative robotic assistance system and it has been validated in temporal bone and surgeon studies prior to planned first in man applications.

Results: The overall accuracy is better than 0.5 millimeter. Injuries to facial nerve and scala tympani can be avoided with high probability. The exact placement of the electrode in the scala tympani was achieved.

Conclusion: Robot assisted ear surgery, especially cochlear implantation is both feasible and possible. Introducing such a system would decrease the time needed for implantation by half. The system is easy to use with minimal requirements in terms of technology. It can be adapted for a wide range of auditory implants.

doi:10.1017/S0022215116002152

Emerging Technologies (2) (R661)

ID: 661.2

Microsurgical robot for direct cochlea access

Presenting Author: **Marco Caversaccio**

Caversaccio M^{1,2}, Williamson T³, Gavaghan K², Gerber N², Wimmer W^{1,2}, Anso J³, Rathgeb C², Wagner F, Weber S²

¹Department of ENT, Head and Neck Surgery, University Hospital, Bern, Switzerland ²ARTORG Center, Bern, Switzerland

Learning Objectives:

Objectives: Over the last decade significant research efforts have been invested towards the application of surgical robotics for cochlear implant surgery. To this end, a high accuracy image guided robotic manipulator was developed at the University of Bern, allowing minimally invasive access to the cochlea. This work aims to evaluate the accuracy and usability of the developed system in a study on human temporal specimens.

Methods: A complete surgical workflow for robotic assisted minimally invasive cochlear implantation, including fiducial screw insertion, pre-operative imaging, semi-automatic trajectory planning, patient-to-image registration, tunnel drilling, and electrode array insertion was developed. The proposed workflow, the accuracy of the robotic system, and the effectiveness of the integrated safety features were evaluated in a total of 22 human temporal bone specimens.

Results: In all cases, access to the cochlea was successfully obtained. A drilling accuracy of 0.15 ± 0.07 mm was observed at the round window of cochlea as determined from post-operative image data. The additional mechanisms provide a means to monitor the safety of the approach during the surgery. The system is approved by the Swissmedic regulatory and the Swiss Ethical Committee has given permission for a first in man clinical trial.

Conclusions: The robotic system allows the accurate and safe drilling of a minimally invasive tunnel to the inner ear for cochlear implantation procedures. The evaluation of the system in a first in man clinical trial will take place in the near future.

Acknowledgments: Artorgcenter (Prof. S. Weber and coworkers), Medel-company, Nano-Tera, CTI, Hear-EU.

doi:10.1017/S0022215116002164

Emerging Technologies (2) (R661)

ID: 661.3

The Case for Cochlear implantation Robotics and an autonomous drilling robot

Presenting Author: **Chris Coulson**

Chris Coulson

Queen Elizabeth Hospital, Birmingham. endoscope-i

Learning Objectives: Cochlear implantation leads to cochlear trauma, reducing this may help optimize implantation performance. An autonomous cochlea drilling robot may be one of the components in reducing this trauma.

Introduction: To detail the intra cochlear trauma caused during cochlear implantation and its effect on CI performance. To demonstrate a human trial of an autonomous robot capable of performing a bony cochleostomy whilst preserving the underlying endosteal membrane.

Methods: A review of the implantation literature assessing cochlear trauma and its impact on implant performance. An autonomous cochleostomy robot was used to create a cochleostomy in 3 live patients during a cochlear implantation procedure.

Results: Twenty one papers were identified which were relevant to our search. In total, 686 implants were inserted and 121 (17.6%) showed evidence of trauma.

The robotic cochleostomy drilling robot was able to perform a complete cochleostomy whilst preserving the underlying endosteal membrane.

Conclusions: Cochlea trauma is a common result of cochlear implantation. An autonomous robotic drill can perform a cochleostomy whilst preserving the underlying endosteal membrane. This is one of the necessary steps in being able to perform a completely robotic cochlear implantation - with an intention to reduce the typical cochlear trauma.

doi:10.1017/S0022215116002176

Free Papers (F662)

ID: 662.1

Middle fossa approach for cochlear implantation

Presenting Author: **Wojciech Gawęcki**

Wojciech Gawęcki¹, Łukasz Borucki¹, Michał Karlik¹, Vittorio Colletti², Witold Szyfter¹

¹Poznań University of Medical Sciences,

²University of Verona

Learning Objectives: To present indications, surgery and results of cochlear implantation via middle fossa approach.

Introduction: Classic approach to the cochlea through the mastoid and facial recess may not be suitable for patients after middle ear surgery for cholesteatoma. In 1998 Colletti presented a technique to bypass the middle ear, and insert the electrode through the middle cranial fossa approach.

Material and methods: In our department cochlear implant program started in 1994 and till now 1266 cochlear implantations were performed. In 4 patients middle fossa approach was used. Indications, surgical technique and results in this group were analyzed. Results: Initially 6 deaf patients after middle ear operation for cholesteatoma were qualified to cochlear implantation via middle fossa approach. A middle cranial fossa craniectomy was performed. Then a careful dissection of the dura was carried out to expose the arcuate eminence and the greater petrosal nerve. In two cases surgery was stopped because of strong adhesions and bleeding from the dura during preparation. In the rest 4 cases the basal turn of the cochlea was discovered, the cochleostomy was done and successful implantation was performed. The time of surgery was nearly two times longer than during standard implantation. In 3 cases there were no complications and in one case hematoma occurred 2 days after surgery and the patient was reoperated. Postoperative CT showed correct intracochlear position of the electrode in all cases. All 4 patients use their implants and have good hearing thresholds in sound free field, but they can't fully communicate using hearing only and require lip reading.

Conclusions: Middle fossa approach enables cochlear implantation in deaf patients after middle ear surgery where implantation through standard approach (antromastoidectomy and posterior tympanotomy) is not possible.

doi:10.1017/S0022215116002188

Free Papers (F662)

ID: 662.2

Systematic Review of VSB in C/M Hearing Loss

Presenting Author: **Arne Ernst**

Arne Ernst¹, Jan Wagner²

¹Charité Medical School, ²dept otolaryngology at ukb, hospital of the univ. of berlin (Charité)

Pubmed, OvidSP (MEDLINE), EMBASE (DIMDI), the NHR Centre for Reviews and Dissemination (including NHS EED, DARE, and HTA), and the Cochrane Library were searched to identify papers published between January 2006 and December 2015 using the MeSH terms

VSB, mixed hearing loss, conductive hearing loss, middle ear implant, vibroplasty and combinations of them. Data were only extracted if reported in the text or tables, or if they could be accurately calculated from graphs, figures, or raw data sets. Information was extracted from each article on 1) sample characteristics (age, gender, aetiology, diagnosis, treatment received/receiving), 2) type of intervention (use of HA, surgical approach, audio processor type), and 3) type of outcome measures (testing intervals, surgical complications, AC and BC pure tone thresholds, sound-field thresholds, functional gain, hearing preservation, speech perception/recognition at various presentation levels in quiet and noise, results of questionnaires). The evidence presented in the selected studies was assessed and classified using the levels of evidence defined by the Oxford Centre for Evidence-based Medicine.

As demonstrated by the variety of studies reported, the VSB and the specific surgical techniques developed (“vibroplasty”) have enabled to adapt this active, electronic middle ear implant to nearly every pathophysiological situation within the middle ear and to restore hearing by amplification of residual hearing. This new strategy in hearing rehabilitation has led to an improved quality of hearing and life of the patients, respectively.

doi:10.1017/S002221511600219X

Free Papers (F662)

ID: 662.3

Prognostic Factors in Paediatric Cochlear Implantation: Definition Location Evaluation

Presenting Author: **Jane Black**

Jane Black¹, Bruce Black²

¹University of Queensland, ²Lady Cilento Children's Hospital

Learning Objectives:

Objectives: Accurate prognostication in paediatric cochlear implantation (PCI) is essential for informed counselling of a child's outlook during the pre-operative period. This work sought to devise a methodology by which researchers could more clearly define, locate and evaluate adverse factors in PCI to formulate an accurate prognosis to counsel the family prior to implantation, the key to success in PCI.

Method: Three steps in the prognostic process are addressed 1) the exact site, action, probability and severity of the individual adverse factors are assessed using refined descriptors to more clearly denote the pathology and action of these influences 2) illustration of the anatomical location of the factors along the route of PCI stimulation, location of the pattern of influences and their potential impact on the functional aspects of the auditory pathway 3) an evaluation method is presented that allows location of individual factors, their impact on ability, then an estimation of their cumulative effect, the prognosis. Six domains of ability are assessed: cortical maturation, neurological function, otological, general medical, psychological and family.

Result: Considerable difficulties and deficiencies of prior prognostic works are demonstrated. The work provides a “road map” by which clinicians may assemble an orderly estimation of the threats present in a particular case. The evaluation technique, yet to be validated by clinical research, offers a sensibility method of prognostic assessment in PCI.

Conclusions: PCI prognostication requires precise evaluation of the site, pathology and action of adverse factors with focus on the specific pathology, systematic examination of the auditory pathway and a method of evaluation of the combined effect of several impaired domains. However, the overall impact remains an individual study, case-by-case due to the complexity of each situa, particularly in the complicated management of the child with multiple difficulties.

doi:10.1017/S0022215116002206

Free Papers (F662)

ID: 662.4

Keyhole cochlear implantation surgery: adaptation to Soundbridge and Bonebridge devices

Presenting Author: **Bruce Black**

Bruce Black

University of Queensland/Lady Cilento Children's Hospital

Introduction: Cochlear implantation (CI) techniques have evolved towards progressively minimalist surgery. Three guiding principles have emerged. Firstly, brief, limited surgery, to minimise the overall impact, particularly in small infants. Secondly, safety issues: good outcomes with minimal complications. Thirdly, acceptable psychological/cosmetic results, especially with respect to the families of children.

Hitherto, similar surgical principles for the implantation of other devices has attracted only limited comment.

Materials and Methods: Keyhole CI surgery, as outlined in previous work, has achieved the above outcomes effectively. A later modification stabilises the device in situ using a soluble percutaneous suture passed around the neck of the device, when in the pericranial pocket, replacing previous stabilisation methods. Bony retention wells are avoided.

The Keyhole method has been adapted to the Med EL Soundbridge and Bonebridge devices. The former requires a larger posterior tympanotomy to permit fixation to the incus, and this may be supplemented by a transcanal approach.

The Bonebridge surgery employes a slightly larger auricular incision and a loose pericranial pocket, as fixation is not problematic. The larger pocket facilitates implant positioning over the fixation points.

Results: In over 600 CI cases, plus 36 Soundbridge and 25 Bonebridge cases the keyhole approach has achieved optimal outcomes in terms of the three principles above, being brief, with minimal trauma and scarring.

Conclusions: The Keyhole implant method is optimal for all three devices, with particular advantages for bilateral simultaneous CI in the small infant.

doi:10.1017/S0022215116002218

Free Papers (F662)

ID: 662.5

Surgical outcomes in BAHA Surgery as a function of incision / soft tissue / implant type

Presenting Author: **Ahmed Allam**

Ahmed Allam¹, Panos Panos Dimitriadis², Jadip Ray²

¹Otology/Neurotology Fellow in Sheffield Teaching Hospital, ²Regional Department of Neurotology, Sheffield Teaching Hospital, UK

Learning Objectives:

Objectives: To determine the relationship between surgical outcomes and incision, soft tissue technique and implant types.

Method: A retrospective study of paediatric / adult patients receiving Cochlear[®] BAHA (April 2010 -March 2013). Age 6–89 years. The outcome compared for a single surgeon. Patients were divided into 3 groups according to technique:

Group 1: Inferiorly based scalp flap raised by dermatome for Cochlear[®] BI300 abutments (n = 20). **Group 2:** Sheffield incision (short ‘lazy S’ within hairline, soft tissue reduction) for Cochlear[®] BI300 abutments (n = 35). **Group 3:** Short linear incision, non-soft tissue reduction technique for the Cochlear[®] BI400 hydroxyapatite coated abutments (n = 35) **Group 4:** BAHA Attract (inferiorly based “C” shaped flap). (n = 20).

Results: **Group 1:** Bald patch with wide numbness in all. Soft tissue complications: overall 14%, flap related problem (14% flap breakdown, 13% granulations) and 8% fixture los. Surgical time 1.5 hours. **Group 2:** Aesthetically pleasing. No bald patch. Divot formation. Significant numbness. No major complications like flap necrosis or fixture loss. One patient had a wound haematoma and dehiscence which needed closure. Minor granulations (13%), skin redness (9%) (Holgers 2), small wound dehiscence (3%). All settled conservatively. Surgical time 45 min. **Group 3:** Aesthetically pleasing. No bald patch. No divot. No granulations. Smaller area of numbness. Wound breakdown in one (abutment placed in incision line) needing secondary suture. Surgical time 25 min. **Group 4:** Aesthetically pleasing. No bald patch. No divot. No granulations. Larger area of numbness. No wound breakdown. Maintenance free. Surgical time 40 min.

Conclusions: The introduction of newer abutments as well as transcutaneous techniques with minimal soft tissue mobilisation / handling has reduced surgical time, post operative care, complications and patient morbidity and has increased throughput and patient satisfaction with percutaneous hearing implants.

doi:10.1017/S002221511600222X

Free Papers (F662)

ID: 662.6

Congenital Inner Ear Malformations as a Cause of Single Sided Deafness

Presenting Author: **Emel Tahir**

Emel Tahir¹, Münir Demir Bajin², Mehtap Öztürk³, Levent Sennaroğlu²

¹Ankara Dışkapı Yıldırım Beyazıt Research and Training Hospital, ²Hacettepe University School of Medicine, Department of Otolaryngology, ³Hacettepe University Faculty of Health Sciences Audiology Department

Learning Objectives: To understand the relationship with concurrent clinically significant inner ear abnormalities (IEMs) and single sided deafness (SSD). To increase awareness of the functional impact of SSD and its radiological findings which may influence the treatment of this condition. To interpret the treatment modalities of SSD by the help of radiological data and find out which IEMs constitute a contraindication to cochlear implantation.

Introduction: Single sided deafness (SSD) was a negligible entity until recently because of normal language development by the help of contralateral normal hearing. A Number of studies revealed that many SSD cases had concurrent inner ear malformations (IEM) which may influence the treatment plan of SSD. The aim of this study was to elucidate the prevalence and distribution of IEMs in congenital SSD which is crucial for the treatment.

Methods: This is a retrospective study of temporal bone CT and MRI findings of 77 consecutive patients 0–18 years old with congenital SSD. Cases with acquired etiology were excluded.

On MRI; the diameter, and signal intensity of the cochlear nerve (CN) were compared to the ipsilateral facial nerve. Also the width of the BCNC was measured on axial CT and it was defined as “stenotic” if the width was less than 1.5 mm.

The diagnosis of pediatric SSD is initially verified by pure-tone audiometry or ABR.

Results: 40 cases had normal CT&MRI findings whereas the remaining 37 had various IEMs. The most common pathology was BCNC stenosis/atresia together with CN deficiency(CND) seen in 27(72%) of the subjects. Interestingly this stenotic/atretic BCNC is seen in otherwise normal cochlear morphology which can be termed as “isolated aperture atresia/stenosis”. Next in frequency were cochlear hypoplasias followed by incomplete partition I with 6 and 2 patients respectively. The most unexpected finding of the present study was the exceptionally high prevalence of CND accompanied by isolated BCNC stenosis/atresia as a cause of SSD rather than other IEMs.

Conclusions: All cases with SSD should have a CT in addition to MRI scan, because the prevalence of BCNC anomalies with CND is very high in SSD. Since the non-functioning hypoplastic or aplastic CN together with BCNC atresia is a contraindication for CI, management of these patients is complex and BAHA could be an option. Cases with SSD should not be implanted before detailed evaluation of BCNC and CN.

doi:10.1017/S0022215116002231

Bacteriology and Biofilm (R663)**ID: 663.1****Stuck in the glue – Biofilms, intracellular bacteria and neutrophil extracellular traps in otitis media**Presenting Author: **Ruth Thornton**Ruth Thornton¹, Stephanie Jeffares², Shyan Vijayasekaran¹, Lea-Ann Kirkham¹, Selma Wiertsema¹, Peter Richmond¹, Harvey Coates¹¹University of Western Australia, ²Telethon Kids Institute**Learning Objectives:** Biofilms, intracellular infection and NET production all play a role in chronic and recurrent OM and need to be targeted if treatments are to be effective.

Introduction: Otitis media (OM) is a complex paediatric disease involving interactions between the child, their environment and the microbes that ultimately cause infection. While OM is mainly attributed to bacterial infections, antimicrobials have limited efficacy in treatment or prevention of chronic or recurrent disease. We have demonstrated that bacteria can evade antimicrobial treatments and the immune response both within biofilms and host cells. These bacteria appear to invade and proliferate within cells and may adopt a biofilm phenotype. Bacteria can also manipulate the immune response to release DNA from neutrophils in the form of neutrophil extracellular traps. This host DNA increases the viscosity of the middle ear effusion and assists in the formation of bacterial biofilms, permitting the persistence of infection. These persistence mechanisms represent targets for development of treatment or preventative strategies to combat chronic and recurrent OM.

Methods: Dornase alfa is a DNase used in treating cystic fibrosis and is able to digest the DNA in middle ear effusion *in vitro*. We have established a clinical trial to determine the safety and efficacy of Dornase alfa at the time of ventilation tube insertion (VTI) in children with OM to prevent complications following surgery and reduce the need for repeat surgery.

Results: The Dornase alfa trial is still blinded so efficacy has not yet been assessed, however direct installation into the middle ear at the time of VTI has been demonstrated to be safe.

Conclusions: Bacterial persistence mechanisms need to be fully characterised and understood if effective treatments and preventions are to be developed. Dornase alfa at the time of VTI represents a novel approach that may target the underlying persistence mechanisms.

doi:10.1017/S0022215116002243

Bacteriology and Biofilm (R663)**ID: 663.2****Bacteriology and Biofilm Panel (R663) 6–6 - Biofilms and Persister Cells in Infected Cholesteatomas**Presenting Author: **Richard Chole**

Richard Chole

Washington University in St. Louis School of Medicine

Learning Objectives: The objective of this presentation is to discuss the evidence for biofilms and persister cells in the pathophysiology of aggressive cholesteatomas.

Microbial biofilm formation has been observed in human and experimental cholesteatomas. These biofilms occur in the keratin matrix of the cholesteatoma. They are sometimes associated with inflammatory cells, but sometimes devoid of inflammatory cells. The most common organisms found in infected cholesteatomas are *Staphylococcus aureus* and *Pseudomonas aeruginosa*. These are well known biofilm forming organisms.

However, recent studies have shown that inoculation of *P. aeruginosa* mutants devoid of the ability to form biofilms (PA01 Δ FleQ and others) are inoculated into experimental cholesteatomas, the persistence of infection and the tissue destruction observed are no different than when they are infected with the wild type bacterium (PA01). These studies raise questions about the role of biofilm formation, per se, in the chronicity of infections in aural cholesteatomas.

Recent evidence supports the concept that isolated bacterial cells, termed “persister cells” may be present in infected cholesteatoma in the presence or absence of a biofilm. Persister cells assume a very low metabolic rate and replicate only at minimal levels. These persister cells are highly tolerant to antibiotics, although viable and under the right conditions would begin replicating again and assume their planktonic phenotype.

doi:10.1017/S0022215116002255

Bacteriology and Biofilm (R663)**ID: 663.3****Past, present and future treatment of biofilms in otitis media**Presenting Author: **Mat Daniel**

Mat Daniel

Nottingham University Hospitals

Learning Objectives: Understand how knowledge of biofilms in otitis media may improve future treatments of otitis media.

Introduction: Otitis media with effusion (OME) is common, and at least a quarter of children require grommets more than once, with attendant risks. Better treatments would be welcome, especially if they obviate the need for repeat surgery, or avoid the requirement for anaesthesia and surgery altogether. Recent advances in our understanding of the importance of biofilms in otitis media pathogenesis have opened up potential new treatment avenues that could improve patient care in the future.

Methods: Review of the treatment of biofilms in otitis media.

Results: Treatment of biofilms requires antibiotic levels that are typically 100 to 1000 times higher than concentrations that inhibit free planktonic bacteria. Systemically administered antibiotics do not reach levels in the middle ear

sufficiently high to eradicate biofilms (at least not without causing systemic toxicity). Ventilation tube insertion dries the middle ear and thus could suppress biofilms, but it may not eradicate them, possibly accounting for the high rate of OME recurrence after VT extrusion. Biofilms in the middle ear could be eradicated by administering antibiotics directly to the middle ear, to reach an antibiotic level that is locally high enough to eradicate biofilms; drug delivery methods could include slow-release formulations placed surgically, or trans-tympanic delivery. Oral treatment strategies could also be useful, but rely on appropriate selection of antibiotics that work well against biofilms, perhaps potentiated by agents to disrupt biofilm matrix and middle ear mucus.

Conclusion: Better understanding of biofilms in otitis media has the potential to lead to development of better treatments in the future.

doi:10.1017/S0022215116002267

Bacteriology and Biofilm (R663)

ID: 663.4

Biofilms in Otitis Media

Presenting Author: **Romain Kania**

Romain Kania

Lariboisiere University Hospital, Paris
Sorbonne Cite

Learning Objectives: To describe: 1. the existence of biofilms in otitis 2. the role of biofilms in the pathogenesis of otitis media 3. the potential targets of treatment.

Biofilms are multicellular network of bacteria encased in a matrix and are noticeably resistant to both antibiotics and host defenses. Biofilms exist in otitis media, cholesteatoma, chronic otitis media, onto prostheses and in adenoids. Demonstration of biofilms in otitis media has shown different mechanisms of persistence of bacteria into the middle ear. Substantial effort in understanding the biologic nature of biofilms has resulted in evidence supporting their importance in otitis media and adenoids. The predominant role played by in biofilms is important, both from the perspective how pathogens develop viable communities in the middle ear as well as how this structure impedes successful antibiotic therapy. Understanding the nature of the biofilm component in the pathogenesis of chronic otitis media will likely have a meaningful influence on the development of novel strategies of treatment.

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Free Papers (F664)

ID: 664.1

A study of the otological outcomes of otitis media with effusion in children with primary ciliary dyskinesia

Presenting Author: **Reshma Ghedia**

Reshma Ghedia¹, Jonny Harcourt², Annakan Navaratnam², Jahangir Ahmed²

¹Imperial College Healthcare Trust, ²Imperial College NHS Trust

Learning Objectives:

Introduction: Primary Ciliary Dyskinesia (PCD) describes a group of inherited disorders that result in abnormal ciliary motion leading to mucous stasis. Clinical features almost always include otitis media with effusion (OME). PCD patients provided us with a cohort of patients with OME that is not treated with ventilatory tube insertion as these have been shown to result in chronic otorrhoea, early extrusion and persistent perforation without significant improvement to hearing in the long term. The most popular theory of cholesteatoma formation is invagination of the tympanic membrane due to a negative middle ear pressure, as found in OME. We used this cohort to investigate whether children with PCD and OME were predisposed to Cholesteatoma formation.

Methods: We performed a retrospective observational review of all the children attending a multi-disciplinary PCD clinic at a national quaternary referral centre. With thorough review of the documentation from their clinic appointments and audiology assessments we collected data regarding the management of the OME.

Results: We found that out of 144 patients on their database, almost all of them had a diagnosis of otitis media with effusion at some point. Of these, the only children who had insertion of a ventilatory tube were those who had the procedure before the diagnosis of PCD was made. The majority of children had none or mild hearing loss and therefore did not require any intervention. Those with moderate to severe hearing loss were referred for fitting of hearing aids. None of the children with OME were diagnosed with a Cholesteatoma in the time they had been followed up in the PCD clinic.

Conclusions: Cholesteatoma has not been found to occur in children with PCD despite having OME which is conservatively managed. This contradicts the traditional invagination theory of cholesteatoma formation and in these patients, the mucosal stasis may in fact provide a protective factor against cholesteatoma formation.

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Free Papers (F664)

ID: 664.2

Cholesteatoma: The effects of poverty and ethnicity in New Zealand's North Central Region

Presenting Author: **Stephen Toynton**

Stephen Toynton¹, David Schreiber²

¹Hawke's Bay Hospital, ²Central-Technical Advisory Service, Analysis

Learning Objectives: Appreciation of social factors is important as delivering health care within ethnic groups is generally more effective.

Introduction: A preliminary study that attempts to separate the effects of ethnicity from deprivation using the surgical intervention rates for some otological conditions, particularly cholesteatoma. Indigenous populations have a greater incidence of chronic ear conditions, however it is difficult to separate deprivation and ethnicity as factors. New Zealand's official bicultural society gives an opportunity to study this. An identification of either ethnicity or deprivation as a major factor is important as it enables more effective targeting of health resources.

Methods: Surgical intervention data from the six Central North Island District Health Boards (DHB) was examined for the interventions of myringotomy with or without grommets; myringoplasty; cholesteatoma related surgery, also the patient demographic profile, including ethnicity and addresses. NZDep2013 is a deprivation index of 1–10 (1-least deprived), assigned to small local areas. Cross tabulation of the data enables preliminary analysis of four ethnic groups and 10 levels of deprivation within the three surgical interventions.

Results: Preliminary data extract: Myringotomy/grommet interventions increase substantially with deprivation score (9.2 to 17.7 per 1000 population; decile 1–10 respectively) although Maori have more than double the intervention rate per deprivation decile. Maori and Pacific Islanders have similar cholesteatoma intervention rates (12–16 per 10,000) which is again more than double that of New Zealand Europeans. This pattern is consistent across the parameters described.

Conclusions: Consistent results have been obtained suggesting that ethnicity and deprivation are separate factors that increase the surgical intervention rates for grommet insertion, myringoplasty and cholesteatoma surgery.

doi:10.1017/S0022215116002292

Free Papers (F664)

ID: 664.3

Bone Conduction Implants in Pediatric Cholesteatoma Management

Presenting Author: **Stephen Cass**

Stephen Cass, Gregory C Allen, Kenny H Chan

University of Colorado

Learning Objectives:

Introduction: The use of bone conduction hearing implants (BCI) to management hearing loss in children with cholesteatoma/CSOM has not been well studied. In particular, can the use of a BCI alter the surgical approach to cholesteatoma and result in better disease management? Are BCI-related complications in patients with cholesteatoma different than patients without cholesteatoma?

Methods: Following IRB approval, a 12 year retrospective chart review of our BCI population at a tertiary academic children's hospital was performed.

Results: 45 subjects were identified with mean age at implantation of 8.2 years (range 1.7 to 19.1 years). All subjects had a device implanted with a percutaneous abutment. In 8 subjects, a BCI was placed in conjunction with surgery for cholesteatoma or chronic suppurative OM.

In total, 58 BCI-related complications occurred in 29 subjects. The majority of the complications were related to skin infection or overgrowth: 18 events required oral antibiotic and/or office-based cauterization and 17 events required revision surgery (43% percent of patients). In the subjects with cholesteatoma, the mean age at implantation was 9 years (range 5–19 years). All 8 subjects with cholesteatoma were also syndromic (Down and Crouzon Syndrome). There was no difference in the complication rate found in subjects with or without cholesteatoma. The use of a BCI permitted alteration of the ear procedure (EAC closure or thick cartilage grafting) that resulted in dry/stable ears in all 8 subjects.

Conclusions: Children with recurrent cholesteatoma/CSOM and unfavorable clinical factors (syndromic) can benefit use of a BCI which then permits use of surgical procedures to better control their underlying ear disease. No postoperative complications occurred related to their ear disease and the rate of BCI-related complications was no different then in children without cholesteatoma.

doi:10.1017/S0022215116002309

Free Papers (F664)

ID: 664.4

The Vibrant Soundbridge middle ear implant in radical cavities

Presenting Author: **Marek Porowski**

Marek Porowski¹, Henryk Skarzynski², Kamila Osinska², Bartłomiej Krol², Piotr H. Skarzynski²

¹Institute of Physiology and Pathology of Hearing, ²World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/ Warsaw, Poland

Learning Objectives:

Introduction: Hearing results obtained after tympanoplasty surgeries in patients after radical operations are not always satisfactory. In these patients with chronic otitis media after radical operations and lack of the ossicles, hearing improvement may be achieved with stimulation of the round or oval windows using Vibrant Soundbridge MEI.

Aim: The objective of the study was to analyze hearing results obtained after surgical application of Vibrant Soundbridge in treatment of hearing impaired patients with chronic inflammation of the middle ear, especially after radical modified operations.

Material and Methods: The selected group of patients were adults with chronic inflammation of the middle ear, after radical modified operations with destruction of the elements of the middle ear - tympanic membrane and ossicles. Patients presented conductive or mixed type of hearing impairment. In these patients Vibrant Soundbridge was used as the method of

hearing improvement. Surgical approach included FMT placement in the direct proximity of the round window membrane. We discussed the indications, contraindications and limitations of use of Vibrant Soundbridge in this group of patients.

Results and conclusions: Direct stimulation of the round window is an alternative method of treatment in selected group of patients with hearing impairment and mild to severe destruction of the middle ear elements. In all cases subjective hearing improvement was noticed and confirmed in audiological tests. The benefits of Vibrant Soundbridge use are significant.

doi:10.1017/S0022215116002310

Free Papers (F664)

ID: 664.5

Cholesteatoma and Retraction pockets in Cochlear Implantation and their Management

Presenting Author: **Hannah North**

Hannah North¹, Simon Freeman², Deborah Mawman³, Lise Henderson³, Martin O'Driscoll³, Iain Bruce², Simon Lloyd²

¹Salford Royal Foundation Trust and Central Manchester Foundation Trust, ²Central Manchester Foundation Trust, Richard Ramsden Centre for Auditory Implants, ³Richard Ramsden Centre for Auditory Implants

Learning Objectives: Management of cholesteatoma in auditory implants Management of retraction pocket disease in auditory implants.

Introduction: Cholesteatoma is a rare condition. In the presence of an auditory implant, the principal concern is damage to the internal device either through the disease process or through surgery to remove the disease.

Methods: A retrospective analysis was performed all implant recipients at the Richard Ramsden Centre for Auditory Implants and the management of patients with a retraction pocket or cholesteatoma was reviewed.

Results: Five patients with cochlear implants were identified with cholesteatoma – one adult and four paediatric patients. Four presented with otorrhoea and wound breakdown, one was an incidental finding of congenital cholesteatoma at time of implantation. Two patients required device replacement, one was removed without reimplantation. Cholesteatoma was managed by canal wall down mastoidectomy and blind sac closure.

Five patients were identified with retraction pockets – two adults, one adolescent, two paediatric patients. Two presented with recurrent otorrhoea and were managed with cartilage tympanoplasty to cover exposed electrodes. Two presented with imbalance and one was noted as an incidental finding. These three patients were managed conservatively with recurrent microsuction in the outpatient clinic. None of these patients required removal of reimplantation of their device.

Conclusions: Device failure or damage is common in cholesteatoma either as a result of disease itself or surgery. Reimplantation should occur at time of electrode explantation where possible to prevent obliteration of the cochlear duct. Cochlear implants in retraction pockets generally do not result in device failure and require surgical intervention only if symptoms dictate.

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Free Papers (F664)

ID: 664.6

VORP 503 in mixed hearing loss and radical cavities

Presenting Author: **Torsten Mewes**

Torsten Mewes

Helios Dr.-Horst-Schmidt-Kliniken Wiesbaden

Learning Objectives: Vibrant Soundbridge VORP 503, Round Window Soft Coupler, radical cavities.

The Vibrant Soundbridge VORP 503 is an active middle implant, which could be coupled at the ossicle chain or directly onto the round window membrane. The Round Window Soft (RWS)-Coupler is a silicone coupler and connects the Floating mass transducer to the round window membrane without any interposition of artificial fascia. The VORP 503 is now simply fixed at the bone with two screws.

We present the results of patients with radical cavities, which had several tympanoplasties for hearing restoration in the past. All of them were implanted with a VORP 503 using a RWS-Coupler.

The postoperative audiological tests showed good results by aided pure tone audiogram, monosyllabic speech test and sentence test in noise. The VORP 503 and RWS-Coupler made coupling to round window membrane easier and more precise. The results are better comparable between different surgeons.

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Mastoid reconstruction (R666)

ID: 666.1

Mastoid reconstruction using autologous materials

Presenting Author: **Joe Kutz**

Joe Kutz

University of Texas Southwestern Medical Center

Learning Objectives: Mastoid defects are commonly found during surgery for chronic otitis media, temporal bone tumors, or trauma. Without repairing defects of the external auditory canal or scutum, cholesteatoma or chronic infection may develop. Encephaloceles can occur if tegmen defects are not adequately repaired. Autologous materials can be used to repair these defects with the benefit of less tissue reaction, availability of tissue, and less cost. Cartilage with or

without perichondrium is readily available and can be used to repair external auditory canal, scutum, and tegmen defects. Bone pate collected during the mastoidectomy can be used to repair bony defects. The advantages and disadvantages of these materials and techniques will be discussed. Photos and videos will be used to demonstrate these techniques.

doi:10.1017/S0022215116002346

Mastoid reconstruction (R666)

ID: 666.2

Bone Cements for Mastoid/Posterior Canal Wall Reconstruction

Presenting Author: **Sujana Chandrasekhar**

Sujana Chandrasekhar

New York Otology; Hofstra-Northwell School of Medicine

Learning Objectives: 1. Understand need for reconstruction of the posterior canal wall in canal wall down mastoidectomy 2. Describe the different types of bone cements that are available for mastoid/PCW reconstruction 3. Know the indications and contraindications for use of cement(s) in chronic ear cavities.

Long-term management of the canal wall down mastoidectomy cavity remains a concerning issue. Quality of life (QOL) measures are reduced in patients with large mastoidectomy bowls that necessitate life-long otologic care. Interestingly, QOL between patients with intact canal wall mastoidectomies and reconstructed canal wall down mastoidectomies is not different. This has spurred attention to various posterior canal wall reconstruction techniques. Since the early 1980s various cements have been tried for reduction of cavity/bowl size and reconstitution of the posterior canal wall. These have fallen into and out of favor as long-term results have become available. The bed should be as pristine and clean as possible before the cement foreign body is placed there. Cement can be used alone or in conjunction with a free island of bone – either from the posterior canal wall or from the cortex of the skull. Certain cements, such as glass ionomers, cannot be used if there is potential contact with cerebrospinal fluid because of possible aluminum encephalopathy. Care must be taken for early identification and treatment of local infection (6% to 35%) or delayed extrusion of the cement. In clean, selected cases, bone cement can be used as a tool for mastoid reconstruction when the canal wall must be removed due to extent of disease. Types of available cements, techniques for use, clinical ‘pearls’ and images of good and bad reconstructive outcomes will be presented.

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Mastoid reconstruction (R666)

ID: 666.3

The benefits and expectations using mastoid reconstruction and obliteration technique

Presenting Author: **Jona Kronenberg**

Jona Kronenberg

University of Tel-Aviv

Learning Objectives: Mastoid obliteration with posterior wall reconstruction techniques gained much popularity among the mastoid surgeon in recent years. The results published in the literature are promising ranging between 0–15% cholesteatoma recurrences. Because of its aggressivity and irreversibility, radical mastoidectomy for cholesteatoma was totally abandoned in some institutions. This presentation describes our attitude toward this surgical trend.

Methods: The experience of the author includes 114 patients operated since 2008. The follow-up ranged between 12 months and 8 years (mean of six year and 5 months). Sixty-nine primary procedures (i.e., no previous mastoidectomy) and 45 secondary procedures (more than one previous mastoidectomy) were performed. Autologous bone was used for posterior wall reconstruction and bone pate was used for mastoid obliteration. The results of cholesteatoma recurrences and the rate of dry ear were evaluated and compared in the two groups of patients.

Results: There were 18 cases of recurrent cholesteatoma in the total group (15.8%). Seven of them in the primary group (10.1%) and 11 in the secondary group (24.4%). Nine patients had a stubborn cholesteatoma, 4 patients of those were operated more than 3 times. Two patients finally underwent radical mastoidectomy. All cholesteatoma were located in the middle ear and no one in the obliterated mastoid. Dry ear with no need for taking precautions against water was achieved in 53 of the primary group of patients (76.8%) compared to 29 in the secondary group of patients (64.4%).

Conclusions: Reconstruction techniques of the posterior wall and obliteration of the mastoid had first appeared to be the “promised land” of a solution for mastoid cholesteatoma, and raised the hopes that radical mastoidectomy surgery could be abandoned. With more experience, however it emerged that this held true solely for primary surgery. The surgical outcomes for cases of secondary cholesteatoma were worse than those achieved in radical mastoidectomy. Thus, radical mastoidectomy is still indicated for stubborn cholesteatoma.

doi:10.1017/S002221511600236X

Mastoid reconstruction (R666)

ID: 666.4

Mastoidectomy reconstruction: titanium sheeting and middle temporal flap technique

Presenting Author: **Bruce Black**

Bruce Black

University of Queensland/Lady Cilento Children’s Hospital

The chronically infected open mastoidectomy cavity is a common problem in otologic surgery. Corrective surgical options include revision surgery, obliteration with flaps or

fillers, ablation (canal closure) or external canal wall (EAC) reconstruction. The latter is preferred, to facilitate reinspection for residual disease, if necessary.

Canal wall repairs require reconstruction of a stable and durable, precisely shaped and fitted support layer, healthy overlying skin and a vascular intermediate layer to nourish the skin and protect the support layer.

This presentation demonstrates the use of titanium sheeting in this role, in conjunction with the middle temporal flap, which has been the basis for optimal long term success.

The surgery employs six phases;

1. Transcanal flap creation and clearance of disease from the stapes and its surrounds.
2. Postaural incision and creation of the middle temporal flap.
3. Clearance of cavity disease, retaining skin flaps for the EAC repairs. Creation of zygomatic root and facial ridge retention grooves. Shaping and sizing the titanium sheeting, using an aluminium foil template.
5. Reconstruction of the hearing and canal wall components.
6. EAC packing and wound closure.

Titanium sheeting has proven a highly effective canal wall repair method with no complications in a series of 35 cases, but mesh was less effective and is not recommended. Second stage surgery is recommended when the cavity lining is fragile, and residual disease possible.

doi:10.1017/S0022215116002371

Mastoid reconstruction (R666)

ID: 666.5

Principles of mastoidectomy reconstruction

Presenting Author: **Bruce Black**

Bruce Black

*University of Queensland/Lady Cilento
Children's Hospital*

Introduction: Cholesteatoma surgery aims to eliminate disease, restore function, and avoid complications. Open cavity surgery is commonly complicated by ongoing problems that may result from failure to achieve one or several of these aims, e.g. poor disease clearance, failed epithelial migration, or ischemia-related infection.

The aim of wall reconstruction is to reverse these problems as far as is practicable. The essentials to achieve this are a well-fitted, durable, biocompatible wall support layer, healthy skin and a restored vascular supply.

Method: Recreating the support layer requires a suitably tensile and biocompatible material that can be readily shaped and curved, remaining durable in the long term. Where possible, full skin coverage is desirable to facilitate EAC healing. Long term stability requires a well-designed vascular supply to nourish the skin; the middle temporal flap has the best theoretical and demonstrable vasculature for this role.

Wall assembly by conventional tympanoplasty methods during reconstruction is difficult, due to space constraints. An alternative "front-to-back" skin-flap-support layer sequence is optimal, preceded by the appropriate drum/chain repair.

Outcomes: The results of previous techniques exhibited difficulties related to the design of each. The use of titanium sheeting appears to have overcome the problems of biocompatibility, shaping and stability. The middle temporal flap has succeeded in restoring vascular supply and canal skin health. Recreation of the EAC lumen dimensions to a more normal diameter without obstructing protrusions largely restores epithelial migration. Restoration of hearing depends on the middle ear pathology and Eustachian function, as in routine tympanoplasty. This pathology is severe in many of these cases.

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Tympanoplasty: How I do it (1) (V667)

ID: 667.1

Simple underlay myringoplasty

Presenting Author: **Yu Yuasa**

Yu Yuasa

Sendai Ear Surgicenter

Learning objectives: Understand the detail of the procedure of SUM and its advantages, including simplicity of technique, a high rate of closure of the perforation and very low incidence of complications.

Introduction: Simple underlay myringoplasty (SUM) has been widely performed over the last 26 years in Japan as a less invasive procedure of myringoplasty than conventional methods. SUM has been gradually recognized in the world since the detail of the procedure had been introduced into instruction courses in AAO-HNS for the last 9 years.

Methods: A transcanal approach is applied. No skin incision is necessary except to harvest subcutaneous connective tissue for the graft from the retro-auricular region. After the topical anesthesia of the tympanic membrane, the perforation edge is removed for both the debridement and the vascularization to the graft. The pressed graft is inserted into the tympanic cavity through the perforation, and then the graft is elevated to touch the perforation edge. The graft is fixed to the tympanic membrane with a little fibrin glue. Packing is not necessary either in the tympanic cavity or in the external auditory canal. The surgery is performed under local anesthesia except in cases with children because thirty minutes is sufficient to accomplish the surgery for one ear by this method. For the persistent perforation after this method, re-closure is attempted in the outpatient clinic by the same procedure using frozen autologous tissue which has been harvested in the initial surgery.

Results: The rate of initial closure was 478/621 (77.0%). Overall success rate after the re-closure was 595/621 (95.8%). There was no significant difference of the success

rate among any size of the perforation or any frequency of otorrhea. There was no serious complication such as sensorineural hearing loss.

Conclusions: SUM is indicated for the case of chronic otitis media with central perforation as a minimally invasive surgery without serious complications.

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Extended Indication of CI (R671)

ID: 671.1

SSD – indication and results of cochlear implantation in children

Presenting Author: **Susan Arndt**

Susan Arndt, Frederike Hassepas, Rainer Beck, Antje Aschendorff, Roland Laszig

Medical Center – University of Freiburg

Learning Objectives: CI: favorable treatment option for acquired SSD children, as it is the only opportunity to restore binaural hearing abilities. Outcomes of auditory habilitation in congenital SSD children with CI vary significantly.

SSD in children can have a negative impact on the normal development of the auditory cortex in the young child. Furthermore, the ability to develop and use binaural hearing and its subsequent hearing abilities in daily life can be affected. Especially when entering full-time education, children with SSD display behavioural problems and academic weaknesses. The impairment of the auditory function may result in fatigue due to increased listening effort. It can also impinge on psychosocial factors. Particularly when the language reaches the deaf ear in additional background noise problems become evident. Furthermore, the localization capacity is significantly limited, since bilateral hearing is mandatory for spatial hearing. Patients with SSD can derive benefit from conventional CROS or Bi-CROS systems (contralateral routing of signal), bone anchored hearing systems or from a cochlear implant (CI). The indications and results of the treatment are presented.

Considering our experience, a thorough evaluation and extensive counselling regarding the treatment options is necessary. Irrespective of age, MRI of the cranium at pre-examination for CI surgery is essential to exclude aplasia or hypoplasia of the hearing nerve. CI as a treatment option for adult patients with acquired SSD is now widely accepted since it can achieve binaural hearing rehabilitation. In contrast, children suffering from SSD have been provided with a CI only in rare cases. While the decision for CI surgery in children with acquired SSD is quite simple due to the good results in adults, CI in children with congenital SSD has been discussed controversially.

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Extended Indication of CI (R671)

ID: 671.2

Extended indications of cochlear implantation

Presenting Author: **Paul van de Heyning**

Paul van de Heyning¹, Gunesh Rajan², Susan Arndt³, Piotr Skarzynski⁴

¹*Antwerp University Hospital University of Antwerp*, ²*University of Western Australia Perth Australia*, ³*Universitätsklinikum Freiburg Germany*, ⁴*Institute of Physiology and Pathology of Hearing Warsaw Medical University Poland*

Learning Objectives: The primary goal of the panel is to focus on extending indications for cochlear implantation in electric acoustic stimulation in children and postlingual adults, single sided and asymmetric hearing loss adults and children and to discuss cognitive capabilities in older cochlear implant candidates.

The last decade cochlear implantation was not only indicated for bilateral profoundly deaf patients, but the indications expanded to other groups of patients with an auditory handicap. Advances in surgical technique, insights into pathophysiology, viewpoints on outcome measures and technological innovations allowed clinical trials to demonstrate benefits for patients with substantial residual hearing. The primary goal of the panel is to focus on these groups of patients. An introductory lecture will be followed by a panel discussion specifically on the following topics:

Electric acoustic stimulation and structure preserving cochlear implant surgery in children introduced by Gunesh Rajan.

Partial Deafness Treatment in adults and what are the limits of residual hearing introduced by Piotr Skarzynski.

Cochlear Implantation in Single sided deafness and asymmetric hearing loss introduced by Susan Arndt.

A last topic which gained attention concerns Cochlear Implantation in elderly and the relation with cognitive functioning introduced by Paul Van de Heyning.

An emerging issue is the viewpoint of the care providers and insurers asking for evidence at the level of participation. Therefore outcome measures have to include also quality of life measures.

The panel discussion will lead towards a consensus on the different outcome aspects consisting of:

- Auditory test e.g. speech in noise.
- Hearing impairment quality of life e.g. SSQ.
- Directional hearing to ascertain central auditory integration.
- Hours of use per day as a measure of experienced benefit.
- Influence on participation (WHO handicap approach).
- Clinical test for cognitive assessment of older in cochlear implant candidates.

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doi:10.1017/S0022215116002425

Free Papers (F672)**ID: 672.1****Intratympanic therapy for refractory tinnitus: up to date evidence for clinical practice**Deep Sarode¹, Rachael Kirkbride¹, Danish A Bari¹, Rona Russell¹, Ophir Ilan², M Iqbal Syed¹¹The Royal Infirmary of Edinburgh, Scotland,²University Health Network, Canada

Background: Intratympanic therapy for tinnitus, first described in 1940, is now re-emerging as a treatment option, particularly in those who fail conventional treatment and find tinnitus disabling.

Objective: To critically evaluate the current evidence on the efficacy of intratympanic therapies on tinnitus using the tinnitus handicap inventory, tinnitus loudness scale, tinnitus awareness score, tinnitus loudness matching, minimum masking level and visual analogue scales.

Search strategy: An electronic literature search was performed on AMED, EMBASE, HMIC, MEDLINE, PsycINFO, BNI, CINAHL, HEALTH BUSINESS ELITE, CENTRAL and Cochrane Ear, Nose and Throat disorders group trials register using various MeSH. The search was restricted to English-language and human subjects. The last date of search was February 2016.

Selection criteria: Randomised controlled trials [RCT's] of intratympanic therapies [steroids, AM-101, AM-111, gentamicin and latanoprost] versus a placebo or alternate therapy.

Results: Our search identified 17 relevant RCT's, of which 15 RCT's [1144 patients] comparing intratympanic steroids, AM-101, AM-111, gentamicin or latanoprost to another form of treatment or placebo were analysed.

Conclusions: On the basis of 3 RCT's (n = 357) for intratympanic AM-101 there is limited evidence to support its effectiveness, and based on 8 RCT's (n = 425) for intratympanic steroids we found contradictory evidence of its benefit in changing the audiometric quality and improving the impact on tinnitus on the patient. Results from ongoing multi-centre RCT's on AM-101 and intratympanic steroids will help to hopefully clarify their efficacy but there is a need for further targeted RCT's to determine which subgroups of patients are likely to benefit most from intratympanic therapy of steroids or AM-101. There is no evidence to support the use of other forms of intratympanic therapies including AM-111, gentamicin and latanoprost for refractory tinnitus.

Free Papers (F672)**ID: 672.2****Assessment of labyrinthine function in patients with chronic middle ear disease using the VHIT and VEMP test**Presenting Author: **Jaswinder Sandhu**Jaswinder Sandhu¹, Jaydip Ray¹, Matthew Yung²¹Sheffield Teaching Hospitals, ²The Ipswich Hospital**Learning Objectives:**

1. A proportion of patients with chronic middle ear pathology develop a vestibular deficit.
2. Standard vestibular testing is often not appropriate for this cohort as middle ear dysfunction precludes assessment.
3. VHIT and BC-VEMPs bypass the middle ear and such can be used to determine underlying function relating to all five aspects of the vestibular system.

Introduction: It is well established that middle ear diseases such as cholesteatoma and otosclerosis can impair hearing as a result of damage to the ossicular chain or the cochlear itself. Given the underlying pathophysiology it is entirely plausible that the disease processes can also impair labyrinthine function. To date it has been difficult to assess the impact on the vestibular system as the traditional test battery cannot be used, however the recent advent of new tests which bypass the middle ear have made this a new exciting possibility.

Methods: A total of 28 patients awaiting middle ear surgery were recruited from two tertiary otology centres. All patients underwent Video Head Impulse Testing (VHIT) of all three semicircular canals on the affected and non-affected sides. Bone Conduction Vestibular Evoked Myogenic Potentials (BC-VEMPs) were also conducted to assess bilateral otolith function.

Results: The vestibular testing results of the 28 patients will be presented. The results of the diseased side and the contralateral side are separated considered and a correlation will be made with the cochlear function.

Conclusions: In this study we have shown how VHIT and VEMP testing can be successfully be used to assess the labyrinthine function of patients with middle ear disease. The tests are non-invasive and are quick to perform opening the possibility of being done routinely in this cohort. Furthermore these patients can be assessed post-operatively and the results compared to baseline to check for any iatrogenic or disease specific vestibular dysfunction.

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doi:10.1017/S0022215116005983

Free Papers (F672)**ID: 672.3****Analysis of gait and posture control in peripheral vestibular disorder utilizing 3D motion capture system**Presenting Author: **Toru Miwa**Toru Miwa, Ryosei Minoda
*Kumamoto University**Learning Objectives:*

Introduction: Electronic walkway and video-based gait analysis provide comparable temporospatial gait information in healthy and peripheral vestibular disorder (PVD) subjects. In this study, we investigated the motion of body parts to establish the quantitative evaluation methods for the gait and posture in PVD patients.

Design: Data were acquired simultaneously by a walkway and an eight-camera motion capture system (Locus 3DMA-8000, Anima Co.) in 8 healthy subjects (Control) (age 24 ± 2.5 yrs) and 4 people with unilateral Canal Paresis (CP) in Caloric test (20°C , 5 ml, 20sec) (Superior vestibular dysfunction: SVN group) (age 70 ± 5.9 yrs), 6 people with unilateral loss of response in vestibular-evoked myogenic potential (VEMP) (Inferior vestibular dysfunction: IVN group) (age 37 ± 1.3 yrs) and 5 people with unilateral CP and loss of response in VEMP (SVN & IVN group) (age 61 ± 8.1 yrs). Each group demonstrated free walk and upright stance posture for 30 secs in their eyes' open or closed, with reflective markers attached to their skin. Movement of each marker, gait velocity, stride time, stride length, step length, percent single support, and percent total support were compared among four groups.

Results: Movement of markers which subjects closed their eye in upright stance posture and free walk was significantly larger than that in open their eyes in "Control, SVN group and SVN & IVN group" and "Control and IVN group", respectively. SVN group walked unsteadily the most among all groups in their eyes' open and closed. Gait speed and stride length were significantly decreased in PVD groups.

Conclusions: We have demonstrated the analysis of gait and posture control in PVD utilizing 3D motion capture system. Quantitative assessment in motion in PVD is necessary for the development of vestibular rehabilitation. We considered that 3D motion capture has the potential to become new methods of the evaluation for gait and postural control in vestibular disorder.

ID: IP102**Current trends of cholesteatoma surgery in Japan: Results from the Japan Otological Society Registry using 2015 JOS Staging and Classification System**Presenting Author: **Manabu Komori**Manabu Komori¹, Tetsuya Tono², Masafumi Sakagami³, Hiromi Kojima⁴, Naohito Hato⁵, Yutaka Yamamoto⁴, Keiji Matsuda², Yuka Morita⁶, Sho Hashimoto⁷¹National Center for Child Health and Development, ²Miyazaki University, ³Hyogo College Of Medicine, ⁴Jikei University School of Medicine, ⁵Ehime University, ⁶Niigata University, ⁷National Sendai Medical Center*Learning Objectives:*

The committee on Nomenclature of the Japan Otological Society (JOS) was appointed in 2004 to create a cholesteatoma staging system widely applicable in Japan and as simple as possible to use in a clinical practice. After the initial proposal of the principal staging system for attic cholesteatoma in 2008, we proposed a 2010 version of the staging system for two main types of acquired cholesteatoma; pars flaccida type and pars tensa type. Since then, this staging system has been widely used in Japan, allowing for more meaningful communication between outcome studies based on surgical methods used for a respective type and stage of cholesteatoma.

A nationwide survey was conducted by the Committee of JOS in order to promote the use of this system among JOS members and to capture the prevalence of cholesteatoma types and stages in Japan in 2015. The operative methods employed in each case were also included to reveal the current trends of cholesteatoma surgery in Japan. Medical information of the patients were anonymized and registered through the JOS website voluntarily between 1 January and 29 February 2016.

As of 2016/02/27, 1480 cases from 59 hospitals have been registered. 99.8% underwent general anesthesia as to local anesthesia 0.2%. Transcanal, retroauricular, and endaural approach was carried out in 8.0%, 88.5%, and 3.5% of the cases respectively. In terms of equipment, microscope alone was used in 74.0%, as to endoscope alone 6.7%. Combination of both microscope and endoscope was used in 19.3%. As to surgical procedure, canal wall down tympanoplasty without canal wall reconstruction, canal wall down tympanoplasty with canal wall reconstruction, canal wall up tympanoplasty, and tympanoplasty without mastoidectomy was pursued in 16.6%, 33.2%, 28.6% and 21.6% respectively. Based on the final registration data, we will propose and analyze the surgical procedure of each stage of cholesteatoma.

doi:10.1017/S0022215116002450

Free Papers (F672)**ID: 672.5****Rehabilitation of unilateral hearing loss in children**Presenting Author: **Rainer Beck**Rainer Beck, Antje Aschendorff, Roland Laszig,
Susan Arndt*University Freiburg Medical Center*

Learning Objectives: - Understanding the importance of binaural hearing – Balancing risk and chances of hearing aids/ other supportive technology vs. hearing prosthesis - Involvement of the family and non-medical professions for optimal results

Introduction: Unilateral hearing impairment in children may be the result of several different etiologies including cochlear nerve aplasia, loss of cochlear function and dysplasia of the middle ear or the outer ear canal. All children usually exhibit regular speech development patterns and show unremarkable clinical symptoms or none at all during early development. Nevertheless, the question of hearing rehabilitation needs to be answered in the face of the clinical complex.

Methods: Different strategies of hearing rehabilitation ranging from cochlear implant, conventional hearing aids, implantable hearing aids and supportive measures like FM-transceivers or CROS will be discussed case by case.

Results: As the major factor in child development is signal-to-noise-ratio (SNR), emphasis must be put on true binaural rehabilitation. Addressability out of the direction of the hearing impairment is a secondary problem and has to be weighed carefully against a decrease of SNR resulting from unwanted transmission of noise. This may be one of the reasons why children usually don't go for CROS-systems in the first place. Trans- and epidermal BAHs as well as active implants provide solutions with diverse invasivity and handling – all surpassing a soft-band approach. CI may yield benefits for children with sensorineural hearing loss. Low SNR can be ameliorated in defined circumstances (i.e. educational) by using FM-transceivers.

Conclusions: Binaural rehabilitation is preferred to unilateral or pseudo-binaural hearing - mostly as a consequence of the increase in SNR. Family and the surrounding infrastructure have to be counseled extensively, as the benefit of the hearing system may not be apparent in a young child.

doi:10.1017/S0022215116002462

Free Papers (F672)**ID: 672.6****Imaging of children with unilateral sensorineural hearing loss**Presenting Author: **Eveline Ban Beeck Calkoen**
Eveline Ban Beeck Calkoen, Erik Hensen*VU medical center*

Learning Objectives: CT and MR imaging are complementary imaging options. Simultaneous dual modality imaging has no additional diagnostic value over sequential diagnostics. We therefore propose a stepwise radiological workup.

Introduction: To evaluate the clinically relevant abnormalities as visualized on CT and MR imaging in children with unilateral sensorineural hearing loss (USNHL), and the association with age and severity of hearing loss.

Methods: From January 2006 until January 2016, a total of 102 children diagnosed with USNHL were included in this study. They underwent CT and/or MR imaging for the evaluation of the etiology of their hearing loss.

Results: Causative abnormalities were identified in 49% of the children with USNHL. Overall, deformities of the labyrinth were the most prevalent abnormality (30%), predominantly identified by CT (20%). MR imaging outperformed CT regarding abnormalities of the cochlear nerve (7 vs. 2 %) and the brain (7 vs. 0 %). In cases where both imaging modalities were performed, concordant CT and MR imaging findings were found in 75 %. No differences in the number and type of abnormalities were found in the different grades of hearing loss or age categories.

Conclusion: Imaging is essential in the etiologic diagnosis of USNHL because of the high prevalence of causative abnormalities that can be identified, irrespective of the patients' age or degree of hearing loss.

doi:10.1017/S0022215116002474

Free Papers (F672)**ID: 672.7****Combined behavioural and soundball therapy outcomes in the management of hyperacusis in children**Presenting Author: **Ida Amir**Ida Amir¹, Dawn Lamerton², Mary-Louise Montague²
¹NHS Tayside, ²NHS Lothian

Learning Objectives: To understand the factors associated with hyperacusis in children and to identify current management strategies and their outcomes.

Introduction: The current evidence on the benefit from counselling and sound therapy approaches in the management of children with hyperacusis remains poor.

Methods: Retrospective cohort study conducted by case note review over a 5 year period (March 2010-March 2015) in a Paediatric ENT/Audiology service.

Results: 412 children were referred with hyperacusis during the study period. All children were assessed and managed within a dedicated Paediatric hyperacusis clinic by a senior Paediatric Audiologist. Median age at referral was 7 years. 76% were boys. Hearing was normal in the majority of children (n = 407, 98.8%). Of the 5 children with hearing

loss, 4 had mild CDHL secondary to OME and had bilateral grommet insertion for the condition; 1 had a profound unilateral SNHL. On average, children were sensitive to 6 identifiable sound stimuli at presentation (range 1–20). 82% complained of sensitivity to noise from household appliances. 60% had a background history of autistic spectrum disorder (ASD), followed by attention deficit hyperactivity disorder (ADHD) (8%) and other neurodevelopmental problems (3%). In 91%, management comprised behavioural therapy combined with provision of a sound-ball (Puretone relaxation therapy ball) for home use. Of these, 25% did not attend their first review. A further 25% were considered to have sufficient symptom improvement to permit discharge after a single clinic review. Only 2% of children required more than 3 review sessions before achieving resolution of symptoms. Only 1% were referred back to the service.

Conclusions: In our series hyperacusis is more common in boys and in children with ASD. A combined treatment approach with behavioural and a sound-ball therapy has a high success rate.

doi:10.1017/S0022215116002486

Update in ossicular reconstruction: Ossicular Replacement Prostheses (ORP), bone cement and new assembly techniques (N673)

ID: 673.1

Adhesive Otitis Media and Ossiculoplasty

Presenting Author: **Kadir Serkan Orhan**

Kadir Serkan Orhan
Istanbul University

Learning Objectives: To present how to do glass ionomer in ossicular reconstruction.

Objective: Eustachian tube dysfunction may deteriorate physiology of middle ear pressure and ventilation that result in ear drum retraction. Cholesteatoma can develop from retraction pocket that may result in ossicular erosion. On the other hand, Ossicular erosion may result from prolonged contact between tympanic membrane and ossicular chain without active infection and cholesteatoma.

Long process of the incus, lenticular process and/or stapes superstructure can be effected and result in complete or partial ossicular discontinuity. In lenticular process erosion, bone cement can be used for reconstruction. Incus interposition, malleus-stapes bone cement or ossicular prosthesis are the reconstruction options in case of incus long process erosion.

Materials and Methods: Thirty patients whose underwent ossicular chain reconstruction with bone cement included in the study. Glass ionomer was used for reconstruction by otomicroscope or endoscope. We compared preoperative and postoperative audiogram findings.

Results: We found better result of ossicular reconstruction with glass ionomer in lenticular process erosion. Malleus-

stapes bone cement application or incus interposition can be performed in case of incus long process erosion.

Conclusion: Glass ionomer can be safely used for ossicular reconstruction in patient with adhesive otitis media that cause ossicular discontinuity.

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Update in ossicular reconstruction: Ossicular Replacement Prostheses (ORP), bone cement and new assembly techniques (N673)

ID: 673.2

Surgical Anatomy-Endoscopic Approach

Presenting Author: **Ali Özdek**

Ali Özdek
private practice

Learning Objectives: Endoscopic ear surgery gained popularity in the last 10 years. Introduction of endoscopes in otologic surgery has several advantages. It allows fully transcanal surgery in many type of ear diseases. It allows better visualization of hidden areas in middle ear. It also helps better understanding of surgical anatomy of middle ear during education period. Although 3-dimensional anatomy is same in every type of surgery, endoscopic ear surgery needs being familiar to endoscopic view of middle ear. In this presentation endoscopic surgical anatomy will be discussed in details and endoscopic application of several ossiculoplasty techniques will be presented.

Endoscopic ear surgery gained popularity in the last 10 years. Introduction of endoscopes in otologic surgery has several advantages. It allows fully transcanal surgery in many type of ear diseases. It allows better visualization of hidden areas in middle ear. It also helps better understanding of surgical anatomy of middle ear during education period. Although 3-dimensional anatomy is same in every type of surgery, endoscopic ear surgery needs being familiar to endoscopic view of middle ear. In this presentation endoscopic surgical anatomy will be discussed in details and endoscopic application of several ossiculoplasty techniques will be presented.

doi:10.1017/S0022215116002504

Update in ossicular reconstruction: Ossicular Replacement Prostheses (ORP), bone cement and new assembly techniques (N673)

ID: 673.3

Endoscopic Ear Surgery in Different Otologic Procedures

Presenting Author: **Yüksel Olgun**

Enis Alpin Güneri, Yüksel Olgun, Aslı Çakır,
Mehmet Durmuşoğlu, Pınar Tunçbilek

*Dokuz Eylül University School of Medicine
Department of Otorhinolaryngology*

Learning Objectives:

Introduction: Despite the routine use of endoscopes for various operations in the fields of rhinology and later laryngology, endoscopic ear surgery (EES) has gained widespread popularity only over the last ten years. Although EES has some disadvantages such as the inherent feature of being a one handed technique and necessity of frequent cleaning of the instruments it also offers some major advantages like direct illumination and wide field view through ear canal.

In this study we aimed to present our experience in EES procedures.

Materials: Charts of 33 patients who underwent various EES in our department were retrospectively reviewed. Patient demographic characteristics, surgery types, hearing results and complications were evaluated

Results: Mean follow up time was 8,2 (6–24) months. Endoscopic stapedotomy was performed in 13, endoscopic tympanoplasty and/or ossiculoplasty was performed in 9 patients. Hydroxyapatite bone cement was used to rebridge the defects between incus and stapes in 4 patients and a PORP was used for ossiculoplasty in one case. Inside out mastoidectomy with manubriostapediopexy using hydroxyapatite bone cement was performed in one case. In 10 patients endoscope assisted cochlear implantation was performed due to the difficult access to the round window under direct microscopic vision. Mean pre and postoperative air bone gaps (ABG) for stapedotomy operations were $29,1 \pm 9,1$ and $9,4 \pm 6,8$ dB respectively. Mean pre and post operative ABG for endoscopic tympanoplasty and/or ossiculoplasty operations $27,8 \pm 10,7$ and $11,3 \pm 7,6$ dB. No graft perforation or deterioration in hearing thresholds were seen in any of the cases.

Conclusion: Our results show that EES can safely be performed in the majority of the middle ear procedures with similar or better outcomes to conventional microscopic approach.

doi:10.1017/S0022215116002516

Update in ossicular reconstruction: Ossicular Replacement Prostheses (ORP), bone cement and new assembly techniques (N673)

ID: 673.4

Manubriostapedioplasty

Presenting Author: **Levent Sennaroglu**

Levent Sennaroglu

Hacettepe University School of Medicine

Learning Objectives: The author developed a technique called manubrio-stapedioplasty using glass ionomer cement for malleus and incus fixation due to tympanosclerosis and congenital fixation. Method: this method can be used in situations where malleus and incus are fixed but stapes is mobile. Head of the malleus and incus are removed and manubrium is connected to the head of the stapes with glass ionomer cement. In a group of five

patients with conductive hearing loss mean pre-operative air-bone gap of 42.75 dB, and mean post-operative air-bone gap was 5.25 dB. This method can also be used in situations with fixation of all ossicles. Here the stapes is mobilized after removing of all tympanosclerotic plaques but the postoperative hearing results are not as good as situations where stapes is mobile. During this presentation videos of different patients will be provided showing the technique.

The author developed a technique called manubrio-stapedioplasty using glass ionomer cement for malleus and incus fixation due to tympanosclerosis and congenital fixation.

Method: this method can be used in situations where malleus and incus are fixed but stapes is mobile. Head of the malleus and incus are removed and manubrium is connected to the head of the stapes with glass ionomer cement.

In a group of five patients with conductive hearing loss mean pre-operative air-bone gap of 42.75 dB, and mean post-operative air-bone gap was 5.25 dB.

This method can also be used in situations with fixation of all ossicles. Here the stapes is mobilized after removing of all tympanosclerotic plaques but the postoperative hearing results are not as good as situations where stapes is mobile.

During this presentation videos of different patients will be provided showing the technique.

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Endoscopic Ear Surgery 1 (R674)

ID: 674.1

Transitioning to Endoscopic Ear Surgery and Training the Next Generation

Presenting Author: **Manuela Fina**

Manuela Fina

Assistant Professor, University of Minnesota

Objective: The objective of this presentation is to illustrate the learning curve of a surgeon who transitioned to Endoscopic Ear Surgery and the surgeon's creation of a teaching program in a U.S. residency program.

Methods: A 5 minutes educational video with 3 power point slides illustrating learning curve, tips, take home points and conclusions.

Results: The surgeon will illustrate the initial difficulties and challenges that can delay the transition and adoption of the primary endoscopic approach, how many cases does it take to fully transition to Endoscopic Ear Surgery, the modifications in OR set up and surgeon's position with time and skill acquisition, utilization of endoscopy in the office setting for chart documentation and patients' education.

The surgeon will present a personal experience in teaching the residents a new surgical technique and creating a structured educational program with goals and skills to achieve according to resident's level of training.

To evaluate the surgeon's initial results in Endoscopic Ear Surgery two cohort of consecutive patients who underwent tympanoplasty with microscopic approach and endoscopic approach were evaluated for closure rate and duration of surgery. All surgeries were performed with residents' participation. The comparison shows that in the surgeon's personal experience the endoscopic approach provided similar rate of closure and duration of surgery than the microscopic approach.

Conclusions: Transitioning to Endoscopic Ear Surgery requires an initial investment of time in attending training courses and observing live surgery performed by experienced surgeons. The surgeon's learning curve is steeper than for a resident that has familiarity with endoscopic sinus surgery. A comparison of 30 consecutive microscopic and 30 consecutive endoscopic tympanoplasty showed no difference in duration of surgery and closure rate, with a trend indicating that duration of surgery may shorten with surgeon's experience.

doi:10.1017/S002221511600253X

Endoscopic Ear Surgery 1 (R674)

ID: 674.2

The History and Development of Endoscopic Ear Surgery (EES)

Presenting Author: **Jean-Marc Thomassin**

Jean-Marc Thomassin

Hopital de la Conception

Binocular otomicroscope in the 1950s, became a revolutionary machine. Yet, it gave a global vision of all cavities of the middle ear except for the retrotympanic region. JAKO (1966) and ZINI (1967) [1] conceived the use of stainless steel micro-mirrors to investigate the sinus tympani area. This system, reflecting the light of the operating microscope, was useful in experienced hands but was not reliable for the eradication of epidermal lesions at this site.

In 1966, Harrold HOPKINS [2] developed the Hopkins rod endoscope with KARL STORZ team. KARL STORZ, manufactured in Tuttlingen, creates a cold light source, tube endoscopes and loupes. The technical quality of the lenses, lit from cold light sources, allowed very simple rapid and precise otoendoscopic examination of the tympanic membrane.

Having arrived at this stage of investigation of the eardrum, did it remain to take a decisive step? The peroperative use the system to visualise the middle cavities.

MER (1967) [3] employed a flexible fiberscope to examine the ears of cadavers as well as ears of living animals through an iatrogenic myringotomy.

MARQUET (1975) [4] introduced an endoscope 1.7 mm of diameter through a tympanic perforation to observe the tympanic cavity. He already foresaw the great possibilities of the technique and wrote: "The retrotympanic regions, such as the sinus tympani, can be observed in a precise manner".

NOMURA (1982)[5] developed a new system of rigid endoscopy used an angled rigid endoscope and called it the Needle Ootoscope.

KANSAKI (1983)[6] was the first to anticipate the importance of endoscopy in postoperative surveillance of the posterior cavities of the middle ear in patients operated for cholesteatoma by a closed technique. Under local anaesthesia, he introduced an endoscope via a retro auricular incision and reported a series of 26 cases.

WULLSTEIN (1984) had a micrometric system manufactured by KARL STORZ company which call ototympanoscope. Using two endoscopes and under a visual control, this allowed the passage through the perforation of an endoscope 2.7 mm of diameter with 30° and 70° angles of vision. Nevertheless, the disadvantage of this endoscope was that both hands of the surgeon were engaged, thus preventing any treatment procedure. Ultimately, it found a little general use.

In 1984, we began using a 2.7 mm optical system with 70° angle as used for Wullstein's ototympanoscope to practice peroperative monitoring of the posterior recesses of the tympanic cavity.

In 1985, with special instruments, we performed EES of the sinus tympani area in cases of cholesteatoma surgery.

From 1988, we developed video-monitored endoscopic guided surgery for the retrotympanium and anterior epitympanium by coupling the endoscope to a micro-camera [7] [8] [9].

Endoscopic Ear Surgery in the 1990's

In 1990 [10], we carried out a second monitoring stage for cholesteatoma operated by tympanoplasty using a closed technique with a minimal cutaneous approach in the retroauricular region. In over 85%, the surgical procedure was very often combined with survey of the tympanic cavity more especially of the retrotympanium via a limited transmeatal route.

POE and BOTTRIL (1992) [11] used transtympanic endoscopy to diagnose perilymphatic fistulae and to identify other middle ear pathologies.

In 1993, MC KENNAN [12] used endoscope in second look surgery. He called this procedure: "Transcutaneous Mastoidoscopy".

The same year, we published in Laryngoscope Endoscopic-guided Otosurgery [13] in the prevention of residual cholesteatoma. Between 1985 and 1991, 36 cases of cholesteatoma in closed technique were operated-on with a systematic control by otoendoscopy (70° angle). The residual rate was 5.5%.

Another early adopter of EES: TARABICHI, in 1997, published a series of the endoscopic management of cholesteatoma [14]. 36 cases underwent a transcanal endoscopic tympanotomy and extended atticotomy for removal of cholesteatoma.

Currently, EL GUINDY,(1992) in Egypt, investigated the utility of endoscope to perform a myringoplasty with fat graft material [15].

We started in 1993 to operate with transcanal approach for myringoplasty using abdominal fat graft with a laser fiber. The great majority of our cases were operated-on under local anaesthesia [16].

Endoscopic Ear Surgery in the 2000's

During this decade, more investigators and Otologic surgeons explored the potential benefits of endoscopic techniques in middle ear cavities and in CPA angle.

An international working group on Endoscopic Ear Surgery (IWGEES) with many surgeons was developed: BADR EL

DINE, TARABICHI, PRESUTTI, MARCHIONI, AYACHE, NOGUEIRA and KAKEHATA.

From 1996 to 1998 in Marseilles, we lectured two courses on Endoscopic Ear Surgery. Today, in the world, many congresses are organized.

One of the important benefits of an endoscope compared to the microscope is the wide field of view during ear surgery. Altogether there are numerous applications in the surgery of the middle ear.

The routine, which uses optical systems for all Tympanoplasties, familiarises the surgeon with the endoscopic anatomy and provides a training for him.

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Endoscopic Ear Surgery 1 (R674)

ID: 674.3

Endoscopic exclusive transcanal approach to the tympanic cavity cholesteatoma in pediatric patients: our experience

Presenting Author: **Matilde Porcaro**

Daniele Marchioni, Davide Soloperto, Matilde Porcaro
University Hospital of Verona

Learning Objectives: The aim of the present study is to describe our experience in the management of tympanic cavity cholesteatoma in pediatric patients, treated with endoscopic exclusive transcanal approach.

Objectives: Describe our experience in the management of tympanic cavity cholesteatoma in pediatric patients treated with endoscopic exclusive transcanal approach.

Methods: Review of surgical cases performed between January 2007 and December 2013. Patients presenting with cholesteatoma of the tympanic cavity with no mastoid involvement were included in the first group and underwent an exclusive transcanal endoscopic approach (TEA). Patients with mastoid extension of the pathology were included in the control group and underwent a canal wall up microscopic technique (CWU).

Results: 59 ears of 54 patients were reviewed. Median age was 9.6 years (range 4–16 years). 31 cholesteatomas underwent a TEA approach, while 28 underwent a CWU approach, based on inclusion criteria. No differences from congenital vs acquired form was made. The ossicular chain was preserved in 26.6% of patients (16 ears): 42% of patients (13 ears) undergoing a TEA and 10% of patients undergoing a CWU approach (3 ears) ($P = 0.006$). Second look surgery was executed in 41.6% of patients (25 ears). In partial ossicular prosthesis reconstructions, the mean preoperative pure-tone average (PTA) was 29.4 dB, while the mean postoperative PTA was 27.1 dB, with a mean increase of 2.3 dB.

In total ossicular prosthesis reconstructions, the mean preoperative PTA was 47.8 dB, while the mean postoperative PTA was 26.5 dB, with a mean increase of 21.3 dB. Recurrence rate was 12.9% (4 ears) for the TEA group and 17.2% (5 ears) for the CWU approach. Residual disease was present in 26.6%: 19.3% (6 ears) for the TEA and 34.4% (10 ears) for the CWU approach. The mean follow up was 36 months (range 8–88). Kaplan-Meier analysis at 36 months showed a lower recurrence risk for the TEA compared with the CWU approach, but this data was not statistically significant ($P = 0.58$).

Conclusion: TEA represents a feasible, minimally invasive and conservative technique for the management of pediatric middle ear cholesteatoma.

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

ID: 675.1

The effects of smoking on Eustachian tube function and chronic ear surgery

Presenting Author: **David Kaylie**

David Kaylie
Duke University Medical Center

Learning Objectives: After this presentation, the attendee will understand the effects of smoking on Eustachian tube dysfunction and its impact on chronic ear disease. They will understand how smoking increases the severity of cholesteatoma and how smoking leads to more extensive surgery.

Smoking is a known to be a risk factor for cardiac disease, chronic obstructive lung disease, head and neck cancer and lung cancer. Cessation of smoking will reduce a person's risk for cardiac and lung disease over time, but will not reduce it back to the risk level of life long non-smokers. Cigarette smoking is also known to worsen outcomes in plastic surgery and sinus surgery. Smoking has multiple deleterious effects on ciliary function, some of which are reversible and some of which are permanent. We will examine, in depth, the effects of cigarette smoking on the severity of chronic ear disease and its effects on surgical outcomes for chronic ear disease.

This talk will describe the effects of cigarette smoking on ciliary function and Eustachian tube function. We will then discuss a large series of patients who underwent surgery for tympanic membrane perforation with or without cholesteatoma and analyze their surgical outcomes with regards to their smoking status. We will show how short term and long-term abstinence from cigarettes smoking effects their surgical outcomes compared to life long non-smokers.

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.

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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.

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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.

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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.

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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

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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.

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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 questionnaires 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.

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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.

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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.

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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, Otolologists 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.

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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.

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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 Rösli²,
Alexander M Huber², Ivo Dobrev²¹Zurich University hospital, ²University of Zurich, University Hospital Zurich, Department of Otorhinolaryngology, Head and Neck Surgery, Frauenklinikstr. 24, CH- 8091 Zurich, 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.

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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.

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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

¹Apollo International Hospitals Group,

²Ashadeep 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.

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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.

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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.

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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.

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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.

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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.

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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.

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Ventilation and Gas exchange in middle ear (R716)

ID: 716.2

The role of the mastoid in middle ear pressure regulation

Presenting Author: **Michael Gaihede**

Michael Gaihede
Aalborg University Hospital

Learning Objectives: Recent studies on the mastoid structure and function has pointed to an important role in middle ear physiology.

The normal function of the middle ear depends on regulation of its pressure relative to ambient pressure, and traditionally gas exchange between the middle ear mucosa and gas pocket has been focused on together with the function of the Eustachian tube. However, recent studies have also pointed to a role of the mastoid mucosa, where volumetric changes effected by changes in the blood vessels congestion may influence the pressure.

Physiological experiments have revealed two distinct patterns for pressure changes in the middle ear, where stepwise fast pressure equilibrations towards ambient pressure represent Eustachian tube openings, and where gradual slow pressure changes in both negative and positive directions represent other mechanisms. The congestion of the mucosa is likely to reflect these gradual changes, and loose connective tissue with abundant blood vessels favors such function together with the high surface area-to-volume ratio of the mastoid.

Recently micro-CT-scanning of temporal bones have revealed a high number of retroauricular microchannels, which represents a rich blood supply to the mastoid, as well as they have shown higher surface areas than previous CT studies. These observations point to a specific function of the mastoid structure. In addition, retroauricular injection of adrenaline has demonstrated a decrease the middle ear pressure, which can be explained by a direct drug transfer to the mastoid via the microchannels, and subsequently a vasoconstriction and shrinkage of the mucosa.

The mastoid mucosa has no cilia and goblet cells resulting in a relative susceptibility to infection in comparison with the tympanum. Repeated or chronic infections often lead to fibrosis, which may hamper the mucosa function. If the overall pressure regulation is represented by the complimentary actions of both the Eustachian tube and the mastoid mucosa, then an impaired function of both factors should be considered in the formation of middle ear underpressure.

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Ventilation and Gas exchange in middle ear (R716)

ID: 716.3

A Formal Description of Middle Ear Pressure-Regulation

Presenting Author: **William Doyle**

William Doyle

University of Pittsburgh

Introduction: Middle ear (ME) pressure-regulation (MEPR) is a homeostatic mechanism that maintains the ME-environment pressure-gradient (MEEPG) within a range optimized for “normal” hearing.

Objective: Describe MEPR using equations applicable to passive gas-exchange and determine if the predictions of that description include the increasing ME pressure observed under certain conditions and interpreted by some as evidencing gas-production by the ME mucosa.

Methods: MEPR was modeled as the combined effect of passive gas-exchanges between the ME and: perilymph via the round window membrane, the ambient environment via the tympanic membrane, the local blood via the ME mucosa and the NP during Eustachian tube openings. The first 3 of these exchanges are described at the species level using Fick’s diffusion equation and the last as a bulk gas transfer governed by Poiseuille’s equation. The model structure is a time-iteration of the state equation: $P_{g(t=(i+1)\Delta t)}^{ME} = \Sigma^S (P_{s(t=i\Delta t)}^{ME} + (1/(\beta_s^{ME} V^{ME}) \Sigma^P (K_s^P (P_{s(t=i\Delta t)}^C - P_{s(t=i\Delta t)}^{ME})))$. There, $P_{g(t=i\Delta t)}^{ME}$ and $P_{s(t=i\Delta t)}^{ME}$ are the ME total and species-pressures at the indexed times, $P_{s(t=i\Delta t)}^C$ is the species-pressure for each exchange-compartment, $\beta_s^{ME} V^{ME}$ is the product of the ME species-capacitance and volume, K_s^P is the pathway species-conductance, and Σ^S and Σ^P are operators for summing the expression over all species or exchange pathways.

Results: When calibrated to know values, the model predicts the empirically measured species-pressures and the observed time-trajectories for total ME pressure and the MEEPG under physiologic, pathologic and non-physiologic conditions.

Conclusions: Passive inter-compartmental gas exchanges are sole and sufficient to describe MEPR and, by Occam’s Razor, discount gas-production by the ME mucosa.

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Hearing Reconstruction: How I do it (2) (V717)

ID: 717.1

Ossiculoplasty techniques

Presenting Author: **Christopher Aldren**

Christopher Aldren
Wexham Park Hospital

Learning Objectives: The video will show the use of the Dresden Partial Clip prosthesis, the KURZ Variac TORP with omega connector and the malleus replacement prosthesis. Results will be presented with surgical tips and time for questions.

The video session will demonstrate the use of various prosthesis that the author uses regularly. This includes the use of the Dresden partial clip prosthesis for use in the

presence of a mobile stapes and absent or deficient incus. The KURZ Variac total prosthesis for use when the stapes is absent will be demonstrated with the omega shoe connector. Malleus relocation combined with the Vincent ALTO prosthesis and the malleus replacement prosthesis will also be shown. Data on results will be discussed with time for questions.

doi:10.1017/S0022215116002863

Middle ear function in normal and pathological ears (K723)

ID: 723.1

Middle Ear Function in Normal and Pathological Ears

Presenting Author: **John Rosowski**

John Rosowski

Massachusetts Eye and Ear Infirmary

Learning Objectives: - New measurements of TM motion tell us more about its function in normal and pathological ears. - Besides being of use in diagnosing the presence of middle-ear effusion, WBI can aid in the diagnosis of ossicular and other conductive disorders. - Normal 'third-window's affect the response of the inner-ear to non-ossicularly conducted sound.

Introduction: In recent years multiple technical and research developments expanded our understanding of the workings of the normal and pathological ear: New measurements of normal and pathological tympanic-membrane (TM) function, new ways to assess ossicular disorders, and an improved understanding of the effect of cochlear 'third-windows'.

Methods: The clinic-based techniques of Wide-Band acoustic Immittance (WBI) and Laser-Doppler Vibrometry (LDV) are described along with experimental techniques: Digital Opto-Electronic Holography (DOEH), Optical Coherence Tomography (OCT), and inner-ear sound pressure measurements.

Results: WBI and scanning LDV and OCT shed new light on the function of the TM. DOEH, without scanning, reveals the temporal response of over 100,000 points on the TM surface, and demonstrates the complex modal response of the TM surface in response to frequencies as high as 20 kHz. The TM motions induced by sound of a few kHz and less assess the presence of multiple conductive disorders, including ossicular fixations or interruptions, as well as the presence of several cochlear conductive disorders. Recent clinical and basic research led to a re-evaluation of the 'two-window' model of the inner ear, which occurred in the presence of evidence for pathological 'third windows' that result from abnormalities in the bone around the inner-ear fluids.

Conclusions: Advances in measurement tools increased our understanding of the workings of the normal and pathological middle ear. (1) Spatially uniform sound-induced TM motions dominate the response to sound, and TM motions near the ossicular attachment contributes most to

ossicular stimulation at high sound frequencies. (2) Multiple clinical techniques aid the pre-surgical diagnosis of ossicular and inner-ear conductive hearing disorders. (3) Normal inner-ear third windows explain multiple lines of evidence associated with non-ossicular stimulation of the inner ear.

doi:10.1017/S0022215116002875

Balloon Tuboplasty (R731)

ID: 731.1

Site of Eustachian Tube Obstruction in COM

Presenting Author: **Muaaz Tarabichi**

Muaaz Tarabichi, Muaaz Tarabichi

American Hospital Dubai

Learning Objectives: 1-Understand the existence of obstructive pathology in COM. 2-Learn how to evaluate for the site of obstruction. 3-Consider options for addressing obstruction within the proximal Eustachian tube.

Objective: To assess the patency of the proximal and distal segments of the Eustachian tube in patients undergoing surgery for chronic ear disease.

Study Design: Case study with control group.

Methods: All consecutive patients presenting for surgery for chronic ear disease in our practice over 14 months underwent preoperative Valsalva computed tomography (CT) and an attempt was made intraoperatively using angled rigid scopes to evaluate obstruction of the protympanic segment of the Eustachian tube. Endoscopic examination of the same segment in 19 cadaver ears served as a control group.

Results: Preoperative Valsalva CT showed patency of the distal one-third of the Eustachian tube in 51 of 53 ears. Intraoperative endoscopy allowed visualization of the protympanic opening of the Eustachian tube in 31/53 ears; 21/31 ears showed obstruction of the protympanic opening of the Eustachian tube.

Conclusion: A clear obstruction was more likely to be present in the protympanic opening of the Eustachian tube in the patient population undergoing surgery for chronic ear disease than in the cadaver control group, and equally likely to be present in the distal cartilaginous tube in patients as in the control population.

doi:10.1017/S0022215116002887

Balloon Tuboplasty (R731)

ID: 731.2

Defining disease and outcome measures

Presenting Author: **Mahmood Bhutta**

Mahmood Bhutta

Royal National Throat Nose and Ear Hospital

Learning Objectives: A review of diseases hypothesised to be due to disorder of the Eustachian tube and a critical review of disease classification. Discussion of future research on tuboplasty, including disease categorisation and outcome measures.

This is for the round table on “Balloon Tuboplasty”

For any treatment it is important that we define and segregate the disease(s) being treated, and evaluate effectiveness in terms of benefit to patient symptoms. Eustachian tuboplasty is a relatively new treatment for disorders of the middle ear, but to date most of the published literature has failed to segregate disease being treated, nor report on relevant outcomes.

I present a synopsis of diseases hypothesised to be due to an underlying dysfunction of the Eustachian tube. I argue that in most of the published literature such diseases are conflated (for example disorders classified under disorders of the Eustachian tube include glue ear, tympanic membrane retraction, and symptoms of aural fullness) but should be segregated. I suggest a nosology with disorders classified under “mucosal otitis media”, “squamous middle ear disease”, and “Eustachian Tube Dysfunction”, with the latter classification based upon a recent consensus statement. There is an inter-relation between such disease categories. However there is little evidence that a disorder of the Eustachian tube is the primary or initiating pathology underlying all of these diseases.

Whether the Eustachian tube is or is not a pathological mechanism for these diseases may be debated, but is largely irrelevant to the evaluation of treatment. Outcomes need to be reported with segregation of disease categories (as much as possible), and using patient reported outcome measures. Such measures may include hearing disability, otorrhoea, otalgia, aural fullness, and disease-specific or general quality of life.

This is a critical consideration in future trials of Eustachian tuboplasty if we are to better understand and define the role of this novel treatment.

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Balloon Tuboplasty (R731)

ID: 731.3

Balloon Dilation of the Cartilaginous Eustachian Tube

Presenting Author: **Dennis Poe**

Dennis Poe

Boston Children's Hospital

Most of the pathology that is responsible for Eustachian tube dilatatory dysfunction has been observed within the cartilaginous portion and is most commonly due to inflammatory disease, which can be readily diagnosed with transnasal endoscopy. A careful assessment of the dynamics of the ET by endoscopy can be very effective in determining the etiology, location and severity of dilatatory dysfunction within the functional valve in the cartilaginous portion. Disorders of dilation may be observed and classified.

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. When the medical causes have been optimally treated, but ET dilatatory dysfunction persists, possibly due to irreversibly injured mucosa, biofilms or other pathology, tympanostomy tubes are usually recommended. When tubes fail to resolve the problem, treatment of the underlying pathology with surgery can be offered. Surgery is tailored to the sites of inflammatory or obstructive pathology and may involve turbinate reduction, sinus surgery, adenoidectomy, or balloon dilation of the ET. All of these procedures are designed to remove irreversibly injured tissue and provide a fresh start, assuming the underlying medical conditions are adequately controlled. Failure to control the medical problems can lead to recurrence of inflammatory disease.

doi:10.1017/S0022215116002905

Balloon Tuboplasty (R731)

ID: 731.4

Measuring Eustachian tube dysfunction

Presenting Author: **James Tysome**

James Tysome

Cambridge University Hospitals

Learning Objectives: Understand the methods available to measure Eustachian tube dysfunction.

Background: Eustachian tube (ET) dysfunction is a common but poorly understood cause of patient symptoms and an important factor in the development of middle ear pathology. Despite this, there are no specific tests of ET function in widespread clinical use. A renewed interest in treatments for ET dysfunction has led to a demand for methods of measuring ET function non-invasively.

Objective: To identify currently available tests and imaging modalities to assess ET function and, where possible, report on their accuracy.

Methods: Narrative systematic review. Tests and imaging methods in included studies were required to measure a physiological function of the ET, or play a role in the diagnosis of poor ET function.

Results: While many tests of ET function have been developed, with some in routine clinical use, all have significant limitations. Published accuracy data are limited and of variable quality due to the range of comparative tests and the spectrum of otological disorders associated with ET dysfunction. CT and MRI are best suited to identifying features associated with obstructive or patulous ET dysfunction

Conclusions: Currently, no single test or imaging modality can be used to diagnose ET dysfunction, but there is some evidence that diagnostic accuracy can be improved by combining the results of different objective tests and patient-reported outcome measures. Further development of ET function tests is required to facilitate the accurate diagnosis of patients and allow outcome reporting for new interventions.

doi:10.1017/S0022215116002917

Free Papers (F732)

ID: 732.1

Surgery of Cholesteatoma in Pediatric Age: Assessment of combined micro-endoscope approach

Presenting Author: **Nader Nassif**

Nader Nassif¹, Tommaso Sorrentino², Silvia Zorzi², Luca Oscar Redaelli De Zinis²

¹Children's Hospital, Spedali Civili of Brescia,

²Spedali Civili of Brescia

Learning Objectives: Use of endoscopy in ear surgery is an interesting technique by offering the possibility to be less invasive.

Introduction: Cholesteatoma in pediatric age is aggressive and necessitates an extensive surgical approach to eradicate the pathology and a long time follow up. Introduction of otoendoscopy lately gave a cue to reconsider certain standardized techniques. The aim of this study is to survey how endoscopy is evolving in our daily practice and the preliminary results obtained.

Methods: Review of medical charts of patients underwent tympanoplasty between January 1995 and December 2014. Data collected included age, sex, features of cholesteatoma, type of tympanoplasty (TPL): trascanal (TC), canal wall up (CWU) or canal wall down (CWD), technique used: microscope and or endoscope, revision surgery for recidivism. Comparison was done on surgical techniques applied before and after the introduction of endoscopy in our department, 2010.

Results: Ninety-three children, 57 M and 36 F, average age 10 (range 3 to 16) were identified for the study. Seven patients had bilateral cholesteatoma. Tympanoplasties performed were 186 divided as follows: **63%** (63/100) **CWU**, 15 of which underwent a second look CWU and 25 underwent a second look CWD. **20%** (20/100) **CWD** where in 10, 2 and 1 cases underwent a second, third and fourth look, respectively. Finally, **17%** (17/100) underwent **TC** where 7 underwent a second look TC. Three out of the 7 underwent a third look and were converted in 2 cases to CWD and in 1 case to CWU. Before and after the introduction of endoscopy the corresponding 56 and 44 first look procedures were performed as follows: CWU 57% vs 45%, CWD 27% vs 16% and TC 16% vs 39%, respectively.

Conclusions: Otosurgery tends to be less invasive by avoiding mastoidectomy. Endoscopic cholesteatoma removal

should be limited to disease interesting only the tympanic cavity. A long time follow up is necessary in order to compare the real benefit of endoscopy.

doi:10.1017/S0022215116002929

Free Papers (F732)

ID: 732.2

Practicality analysis of JOS staging system for congenital cholesteatoma: Japan Multicenter study (2009–2010)

Presenting Author: **Yuka Morita**

Yuka Morita¹, Tetsuya Tono², Yutaka Yamamoto³, Hiromi Kojima³, Masafumi Sakagami⁴, Yasuo Mishiro⁴, Taeko Okuno⁵, Yasuyuki Hinohira⁶, Keiji Matsuda², Sho Hashimoto⁷

¹Niigata university, ²Miyazaki University, ³Jikei University School of Medicine, ⁴Hyogo College of Medicine, ⁵Mitsui Memorial Hospital,

⁶Kamio Memorial Hospital | Syowa University,

⁷National Sendai Medical Center

Learning Objectives:

Introduction: Potsic classification has been widely used as the classification of congenital cholesteatoma. According to this classification, destruction of ossicles is one of the important points. And the stage will be progressed if the ossicular chain is destructed even in the case of small cholesteatoma which is limited in tympanic cavity. The committee on Nomenclature of the Japan Otological Society (JOS) was appointed in 2004 to create a cholesteatoma staging system widely applicable in Japan and as simple as possible to use in a clinical practice. We introduce our staging system about congenital cholesteatoma.

Methods: A total of 599 ears that underwent surgery for fresh cholesteatoma between 2009 and 2010 at 6 institutions in Japan were recruited and cases with congenital cholesteatoma were selected. In order to know the progress site reliably, we selected strictly the cases which could be obtained surgical records in details. We evaluated the progression of cholesteatoma according to the 2015 JOS cholesteatoma staging and classification system as followed;

Stage I: limited in tympanic cavity (Ia;anterior part, Ib;posterior part, Ic; both of them)

Stage II: beyond tympanic cavity

Stage III: associated with intratemporal complications

Stage IV: associated with intracranial complications

Results: Seventy one ears of 599 ears were diagnosed for congenital cholesteatoma and 37 ears of 71 have been studied. Six ears were classified for Stage Ia, 11 ears for Ib, 1 ear for Ic, 17 ears for II and 2 ears for III. Concerning about the pathology of stapes in Stage I, the missing rate of stapes superstructure was 0%, 54.5% and 100% in Stage Ia, Ib and Ic, respectively.

Conclusions: Congenital cholesteatoma which was limited in tympanic cavity was different in stapes status by the part of existence of cholesteatoma. Especially in this study, Stage Ib was

most common in Stage I. Our staging system which is classified from point of the cholesteatoma extent is simple and useful.

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Free Papers (F732)

ID: 732.3

Incidence of congenital cholesteatoma in persistent unilateral glue ear

Presenting Author: **Victoria Wilmot**

Victoria Wilmot¹, Alok Sharma²
¹Edinburgh, ²Royal Hospital for Sick Children, Edinburgh

Learning Objectives:

Introduction: Early congenital cholesteatoma is often undiagnosed and usually presents only when the tympanic membrane is breached and the ear chronically discharges. Early detection and intervention of congenital cholesteatoma should intuitively allow better surgical outcomes. Otitis media with effusion could be an early indicator of underlying cholesteatoma and children presenting with persistent unilateral effusion should be investigated.

Method: Over a 5-year period from 1st March 2009 to 1st March 2014 every child with a persistent unilateral conductive loss, flat tympanometry for 6 months and normal tympanic membrane was listed for insertion of a ventilation tube. At follow up audiological evaluation, any child with persistent hearing loss underwent CT scanning to investigate for cholesteatoma and exploratory mastoid surgery where CT findings were suggestive.

Results: 29 patients in total, age range 3 to 12 years (mean 5 years) were listed for ventilation tube insertion. 2 patients were lost to follow up. 10 patients (34%) had persistent conductive loss at 3 months despite ventilating tubes; 6 patients (21%), age range 4 to 8 years (mean 5 years) had CT scans suggestive of congenital cholesteatoma resulting in mastoid exploration; 5 patients (17%), age range 4 to 8 years (mean 5 years) had congenital cholesteatoma and resulted in mastoidectomy/middle ear surgery.

Conclusion: Persistent unilateral glue ear in a child should be considered suspicious of congenital cholesteatoma. Insertion of a ventilation tube, audiology follow up and CT scan can screen for this otherwise undetected disease, allowing early intervention. The incidence of congenital cholesteatoma in persistent unilateral glue ear in this series is 17%.

doi:10.1017/S0022215116002942

Free Papers (F732)

ID: 732.4

Clinical Incidence and Management of Otitis Media with Effusion in Vietnamese Children

Presenting Author: **Thuy Tran Le**

Thuy Tran Le¹, Tan Huynh Ba²
¹Thuy Tran ENT Clinic, ²Danang Ear and Hearing Center

Learning Objectives:

Subject: Researching clinical incidence and active management of Otitis Media with Effusion in Vietnamese children and how OME often occurs together with other diseases of Recurrent Upper Respiratory Infections and Gastro Esophageal Reflux Disease. The diagnosis and treatment of GERD and RURIs sometime is essential in the treatment of OME.

Study: Retrospective review study.

Method: A clinical study of 300 Vietnamese children of RURIs, ages 6 months to 7 years at Thuy Tran ENT Clinic from 09/2008 to 04/2015. OME was diagnosed by endoscopy of the tympanic membranes and tympanogram. Treatment of OME was carried out by the traditional procedures and adenoidectomy if indicated. Treatment of recurrent nasopharyngitis consisted of daily endoscopic irrigation for 5–7 days of the nasal passage and Eustachian tubes with Natri Chloride 0,9% and topical antibiotic solution.

Results: 1/ Incidence of OME/ RURIs is 234/300: 78%. In which OME + Recurrent Nasopharyngitis + Adenoiditis + GERD: 115; OME + RN + Adenoiditis: 49; OME + RN + GERD: 46; OME + RN: 24. 2/ Hearing recovery: 192/234. 3/ Symptoms of RURIs were completely resolved for all patients without tonsillectomy. Follow up period: 6–12 months.

Conclusion: 1/ The incidence of OME / RURIs is 234/300. 2/ Management of RN and GERD on the patients of OME is necessary. 3/ RN in all cases of OME treated with the Modified Thuy Tran Technique yields good results without tonsillectomy. 4/ Limited antibiotics.

Discussion: 1/ The incidence of OME/RURIs of Vietnamese children is high. 2/ By the Modified Thuy Tran technique, endoscopic nasal irrigation cleans the nasal passage and Eustachian tube. 3/ A national program of OME in the developing countries should be considered. 4/ Public education on OME and GERD in children is necessary.

doi:10.1017/S0022215116002954

Free Papers (F732)

ID: 732.5

Type I Tympanoplasty Meta-analysis: A Single Variable Analysis of More Than 26 Thousand Adults and Children From 214 Studies

Presenting Author: **Hsern Ern Tan**

Hserrn Ern Tan¹, Peter Santa Maria², Robert Eikelboom², Marcus Atlas²

¹1. Sir Charles Gairdner Hospital, 2. Ear Science Institute of Australia, ²1. Sir Charles Gairdner Hospital, 2. Ear Science Institute Australia

Learning Objectives:

Objective: To determine which independent variables influencing the efficacy of type I tympanoplasty in adult and pediatric populations.

Data Sources: A search of the PubMed database and Cochrane Database of Systematic Reviews using the key words “tympanoplasty OR myringoplasty” from January 1966 to July 2014 was performed.

Study Selection: Studies reporting outcomes of myringoplasty or Type I tympanoplasty in primary non-cholesteatomatous chronic tympanic membrane perforation were included.

Data Extraction: Of 4,698 abstracts reviewed, 214 studies involving 26,097 cases met our inclusion criteria and contributed to meta-analysis.

Data Synthesis: The primary outcome of success was defined as closure rate at 12 months. The independent variables analyzed were age, follow-up period, approach, graft material, perforation cause, size, location, ear dryness, and surgical technique. Only those studies providing data on a given parameter of interest could be included when comparing each variable.

Conclusion: The weighted average success rate of tympanic closure was 86.6%. Based on this meta-analysis, there is a failure rate of tympanoplasty observed over time (worsened by 4.4% in follow-up periods >12 months). Pediatric surgery has a 5.8% higher failure rate than adults. Other variables associated with improved closure rates include perforation with a size less than 50% of total area (improved by 6.1%) and the use of cartilage as a graft (improved by 2.8% compared to fascia), while ears that were operated on while still discharging, those in different locations of the pars tensa, or using different surgical approaches or techniques did not have significantly different outcomes.

doi:10.1017/S0022215116002966

New trends in cholesteatoma management (N733)

ID: 733.1

Why does cholesteatoma epithelium behave differently from normal skin? – a c-MYC study with special concern on proper CWD cavity cleaning.

Presenting Author: **Frigyes Helfferich**

Frigyes Helfferich

MH EK - Health Center Hungarian Defense Forces

Learning Objectives: Genetics behind cholesteatoma formation.

In our country CWD tympanoplasty has been a widespread surgical technique in the recent decades to remove cholesteatoma. Therefore we meet several patients for regular check-ups, when the proper cleaning of the mastoid cavity is mandatory, otherwise severe inflammation may recur. The gold standard is the use of microscopes which allows good manipulation. However, to examine and clean hidden recesses, rigid or flexible endoscopes may be indispensable. Our technique is presented on a short video.

Uncleaned mastoid cavities filled with desquamation may behave like a cholesteatoma. Our working group tried to explain the genetical background of the different behavior of normal skin compared to the epithelium of the cholesteatoma. Previous studies have found aneuploidy of chromosome 8, copy number variation of c-MYC gene and the presence of elevated c-MYC protein level in cholesteatoma. We compared the expression of c-MYC gene in samples taken from acquired cholesteatomas, atheromas and normal skin samples using RT-qPCR. Significantly elevated c-MYC gene expression was found in cholesteatoma compared to atheroma and to normal skin samples. It implies a more prominent hyperproliferative phenotype that might be due to the presence of inflammation in acquired cholesteatoma.

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New trends in cholesteatoma management (N733)

ID: 733.2

Subtotal petrosectomy in selected advanced cholesteatoma cases

Presenting Author: **Imre Gerlinger**

Imre Gerlinger¹, Imre Gerlinger²

¹Pécs University, Hungary, ²Pécs Universtij ENT Department

Learning Objectives: Subtotal petrosectomy is the basic procedure in skull base surgery. It involves complete exenteration of all air cells of the temporal bone (middle ear and mastoid). It includes the following air tracts: retrosigmoid, retrofacial, antral, retrolabyrinthine, supralabyrinthine, infralabyrinthine, subprattubal and peritubal carotid cells. Only a few cells in the petrous apex left behind. The otic capsule is either removed or left behind. In advanced cholesteatoma cases, where numerous previous middle ear procedures could not reassure dry ear and when there is no possibility of hearing reconstruction and one wishes to attain a dry safe ear this procedure has proved to be the solution. Depending on the bone conduction result the procedure can be combined with the asimultaneous application of round window vibrant soundbridge or BAHA/Bonbridge implants. During the past years we carried out subtotal petrosectomies in 4 cases due to advanced cholesteatomas. The steps of the procedure will be demonstrated and conclusions will be drowed based on our experiences. Further rare indications of this useful procedure will be briefly discussed too.

Subtotal petrosectomy is the basic procedure in skull base surgery. It involves complete exenteration of all air cells of the temporal bone (middle ear and mastoid). It includes the following air tracts: retrosigmoid, retrofacial, antral, retrolabyrinthine, supralabyrinthine, infralabyrinthine, subpratubal and peritubal carotid cells. Only a few cells in the petrous apex left behind. The otic capsule is either removed or left behind.

In advanced cholesteatoma cases, where numerous previous middle ear procedures could not reassure dry ear and when there is no possibility of hearing reconstruction and one wishes to attain a dry safe ear this procedure has proved to be the solution. Depending on the bone conduction result the procedure can be combined with the simultaneous application of vibrant soundbridge in the round window or BAHA/Bonbridge implants. During the past years we carried out subtotal petrosectomies in 4 cases due to advanced cholesteatomas. The steps of the procedure will be demonstrated and conclusions will be drawn based on our experiences. Further rare indications of this useful procedure will be briefly discussed too.

doi:10.1017/S002221511600298X

New trends in cholesteatoma management (N733)

ID: 733.3

Bony obliteration technique (BOT) surgery in paediatric cholesteatoma cases

Presenting Author: **Gabor Katona**

Gabor Katona
Heim Pál Children's Hospital, Budapest,
Hungary

Learning Objectives: bony obliteration technique in pediatric acquired cholesteatoma - results and discussion on advantages

Paediatric cholesteatoma is aggressive, destructive disease to all surrounding tissues. It has high recurrent tendency even after careful removal. High complication rate, severe, sometimes life-threatening complications can occur. Hearing deterioration is characteristic. Main goals of therapy are the following:

- complete eradication of the disease (no residual disease)
- prevention of recurrent disease, prevention complications
- improvement of the hygienic status of the ear
- preservation or improvement of hearing

Formerly in childhood mostly operations has been done in 2 sessions: one year after the first op – enough time to grow a „spider-egg” to be removed and reconstruction. Today the method of choice is in cases of invagination cholesteatoma the CWU /CWD with BOT, complete removal of the matrix and keratin, primary reconstruction of the ear. For control of recurrent/ residual cholesteatoma is done by non-epi DW MRI.

Own results: In the last 5 years we had 53 cholest cases, 4 congenital, 49 epitympanic, and invagination type. In non-obliteration cases (n = 32) the recurrent/residual rate was 37, 5% (12), in obliteration cases (n = 17) this figure was 5, 9% (1). Hearing results in obliteration group was better than in non-obliteration group (average ABG improvement was 5, 3 vs 12, 5 dB).

Conclusion: After a learning curve BOT surgery is the method of choice in paediatric invagination cholesteatoma cases.

doi:10.1017/S0022215116002991

New trends in cholesteatoma management (N733)

ID: 733.4

Middle ear gas exchange problems in OME and cholesteatoma

Presenting Author: **Zsuzsanna Csakanyi**

Zsuzsanna Csakanyi¹, Gabor Katona¹, Denes Konya²,
Ferenc Mohos³, Istvan Sziklai⁴

¹Heim Pal Children's Hospital, ²Budapest
University of Technology and Economics,

³University of Szeged, Faculty of Engineering,

⁴Department of Otorhinolaryngology and Head
and Neck Surgery, Health Science Centre,
University of Debrecen

Learning Objectives:

Background: Gas pressure balance is substantial for normal middle ear (ME) function, however, mechanisms involved in the ME pressure control are still not fully understood. In vivo examination of the ME gas pressure (MEP) regulation is difficult, therefore mathematical models are developed to describe and test hypotheses concerning ME gas exchange function.

Objective: To examine the role of ET function and mastoid pneumatization in MEP balance, and to interpret the possible clinical relevance of the mathematical model predictions.

Method of approach: A mathematical description and MatLab® modeling of the MEP development is presented in the function of different ME volumes (V_{ME}), considering normal and malfunctioning ET. Published data as input values and our 3D CT reconstruction data of healthy and pathological MEs of children are applied.

Results: The model predicted larger MEP fluctuations in $V_{ME} < 3 \text{ ml}$ than in $V_{ME} \geq 3 \text{ ml}$ considering normal ET function due to the different pressure change rate and pressure buffer effect of the MEs. Substantially larger MEP fluctuations can be expected in a $V_{ME} < 3 \text{ ml}$ with malfunctioning ET. Modeling mastoid obliteration predicts similar MEP fluctuations to a $V_{ME} \geq 3 \text{ ml}$ resulting from elimination of gas exchange surface. The 5-year follow-up study in children with persistent OME indicates lower ME growth rate as compared to healthy

children and decrease in ME volume over time in 40% of cases.

Conclusions: Results support that the ME volume, the ME surface area/volume ratio along with the duration of ET dysfunction influence the extent of ME pathological changes. These parameters can be important to consider for a pathophysiology-oriented approach to the ME surgery that may improve the long-term outcome.

doi:10.1017/S0022215116003005

Bone conduction hearing devices in children (R734)

ID: 734.1

Tissue preserving technique for introducing bone conducting devices in children

Presenting Author: **Malou Hulcrantz**

Malou Hulcrantz

CLINTEC, Karolinska Institutet

Learning Objectives: BHCD in children operated with tissuepreserving technique has a better outcome.

Objectives: A tissue preserving surgical technique has shown no increased inflammatory reactions after a non- skin reduction technique in adults. Objective was to evaluate in children the extent of the stability, the skin in contact with the device, numbness and clinical signs and symptoms of inflammation or infection at the site of the skin penetration.

Methods: A single-centre clinical investigation comparing the surgical technique without the skin thinning procedure with the results from earlier techniques, now using longer individualized abutments. Participants in the study were included consecutively and operated in general surgery in a day surgery setting. The Ostell instrument for registration of stability was used.

Results: Clinically there were no surface related adverse events, nor were any skin reactions noted in the test or control groups during 12 months follow up. Numbers of stability with RFA is given.

Conclusions: This human clinical trial in children, as compared to earlier techniques support and extend findings of newer surgical tissue preserving techniques, with good tissue response and no surface related adverse events.

doi:10.1017/S0022215116003017

Bone conduction hearing devices in children (R734)

ID: 734.2

Use of bone conduction hearing devices in management of patients with congenital aural atresia and microtia- Experience in Hong Kong Chinese

Presenting Author: **Michael CF Tong**

Michael CF Tong, Willis SS Tsang

The Chinese University of Hong Kong

Learning Objectives: Understand the approach in using bone conduction hearing aids in children with aural atresia and microtia.

Introduction: The prevalence of external ear abnormalities is around 1 % in Chinese children in Hong Kong. Coexisting hearing loss could be of outer ear, middle ear or inner ear in origin. Management of hearing losses depends on whether it is unilateral or bilateral, the severity and type as well as the plan of management of the external ear abnormalities.

Methods: A review of the management of Chinese patients underwent bone-conduction hearing aid with co-existing outer ear deformities is made from 1995 to 2015 in a single tertiary referral centre in Hong Kong.

Results: Early cases were managed with percutaneous Baha™ until 2012. With the introduction of Bonebridge™ and Baha Attract in 2013 and 2014 respectively in our centre, there is a change of management leaning towards these transcutaneous devices. Adults or older children were managed with either Bonebridge™ or Baha™ Attract system and children were managed with Baha™ Attract.

Auricular reconstruction could be performed in the same procedure or as a separate procedure as long as a good surgical planning is made.

Two children and one adolescent (age 9, 13 and 19) with Nagata stage 1 auricular reconstruction and Baha™ Attract at same setting were described as an illustration of our technique. Adults with Bonebridge™ cum Nagata stage 1 were described in parallel for discussion.

Discussion and Conclusion: We describe the successful management of a series of congenital atretic and microtia patients with bone conduction hearing devices.

The transcutaneous system allows earlier switch on. The Baha™ Attract system is particularly suitable for some of these children with very thin skull. We see more patient/ parental acceptance with transcutaneous devices after their introduction into clinical practice.

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Bone conduction hearing devices in children (R734)

ID: 734.3

Adapting the BAHA surgical technique for Children

Presenting Author: **Iain Bruce**

Iain Bruce

Royal Manchester Children's Hospital

Learning Objectives: 1. Percutaneous and transcutaneous BAHA are both important options in children

2. Adaptations to the skin and soft tissue technique used may be required in children 3. Special circumstances, such as microtia cases, require particularly careful planning and collaborative working with the reconstructive surgeon.

Introduction: The appropriateness and effectiveness of BAHA in selected children and young people is well established. Lower than expected uptake in children has contributed to recent technological advances, most notably percutaneous BAHA without soft tissue reduction and the development of transcutaneous BAHA (Cochlear™ Baha® Attract System), aimed at improving cosmesis and reducing skin problems. Adaptations in surgical technique and special considerations may be necessary when undertaking BAHA surgery in children.

Methods: A single surgeon's experience of BAHA surgery in children will be reviewed and illustrated, with emphasis upon adaptations in skin and soft tissue surgical technique and decision making regarding siting of the fixture in relation to the pinna.

Results: Five scenarios will be considered: 1. 'No soft tissue reduction surgery', 2. Adapting the recommended surgical technique for ATTRACT surgery, 3. Transitioning from percutaneous to transcutaneous BAHA, 4. Simultaneous BAHA and mastoid surgery, and 5. Microtia. Illustrative cases will be presented for each scenario. Most notably changing the position of the skin incision for ATTRACT surgery from anterior to posterosuperior to the implant magnet, offers potential cosmetic benefits and avoids disruption of the soft tissue planes in planned autogenous pinna reconstruction cases. Inappropriate choice of the implant site may also compromise future pinna reconstruction. Scar tissue over the implant magnet does not lead to problems with pressure induced skin necrosis, when transitioning from percutaneous to transcutaneous BAHA.

Conclusions: Traditionally, cosmesis and recurrent inflammation have limited uptake of BAHA in children. Advances in BAHA technologies have led directly to greater applications in children. The anticipated development of an active transcutaneous BAHA promises further improvement in cosmesis and acceptability to children and young people.

doi:10.1017/S0022215116003030

Late problems following surgery on chronic otitis media (N735)

ID: 735.1

Granular myringitis after middle ear surgery?

Presenting Author: **Iain Swan**

Iain Swan

Glasgow Royal Infirmary

Granular myringitis is a problem that we all encounter. There is no good definition for granular myringitis in post-surgical ears but the term is loosely applied to ears where there is a

small area of granulation tissue on the grafted tympanic membrane or in the mastoid cavity.

It may appear many months after surgery in what was initially a well healed ear, and there are usually no obvious identifiable causes. There are several papers about granular myringitis in patients with no history of ear surgery but none about post-surgical patients. It is rarely mentioned in case series, but all surgeons encounter it.

There is no good evidence on aetiology or on treatment, in post-surgical cases or in non-surgical cases. Many treatment modalities have been reported in non-surgical cases including topical antibiotics/steroids, acetic acid, hydrogen peroxide, 5-fluorouracil, Castellani's paint, cautery, laser and surgery. Most of these, except surgery, are used in post-surgical cases.

It seems that most surgeons try a variety of treatments until the inflammation settles, which can take many months. There is no evidence for efficacy of any specific treatment. The most reasonable conclusion is that no specific treatment has been found to be effective in a significant proportion of patients.

doi:10.1017/S0022215116003042

Late problems following surgery on chronic otitis media (N735)

ID: 735.2

Problems associated with the use of Serenocem granules in mastoid obliteration

Presenting Author: **Christopher Aldren**

Christopher Aldren

Wexham Park Hospital

Learning Objectives: Significant bone erosion has been detected in patients who have had mastoid obliteration using Serenocem granules. The lecture will discuss the issues regarding use of new materials. Advice will be given on how to report and investigate adverse reactions and the management of patients affected when things do not go to plan.

Serenocem granules are a ceramic granule produced by Corinthian Surgical in the United Kingdom. They have been marketed since 1997 as an ideal material for obliteration of the mastoid cavity. The author used the granules for mastoid obliteration in 40 cases over a 10 year period. Results were generally good however at recent revision surgery one patient was noted to have significant erosion of the temporal bone adjacent to the granules. Subsequent CT scanning of other patients found bone erosion to be a common finding, occurring in 75% of patients. The product was reported to the medicines and healthcare products regulatory agency (MHRA) and to the company. Other surgeons were contacted and similar findings were noted in their patients. The product was withdrawn by the company. Surgical findings will be illustrated with video. CT scans and histology will be presented. The possible aetiology will be discussed as well as the significant management issues arising for the patients affected.

doi:10.1017/S0022215116003054

Bio-mechanics of the middle ear (R736)**ID: 736.1****Mechanical effects of tympanic membrane replacement with cartilage and other materials**Presenting Author: **Manohar Bance**

Manohar Bance, Mostafa Salem

Dalhousie University

Learning Objectives: 1. To understand the mechanical effects of replacing the TM with other materials 2. To compare different materials used for reconstruction of the TM from a micromechanical sense.

We will present our results in cadaveric temporal bones measuring the vibration responses of overlaying cartilage at different sites on the TM, replacing different parts of the TM with cartilage, with perichondrium, with silastic, and with ointment.

We report both TM malleus vibrations and stapes vibrations.

doi:10.1017/S0022215116003066

Bio-mechanics of the middle ear (R736)**ID: 736.2****Influence of tension and positioning in middle ear reconstruction**Presenting Author: **Thomas Zahnert**

Thomas Zahnert, Matthias Bornitz, Marcus Neudert, Thomas Beleites

TU-Dresden

Learning Objectives: Optimal prosthesis position at tympanic membrane and stapes; optimal prosthesis length; tension of annular ligament in middle ear reconstruction, tympanoplasty.

Introduction: For an optimal sound transfer function (STF) positioning and coupling are the most important factors in middle ear reconstruction with passive implants. Middle ear ventilation problems can change the position and coupling of prosthesis after surgery leading to dislocation or tension of the ligaments. Therefore mechanism and techniques in prosthesis design had to be established to prevent dislocation and tension.

Methods: STF between tympanic membrane and footplate was calculated in a Finite Element Model of the middle ear and measured with Laser-Doppler-Vibrometry in temporal bones. The coupling to the tympanic membrane, malleus handle, stapes head and footplate was compared. The influence of prosthesis' length was measured in temporal bones using a memory-metal TORP. For the investigation of a new prosthesis concept a new flexible TORP was developed

and measured in temporal bones during atmospheric pressure alternations.

Results: Malleus attachment near its neck improves the STF in higher frequencies in comparison to tympanic membrane coupling. The stapes head and the center of the footplate are both best suitable for prosthesis coupling. The elongation of prosthesis length between 50 and 200 μm leads to a frequency dependent STF reduction of 5 to 25 dB below 1.0 kHz. At frequencies >2.0 kHz the reduction was less prominent or the STF showed even an improvement of up to 10 dB (SPL).

Conclusion: At the tympanic membrane malleus handle is optimal for prosthesis coupling. At the footplate the center is the optimal position for TORPs. The correct length of implanted prostheses (functional length) should be measured before implantation to prevent tension at the annular ligament. In the future, prosthesis with pressure compensation elements might reduce the risk of dislocation and annular ligament tension. Tension has a significant impact on the STF in middle ear reconstruction.

doi:10.1017/S0022215116003078

Bio-mechanics of the middle ear (R736)**ID: 736.3****Session R736: Round Table on The BioMechanics of the Ear**Presenting Author: **John Rosowski**

John Rosowski

Massachusetts Eye and Ear Infirmary

Learning Objectives: Learn about the latest ideas on how the biomechanics of the middle ear affect our understanding of ear disease and its treatment.

Presentations and discussions on middle-ear biomechanics with some of the leading surgeon scientists familiar with the topics: Manohar Bance of Dalhousie University of Halifax Canada, Thomas Zahnert of the University of Dresden Germany and Karl-Bernd Hüttenbrink of the University of Köln Germany. Topics to be discussed include: The normal and reconstructed tympanic membrane (MB), the influence of tension and position on the function of ossicular replacement prostheses (TZ), the significance of a solid contact in ossicular reconstruction in acoustic and non-acoustic pressure environments (K-BH), and the coupling of sound to the ossicular chain by the normal tympanic membrane (JJR).

doi:10.1017/S002221511600308X

Bio-mechanics of the middle ear (R736)**ID: 736.4****The Significance of a Solid Contact in Ossicular Reconstruction in acoustic and non-acoustic pressure environment**Presenting Author: **Karl Hüttenbrink**

Karl Hüttenbrink
HNO-Klinik der Universität zu Köln

Learning Objectives: TBC

The reconstruction of the ossicular chain has the goal to connect the vibrating tympanic membrane with the inner ear via the stapes. Two aspects have to be considered: Firstly the Hi-Fi sound transport. For this purpose, the prosthesis has to be anchored tightly to the vibrating structures in order to avoid a loose contact. Any soft tissue in the gap between the prosthesis and the vibrating structures will reduce the energy transmission due to its damping effect. Secondly, the prosthesis has to be stabilized against a displacement by static forces, like atmospheric pressure variations, scar tissue traction, tympanic membrane retraction etc. Simple water-adhesion is not solid enough for the stabilization of the prosthesis against these forces. Therefore, new designs for a more stable attachment are necessary. They must not only guarantee a stable positioning, but, especially in cases of cholesteatoma surgery with its high risk of recidives, an easy removing must be possible, to reduce the risk of a stapes' luxation.

doi:10.1017/S0022215116003091

Big Cholesteatoma: How I do it (2) (V737)

ID: 737.1

Large Cholesteatoma

Presenting Author: **Levent Olgun**

LEVENT Olgun
Izmirbozyaka Teaching Hospital

Learning Objectives:

Introduction: Large cholesteatomas are generally congenital origin and by the years reach considerable sizes. Most of the cases may be indolent for years and first detected only after development of complications.

Method: Between 2010–2016 34 large cholesteatomas were operated on at Izmir Bozyaka Teaching and Research Hospital ENT Clinic. Eighteen of them needed attention because of intratemporal complications, intracranial complications led to surgery in 4 other cases. In this presentation short clips of operative videos of some of these cases would be shown and important points would be stressed.

doi:10.1017/S0022215116003108

Big Cholesteatoma: How I do it (2) (V737)

ID: 737.2

Intra-op warning signs to look for in implant surgery

Presenting Author: **Mohan Kameswaran**

Mohan Kameswaran
Madras ENT Research Foundation (P) LTD

Learning Objectives: The otologist very often has to deal with extensive cholesteatoma in the Indian population. This video presentation will focus on extensive cholesteatoma and its management.

The otologist very often has to deal with extensive cholesteatoma in the Indian population. This video presentation will focus on extensive cholesteatoma and its management.

doi:10.1017/S002221511600311X

Mastoid Obliteration (R741)

ID: 741.1

Why consider obliterating the mastoid in cholesteatoma surgery anyway? Lessons learnt from changing treatment strategy, preliminary results and future perspectives

Presenting Author: **Robert Jan Pauw**

Robert Jan Pauw, Mick Metselaar, Anne van Linge, Laura Veder, Bas Pullens, Marc van der Schroeff
Erasmus MC

Learning Objectives: To demonstrate the advantages of mastoid obliteration in cholesteatoma surgery. To emphasize the importance of structured follow-up after cholesteatoma surgery in order to assess both medical and patient reported outcome measures.

Mastoid obliteration in cholesteatoma surgery can decrease the cholesteatoma recurrence rate.

In the Erasmus Medical Center we have implemented canal wall up tympanoplasty with bony obliteration of the mastoid as the treatment strategy of choice for primary or recurrent cholesteatoma. Preliminary results of this treatment strategy will be shown and compared to our previous results with cholesteatoma recurrence and residual rate as primary outcome measures.

Currently, all patients are included in a prospective database that includes not only medical outcome measures like cholesteatoma recurrence and residual rate, complication rate and hearing results, but also patient reported outcome measures using general and disease specific questionnaires. An overview of the current standardized follow-up regimen and the outline of the database will be given. A concept version of an interactive cholesteatoma dashboard that allows real time insights in different outcome measures will be demonstrated.

doi:10.1017/S0022215116003121

Mastoid Obliteration (R741)

ID: 741.2

Mastoid obliteration 6 years follow up results. European trend, local peculiarities

Presenting Author: **Sergey Kosyakov**

Sergey Kosyakov¹, Ekaterina Pchelenok²

¹Russia Medical Academy for postgraduate Education, ²Russia Medical Academy for Postgraduate Education

Learning Objectives:

Introduction: To prevent residual and recurrent cholesteatoma, we performed canal wall down technique with the obliteration of paratympanic spaces for patients with acquired cholesteatoma.

Material and Methods: 229 ears were operated (223 patients: 81 females and 142 males). In 158 cases an operation was performed for the first time and 71 cases were revision and re-operation after surgery by other surgeons. All patients underwent sanation surgery with the obliteration of paratympanic spaces followed by the restoration of the posterior wall of the external auditory meatus and simultaneous tympanoplasty (closed-type surgery). Close tympanic cavity with chondro-perichondrial flap with simultaneous ossiculoplasty. Obliterate paratympanic spaces with bone pate, or bioglass, or allocartilage and cover it with chondroperichondrial flap. The patients were examined one year after the treatment with the use of the MRI technology using the non-EPI DWI regime to monitor the residual and recurrence cholesteatoma.

Results: From 2009 to 2015, we operated 229 ears. The results were evaluated according to otomicroscopy, MRI sequences, such as the non-EPI DWI and recorded for survey. From 2009 to 2011 the residue of cholesteatoma was diagnosed in 3 cases (3,7%), from 2009 to 2012–7 cases (5.9%), from 2009 to 2013–9 cases (6%), from 2009 to 2014–11 cases (5,8%) and from 2009 to 2015–11 cases (4,8%). No residual cholesteatoma were detected in the obliterated mastoid cavity.

Conclusion: Long-term follow up indicated that the canal wall down technique with bony obliteration is a safe method with which to treat primary cases and to reconstruct unstable cavities. The MRI technology in the non-EPI DWI regime was successful in differentiating soft tissues and enabling the detection of residual or recurrent cholesteatoma after a canal wall down bony obliteration technique procedure.

doi:10.1017/S0022215116003133

Mastoid Obliteration (R741)

ID: 741.3

The Bony Obliteration Tympanoplasty Technique in cholesteatoma Management

Presenting Author: **Erwin Offeciars**

Erwin Offeciars¹, Joost van Dinther², Jean-Philippe Vercreyusse², Andrzej Zarowski², Thomas Somers²

¹European Institute for ORL - Sint-Augustinus Hospital, ²European Institute for ORL, Sint-Augustinus Hospital

Learning Objectives: 1. To share the long term results of our bony obliteration tympanoplasty technique in primary and revision cholesteatoma cases (BOT), and in the reconstruction of unstable CWD cavities (CR-BOT). 2. To illustrate the advantages of an intact bony canal wall over CWD procedures. 3. To discuss the prerequisites for long term safety when using the BOT. 4. To advocate the use of the non-EP DW MRI sequence for the follow-up of cholesteatoma cases.

Introduction: Since the last 15 years we have used the Canal Wall Up Bony Obliteration Technique (CWU-BOT) in 87% of our cholesteatoma cases. The BOT preserves the bony CW and closes the tympano-attical barrier and posterior tympanotomy with sculpted cortical bone. After removal of all diseased soft tissue and bone, the antro-attico-mastoid space is completely obliterated with healthy bone pâté. The middle ear is reconstructed using a tympano-ossicular allograft, including the malleus handle, which acts as the anchor point for columellar reconstruction to the stapes with a remodelled allograft incus or malleus.

Methods: We report on the long term outcome of 2 series of consecutive cases operated on by a single surgeon (EO). The first series comprises 34 paediatric cholesteatoma cases, followed up for at least 5 years without drop-outs. Control for residual disease was done by non-EP DW MRI (100%) at 1 and 5 years post-op. Control for recurrent disease was done by yearly micro-otoscopic evaluation. We compare the outcome with a similar series, previously operated by the same surgeon, using identical dissection and reconstruction techniques, however without bony obliteration. As such, we evaluate the contribution of the BOT factor to long term safety (prevention of recurrence).

The second series comprised 50 unstable CWD cavities surgically restored by means of the BOT, and followed up for a mean of more than 8 years. Control for residual disease was done by a combination of staging (the early cases) and non-EP DW MRI (76%). Control for recurrent disease was done by yearly micro-otoscopic evaluation.

Results: We report on recurrence rate, residual rate and anatomical/hygienic outcome.

In the paediatric series the 5 year recurrence rate was 5.8% (2 cases). The residual rate was 2.9% (1 case). At 5 years post-op all patients reported 0% otorrhea. The ears were waterproof in 100%. The operation rate (re-operation risk) to achieve this final result was 1.47. This re-operation rate included the revisions for the 2 residual cholesteatoma cases and for the single recurrence case, as well as secondary closure of 3 reperforations and some secondary Meatoplasty cases. The comparison with the non-BOT series showed a vast improvement of the recurrence rate, from 19.4% to 2.9%, as well as an improvement of the residual rate (from 24.3% to 5.8%).

In the cavity BOT-reconstruction series the recurrence rate was 2% (1 case). The residual rate was 2% (1 case). The long term final post-op outcome showed a dry and self-cleaning ear in 94% of the cases.

In both series there was no bone conduction loss and no facial paresis or palsy.

Conclusion: The CWU-BOT combines the advantages and avoids the disadvantages of both the CWU and CWD

technique, reconciling the long term safety aim with excellent anatomical/hygienic outcome. The long term recurrence rates have dropped significantly in our series, as well as the residual rates. The vast majority of the patients report a dry, selfcleaning and water-resistant ear in the long term. The use of non-EP DW MRI as a screening tool for residual disease has obviated the need for routine second stage surgery and provides long term safety.

For us this solves the old debate of CWU versus CWD techniques in cholesteatoma management. Since 1997 we have completely abandoned the use of CWD techniques for the management of cholesteatoma. The suppression of the paratympanic cell system by complete bony obliteration seems to favourably influence the behaviour of the biologically unstable middle ear and its mucosal lining. The careful reconstruction of a solid bony partition between the mastoid and attic space on the one hand and the ear canal and tympanic cavity on the other hand seems to limit the effect of the pathological biological behaviour of the canal skin.

doi:10.1017/S0022215116003145

Free Papers (F742)

ID: 742.1

External Ear Otalgia treated with Subcutaneous Methylprednisolone Acetate injections – a novel case series

Presenting Author: **Paula Coyle**

Paula Coyle, Clair Saxby, James Quinn
Lister Hospital

Learning Objectives: To show delegates a novel way of treating neuralgic external ear otalgia.

Introduction: Steroids are used in other specialities such as orthopaedics and anaesthetics for pain relief. It is felt that corticosteroids reduce pain by inhibiting prostaglandin synthesis which reduced inflammation and tissue oedema by stopping the reduction in tissue vascular permeability. They have also been shown to reduce spontaneous discharge in an injured nerve with reduced neuropathic pain. Steroids are in all ENT department as we use them regularly to help with other symptoms such as hearing loss and vertigo. We present five cases where steroids were used for neuralgic otalgia of the external ear over a year period in an ENT Clinic in a UK district general hospital.

Method: Usual causes of otalgia which can be varied and sinister had to ruled out with full history taking, examination including otoscopy and flexible nasendoscopy. Any further imaging needed was decided on a case by case basis. Patients were examined by the consultant under the microscope. The location of pain on the pinna or external auditory canal was tested by pressing the areas with the speculum or wax hook. Patients were verbally consented and subcutaneous Methylprednisolone Acetate in the form of Depo-Medrone 40 mg/ml was injected into the area. The patient's notes were reviewed and symptoms pre-procedure and post-procedure reviewed and assessed.

Results: Patients all had an improvement on their pain score. Most needed repeated treatment, but were grateful for the temporary relief.

Conclusion: To our knowledge this treatment has not been used in ENT before for managing otalgia. We have had great success with it with small patient numbers and over a short time period. It is easy, safe and practical in perform in the clinic room. We would conclude that large patient numbers and research is needed to assess the reliability, cost analysis and predictability of this procedure in the short and long term.

doi:10.1017/S0022215116003157

Free Papers (F742)

ID: 742.2

Chronic suppurative otitis media in adult cochlear implantation: a review of our experience

Presenting Author: **Nina Mistry**

Nina Mistry¹, Jeyanthi Kulasegarah², Rupan Banga², Christopher Coulson², Peter Monksfield², Konstance Tzifa², Andrew Reid², Richard Irving²

¹University Hospitals Birmingham NHS Foundation Trust, ²University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK

Learning Objectives:

- Importance of the prompt treatment of CSOM post-CI.
- Recognition of surgical factors when performing CI to minimise the potential for future CSOM development: avoiding or correcting damage to posterior canal wall and annulus.
- In cases of pre-existing CSOM, steps should be taken to treat the disease and prevent recurrence.

Chronic suppurative otitis media (CSOM), with or without the presence of cholesteatoma, may occur following cochlear implantation. At present, however, there is paucity of published data regarding the incidence and management of CSOM in adult cochlear implant (CI) recipients. Here we describe our experience of treating these patients and discuss important lessons learnt.

Details of all CI recipients who underwent procedures for CSOM from January 2001 to December 2015 were identified. Information regarding the patient's case history, type and timing of the surgical procedure, post-operative complications and CI use were collected.

Results: Eight CI patients with CSOM were identified (1.18% of patients undergoing CI during this period). The mean age at initial CI was 53 years. Two patients were identified as having pre-existing CSOM prior to CI and underwent simultaneous procedures. In the other 6 patients, CSOM developed post-CI with the main symptom being chronic otorrhoea. The mean time interval between CI and CSOM surgery was 5.6 years (range 3–11 years).

Treatment included explant and blind sac closure, with re-implantation in 3 cases. One case of extensive cholesteatoma required a subtotal petrosectomy. Of the 8 patients, 4 patients required an average of 3 further procedures (range 2–5) to treat continuing CSOM symptoms. Implant outcomes were as follows: original CI retained and in use, n = 1; bilateral CI and use of contralateral non-affected side, n = 4; re-implantation and use of CI on affected side, n = 3.

Conclusions: CSOM can occur, often several years, following CI. Recognition of symptoms together with prompt treatment may allow retention of the original CI and prevent further complications and multiple procedures. CSOM noted preceding CI should be treated adequately prior to or at the time of implantation and steps taken to prevent the recurrence of disease.

doi:10.1017/S0022215116003169

Free Papers (F742)

ID: 742.3

Key factors for developing a Successful UK-Surgical Ear Implant Registry

Presenting Author: **Rishi Mandavia**

Rishi Mandavia¹, Peter Littlejohns², Anne Schilder¹

¹Ear Institute, University College London,

²Kings College London

Learning Objectives:

Introduction: Hearing loss has a major social, mental and financial impact worldwide. This impact is set to increase with our ageing population. Industry are targeting this with an increasing range of surgically implanted hearing devices. There is currently no UK registry capturing data on these devices. In the absence of such data it is difficult to reflect on practices and monitor clinical and cost-effectiveness. Establishing such a registry faces several challenges. We aim to identify the requirements for establishing a successful UK-surgical ear implant registry.

Methods: We performed a systematic review adhering to PRISMA recommendations. Articles were included if they described UK-surgical registry design, development, or provided critical analysis of a surgical registry.

Results: 48 studies were included. The major challenges encountered by registries included: poor rates of data completion, difficulty in securing funding and registry maintenance.

Recommendations included: datasets be selected following stakeholder consensus meetings; datasets be flexible and quick to complete; registry participation should be compulsory; the registry should be useful for clinicians and easy to use; data should undergo rigorous processing and cleaning; patients should be involved in registry development and be able to access and input their own data.

Funding sources included industry, participating hospitals, professional societies, and research grants.

Conclusion: This study provides an overview of the key requirements for successful UK-surgical registry development based on previous registry experiences. Our future plans are to conduct stakeholder interviews and patient focus groups to further inform the development of a successful UK-surgical ear implant registry.

doi:10.1017/S0022215116003170

Free Papers (F742)

ID: 742.4

Successful Loading of a Bone Anchored Hearing Implant One Week After Implantation - Stability Measurements and Soft Tissue Reactions

Presenting Author: **Morten Høgsbro**

Morten Høgsbro¹, Lars Vendelbo Johansen², Andreas Agger²

¹Aalborg University Hospital, Aarhus University Hospital, ²Aarhus University Hospital

Learning Objectives: Potential clinical implications of early loading of a bone anchored hearing implant. How to evaluate stability and soft tissue reactions of a bone anchored hearing implant. Results from a clinical study of early loading of a bone anchored hearing implant.

Objectives: To assess implant stability and safety of loading a bone anchored hearing implant one week after surgery. To evaluate post-operative skin complications of a bone anchored hearing implant abutment coated with hydroxyapatite.

Design: Single centre, prospective cohort study of 25 adults with normal skin and bone quality, approved by danish health authorities.

Intervention: Implantation of the Baha BA400 implant system using a linear incision technique without skin thinning. Abutment lengths of 8 mm, 10 mm and 12 mm were used.

Outcome measures: Implant Stability Quotient (ISQ) (primary) and soft tissue evaluation (Holgers grade, skin overgrowth, pain, numbness) (secondary) at 0, 7, 14, 30 days and 3, 6 and 12 months.

Results: 25 patients were included, 23 could be followed up for one year. Mean ISQ was increasing with no sign of adverse influence from the early loading. No implants were lost or clinically unstable. Individual ISQ curves fall in two categories: continually increasing ISQ or increasing ISQ with initial dip. 93.8% of all visits resulted in a Holgers Grade 0 or 1. Skin overgrowth occurred in 2.1% of all visits. Pain was none or mild in 97.9% of all visits. For all visits there was no (95.8%) or mild (4.2%) numbness around the implant. Within the first month of follow-up there was a significantly higher score for the Holgers Grade ($p = 0.005$, Mann-Whitney U-test) and significantly more pain ($p = 0.01$, Mann-

Whitney U-test) compared with the previous generation implant.

Conclusion: Loading of the implant system 1 week after surgery has been successful for 25 patients with normal bone quality followed up for one year. No implants were lost. All individual ISQ were increasing throughout the study period, although some showed an initial ISQ dip. Soft tissue reactions around the hydroxyapatite coated abutment were generally mild and tolerable but elevated in the first month of follow-up compared with the previous generation implant.

doi:10.1017/S0022215116003182

Free Papers (F742)

ID: 742.5

A Review of Paediatric Bone Anchored Hearing Aid (BAHA) use in Chronic Otitis Media (COM)

Presenting Author: **Nicholas Dawe**

Nicholas Dawe¹, Denise Leese², Suzanne Marley², Kate McPherson², Ian Johnson²

¹Freeman Hospital, Newcastle upon Tyne,

²Newcastle BAHA Programme, Freeman Hospital, Newcastle upon Tyne

Learning Objectives: BAHA placement in paediatric cohorts with COM is a viable option following trial of soft band device. Medium and longer-term concordance with the device demonstrates tolerance and acceptability in carefully selected paediatric patients.

Introduction: Bone anchored hearing aids (BAHA) are an accepted treatment alternative for patients with hearing loss associated with chronic otitis media (COM). Reports of BAHA use and outcomes in paediatric cohorts, with conductive or mixed hearing loss, in the context of COM, are limited. We present long-term follow-up data for paediatric patients undergoing BAHA at a large tertiary referral centre.

Methods: Retrospective case series.

Cases identified from a prospectively maintained database of paediatric cases (under 18 years at first fitting), performed over a 10-year period (2003–2013).

Results: 180 consecutive paediatric surgical cases were reviewed. 16 patients were identified as having undergone BAHA placement for COM hearing rehabilitation. 69% were female, and one had associated Down's syndrome. Median age was 14 years (mean 12.7 years) and ranged from 4 to 17 years old at first fitting.

43.8% of placements were bilateral. Median duration of follow-up was 64 months (range 19–150 months). One patient requested removal of bilateral abutments at seventeen months follow-up. The remaining cases were continuing to use their implant regularly in

the medium to longer-term. There were no adverse surgical outcomes.

Conclusions: In this unselected case series, the use of BAHA in patients with COM has been demonstrated to be safe, well-tolerated and reliable method of hearing rehabilitation demonstrated by patient concordance at medium to longer-term follow-up.

doi:10.1017/S0022215116003194

Free Papers (F742)

ID: 742.6

Management of Chronic Otitis Media for Cochlear Implantation and Other Implantable Devices.

Presenting Author: **Robert Briggs**

Robert Briggs¹, Alice Stringer¹, Henrik Smeds²

¹University of Melbourne, ²Karolinska University, Sweden

Learning Objectives:

The presence of Chronic Otitis media presents a significant management challenge in patients who are candidates for, or who have, a Cochlear Implant or other Implantable Hearing device. Permanent eradication of middle ear disease, including cholesteatoma and infection, is required together with reconstruction to provide robust cover of the implanted device or secure separation from the external environment. This can be achieved with either staged or primary surgery depending on the nature and extent of the chronic otitis media. Procedures include: routine Tympanoplasty with or without Intact Canal Wall Mastoidectomy; Blind Sac Closure of the external auditory canal with removal of all squamous epithelium from the canal, tympanic membrane and middle ear cleft, with or without obliteration of the mastoid or plugging of the Eustachian tube.

This paper presents an algorithm for the management of such cases based on the Melbourne Cochlear Implant Clinic experience and provides an overview of the aims and surgical techniques utilized in patients with Chronic Otitis Media for the eradication disease and creation of safe stable ears with Cochlear Implants and various other implantable devices.

doi:10.1017/S0022215116003200

Classification of Cholesteatoma (N743)

ID: 743.1

The ChOLE-Classification. A proposal from the Swiss Otology Committee

Presenting Author: **Thomas Linder**

Thomas Linder¹, Nue Milici¹, Shankar Shah²

¹Luzerner Kantonsspital, ²Luzerner Kantonsspital, ENT Fellow

Learning Objectives: Competing surgical techniques and new modes of ossiculoplasties necessitate the uniform classification of cholesteatomas worldwide. We present a ChOLE staging system based on the extension, ossicular chain involvement, complications and pneumatization & ventilation of the temporal bone.

Competing surgical techniques and new modes of ossiculoplasties necessitate the uniform classification of cholesteatomas worldwide. Whereas the pathogenesis remains a topic of debate, the extent of middle ear & temporal bone cholesteatomas should be determined and the involvement of the ossicular chain verified. Intra- and extracranial complications are rare in well-developed countries, but challenge surgeons in more remote areas. The extent of pneumatization and ventilation of the temporal bone implicating the function of the Eustachian tube are frequently discussed, but have never been thoroughly addressed. Our ChOLE-Classification condenses Ch for cholesteatoma extension, O for ossicular chain status, L for Life threatening complications and E for Eustachian tube function. We present our experience with a retrospective review of 100 consecutive patients and a 9.5 years follow-up.

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Classification of Cholesteatoma (N743)

ID: 743.2

First Experience with the ChOLE Classification in Combination with a QoL questionnaire

Presenting Author: **Christof Rösli**

Christof Rösli¹, David Baechinger², Alex Huber²

¹University Hospital Zurich, ²Department of ENT, Head and Neck Surgery, University Hospital Zurich, Switzerland

Learning Objectives: A questionnaire to assess HRQoL concerning the ear was developed and compared to the score of a new classification system for cholesteatoma.

Introduction: In otology, surgical outcome is most often assessed by reporting postoperative hearing thresholds. Subjective complaints are not always and systematically reported, although several patient-reported outcome measure exist for chronic otitis media. However they lack certain relevant symptoms concerning the ear a health-related quality of life (HRQoL).

Methods: A new questionnaire for comprehensively measuring HRQoL was developed and an electronic application was chosen to facilitate and accelerate data analysis. In a first step, it was tested in a cohort (n = 85) and the number of questions was reduced from 33 to 21 using sequential statistical analysis. Then the adjusted questionnaire was validated in a second cohort (n = 76). Finally, the validated questionnaire was tested in a cohort of patients with Otitis media cholesteatomatosa preoperatively and up to 3 months postoperatively

to compare HRQoL to characteristics of the cholesteatoma defined by a newly developed classification of cholesteatoma (ChOLE).

Results: Statistical analysis allowed a reduction of questions from 33 to 21. Validation revealed a Cronbach's α of 0.91, indicating excellent internal consistency. Moreover, the questionnaire was able to discriminate between patients with chronic otitis media and healthy participants ($p < 0.0001$), thus possessing good discrimination validity. Finally, first experience comparing HRQoL assessed by the questionnaire with stage of disease defined by the ChOLE classification showed good correlation.

Conclusions: Sufficient information on reliability and validity of the questionnaire was obtained. It can be applied to quantify HRQoL in patients with cholesteatoma and shows good correlations to the ChOLE classification.

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Chronic Ear Diseases in developing world (R744)

ID: 744.1

Developing Complex Ear Surgery in Malawi

Presenting Author: **David Strachan**

David Strachan¹, Wakisa Mulwafu²

¹Bradford Royal Infirmary, ²Queen Elizabeth Hospital, Blantyre, Malawi

Learning Objectives: To understand the challenges and difficulties in developing an otology service in one of the world's poorest countries. To reflect on the help that can be provided from more developed countries.

Malawi is one of the world's poorest and least developed countries. It has a population of 16 million, with over half living below the poverty line. Life expectancy is little over 50 years with 1 in 8 children dying before the age of five. The main health burden in Malawi is HIV (10% of the population are HIV positive) along with tuberculosis and malaria, which together account for 40% of hospital deaths.

The rate of chronic ear disease is unknown due to lack of trained clinicians and difficulties in diagnosis however the population is twice as likely as those in Europe to be born with, or develop, hearing loss. Untreated ear disease is one of the causes of such loss.

The co-author is one of only two ENT surgeons in the whole country and the presenting author visited Malawi as part of a sabbatical in 2013. It was evident during this visit that whilst the infrastructure was being slowly developed there was a complete lack of expertise and equipment to carry out any complex otological surgery. With the support of various charitable organisations and associated industry the visit subsequently led to four cochlear implants being successfully implanted on 2 separate visits to Malawi.

Due to these developments the facilities are now such that future plans are in place to carry out regular weeks of otological surgery alongside developing a CI programme. These weeks will facilitate the short term aim of training Malawian (non-medical) clinical officers in

the diagnosis and treatment of ear disease as well as the longer term aim to identify and train a Malawian otologist. The project has also raised awareness of deafness in Malawi and has highlighted the significant public health issues relating to the aetiology of ear disease and deafness in 3rd world countries.

As well as addressing the practical and ethical issues relating to the project the presentation will outline future plans in developing both implant and otological surgery in Malawi and southern Africa.

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Chronic Ear Diseases in developing world (R744)

ID: 744.2

What do we know about the burden of cholesteatoma in the developing world and what strategies could help

Presenting Author: **Michael Smith**

Michael Smith

International Nepal Fellowship

Learning Objectives: Understanding the burden of cholesteatoma in the developing world. Consideration of optimum management strategies in resource poor settings.

Chronic Otitis Media and its effects include hearing loss, reduced Quality of Life (QoL) and life threatening complications. These are major public health problems in developing countries. Many reviews include data from small or old studies and make generalisations that may now be inaccurate. The prevalence of cholesteatoma in most developing countries is unclear. It appears to be less frequent in some populations such as parts of Africa and S America, but much commoner in others such as SE Asia. Understanding of Otitis Media and COM has taken major steps forward in recent years. Risk factors and causes are generally agreed, but those specifically for cholesteatoma are less clear, in a developing country context. Some factors are amenable to targeted public health and primary care interventions and some countries have seen reducing incidence of COM and its complications. Prevalence studies of COM rarely distinguish between types of COM such as mucosal central perforations and cholesteatoma. Often the skills and materials required for diagnosis are lacking in under resourced health systems. Most agree that the treatment of cholesteatoma requires surgery. The complications of cholesteatomatous COM are usually considered more severe than mucosal COM. Both can be life threatening and many cases of 'safe' COM can also benefit from surgery. In poor resource settings with few specialists, how can patients be identified and surgery delivered? Do out reach camps play a useful part? Extensive disease is common and late stage, often worse than commonly seen by specialists from developed centres. What forms of surgery are most cost effective and safe to teach? Can developed nations partner in the development and training of local specialists?

After over 30 years experience in such settings, principally in Nepal I hope to open up some of these questions.

doi:10.1017/S0022215116003248

Chronic Ear Diseases in developing world (R744)

ID: 744.3

The impact of chronic otitis media on quality of life

Presenting Author: **Robin Youngs**

Robin Youngs¹, Edward Maile², Puran Tharu³, Hannah Blanchford⁴, Rachel Edmiston⁵

¹Gloucestershire Hospitals NHS Foundation Trust, ²Harvard University, ³Britain Nepal Otolaryngology Service (BRINOS), ⁴ENT Department, Darlington Memorial Hospital, ⁵University Hospital of South Manchester

Learning Objectives: To present quality of life issues in chronic otitis media, including the impact of corrective surgery. This study focuses in chronic otitis media in a developing world setting.

Hearing impairment is a significant burden in the developing world. However, no suitable quality of life (QoL) measures exist for use in Nepal. We aimed to amend and translate the Glasgow Health Status Inventory (GHSI), assessing QoL at any given time, and the Glasgow Benefit Inventory (GBI), assessing change in QoL following intervention, into Nepali and to assess the impact of ear disease and effect of surgery on QoL.

The GHSI and GBI were translated into Nepali and independently verified. The GHSI was administered by interview to patients before surgery, and the GBI was administered 6 months after surgery. The Mann–Whitney U-test was used for hypothesis testing.

The GHSI was administered to 242 patients. In total, 205 had chronic suppurative otitis media (CSOM) without cholesteatoma and 37 had cholesteatoma. The mean GHSI score was 47.9.

There was no significant difference in GHSI scores between patients with CSOM without cholesteatoma and those with cholesteatoma. The GBI was administered to 161 patients, 73 of whom had also been in the GHSI group. In total, 130 had CSOM without cholesteatoma, 31 had cholesteatoma. The mean GBI score was + 38.4 with no significant difference between disease groups.

Conclusions: Ear disease in Nepal is associated with reduced QoL, and surgical intervention is associated with improved QoL. There is no difference in QoL or benefit following surgery for CSOM between patients with or without cholesteatoma. There are few QoL measures suitable for the developing world. It is essential to invest in these measures to guide health interventions.

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Chronic Ear Diseases in developing world (R744)

ID: 744.4

Chronic Ear Diseases in The Developing World

Presenting Author: **Mohan Kameswaran**

Mohan Kameswaran

Madras ENT Research Foundation (P) LTD

Learning Objectives: There is a high prevalence of chronic ear disease in the developing world. Poverty, lack of awareness regarding the importance of treating ear diseases and long distances are factors which result in late presentation with advanced disease. Tuberculous otitis media is also common in the Indian subcontinent, the hallmark being atypical presentation, severe hearing loss and early complications. TBOM can co-exist with cholesteatoma. This presentation will focus on the challenges in the management of chronic ear diseases in the developing world.

There is a high prevalence of chronic ear disease in the developing world. Poverty, lack of awareness regarding the importance of treating ear diseases and long distances are factors which result in late presentation with advanced disease. Tuberculous otitis media is also common in the Indian subcontinent, the hallmark being atypical presentation, severe hearing loss and early complications. TBOM can co-exist with cholesteatoma. This presentation will focus on the challenges in the management of chronic ear diseases in the developing world.

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Chinese experiences in management of chronic otitis media and cholesteatoma (N745)

ID: 745.1

Petrous bone cholesteatoma: transmastoid endoscopic surgery or Infratemporal fossa approach Type B

Presenting Author: **Zhiqiang Gao**

Zhiqiang Gao

Peking Union Medical College Hospital

Six difficult petrous bone cholesteatoma patients will be demonstrated which are divided into two groups according to the surgical methods. Three of them were performed transmastoid endoscopic approach and another three cases infratemporal fossa approach Type B. All the six cases achieve satisfied outcomes with follow-up. All these six cases related with the apical area where we think would be better be eliminated through the infratemporal fossa approach Type B or transmastoid together with the endoscopy. The former one can acquire the best exposure by inferiorly dis-joint the temporomandibular joint which do not cause subsequent mastication problems and have little influence on patients' appearance. The latter one, with the advancement of the surgical instruments such as the endoscopic, can also realize the surgical purpose which means to radical eliminate the lesion especially that medially to the otic capsule. At the same time, endoscopic have obvious advantages of function preservation for specially cases.

In conclusion, we'd better focus more on the lesion and the way to reach to and radical removal of them and should not be limited by any approach. Exposure, radical exenteration, adequate exteriorization, we recommend, are the basic principles for the temporal bone and lateral skull base surgeries include the PBC surgery. Even with the help of endoscopy, a radical exteriorized mastoid cavity

is always required for a best exposure. With the development of the instruments and equipment, so manipulation may be changed, the principle will be go on.

doi:10.1017/S0022215116003273

Chinese experiences in management of chronic otitis media and cholesteatoma (N745)

ID: 745.2

Our experience of ossiculoplasty in chronic otitis media and cholesteatoma

Presenting Author: **Hao Wu**

Hao Wu¹, Jun Yang², Qi Huang², Zhaoyan Wang², Zhihua Zhang²

¹Shanghai Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine; Ear Institute, Shanghai Jiao Tong University School of Medicine, ²Department of Otolaryngology Head & Neck Surgery, Xinhua Hospital Shanghai Jiaotong University School of Medicine, Shanghai Key Laboratory of Translational Medicine on Ear and Nose diseases, Ear Institute Shanghai Jiaotong University, Shanghai, China

Learning Objectives:

Objectives: The aim of this study was to demonstrate our experience of ossiculoplasty using either partial ossicular replacement prosthesis (PORP) or total ossicular replacement prosthesis (TORP) in patients with chronic otitis media with or without cholesteatoma.

Methods: Five hundred seventy-three patients presenting chronic otitis media with or without cholesteatoma underwent ossiculoplasty from January 2001 to December 2014. A PORP is used when the stapes superstructure is intact. Conversely, a TORP is used if the superstructure is absent. The footplate of all patients was present and mobile. Audiometric results included ABG, closure of ABG, achievement of ABG ≤ 20 dB, and stability over time. The association between air-bone gain and age, ossiculoplasty material, preoperative diagnosis (chronic otitis media without cholesteatoma, cholesteatoma), and type of surgery (tympanoplasty, canal wall-down mastoidectomy, or canal wall-up mastoidectomy) was explored using regression analysis. Short-term results were analyzed within 6 months after surgery and long-term results were analyzed ≥ 12 months after surgery.

Results: There were 372 PORPs and 201 TORPs in our series. Overall, mean postoperative ABG was 18.5 dB at short-term and 21.7 dB at long-term follow-up ($p > 0.05$). And closure of ABG was 11 and 8 dB, respectively ($p > 0.05$). 74% of patients in PORP group and 56% of patients in TORP group achieved postoperative ABG ≤ 20 dB at 6 months after surgery. At long-term auditory follow-up (12 months), 71% of patients in PORP and 50% of patients in TORP group achieved postoperative ABG ≤ 20 dB. No significant differences in hearing results were found in different ossiculoplasty material.

Conclusion: Our results indicate that ossiculoplasty provide stable and excellent hearing improvement in patients with otitis media with or without cholesteatoma. Results with PORP was better than those with TORP. Several influential factors affected the outcomes of ossiculoplasty.

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Complications in Chronic ear surgery (R746)

ID: 746.1

Management of large tegmen defects and meningoencephalic herniation following Cholesteatoma surgery

Presenting Author: **Mohamed Badr-El-Dine**

Mohamed Badr-El-Dine

Faculty of Medicine, University of Alexandria, EGYPT

Learning Objectives:

Objective: The purpose of this presentation is to highlight the importance of tegmen defects that may result following cholesteatoma and mastoid surgery and emphasize the technical details for their reconstruction.

Introduction: Despite marked decline in the incidence of complications of CSOM, life-threatening complications still exist. The presence of thinning or dehiscence of the tegmen tympani or mastoidium is fairly common in CSOM especially after mastoidectomy, but only small portion of patients will demonstrate meningo/encephaloceles and CSF leakage.

Objective: The purpose of this presentation is to highlight the importance of tegmen defects that may result following cholesteatoma and mastoid surgery and emphasize the technical details for their reconstruction.

Methods: Fourteen patients operated for surgical repair of tegmen defects associated with different degrees of meningoencephalic herniation. Surgical approaches: 1) transmastoid; 2) middle cranial fossa; and 3) combination of both approaches. The choice of approach depends on size and site of the defect, hearing level, and surgeon experience. Small tegmen defects can be managed efficiently through the mastoid approach, while large defects require combined MCF and mastoidectomy. Following extradural dissection and encephalocele reduction or resection, we use a multilayer closure for direct repair of the dural and bony cranial base defects. Concave calvarial bone cut from the temporal craniotomy flap provides excellent material for reconstruction without any impingement on ossicular chain.

Results: All patients underwent surgical reconstruction of their tegmen defects without significant intraoperative or postoperative complications. All patients exhibited normal facial function postoperatively. None of our cases required lumbar drain placement.

Conclusion: Combined MCF and mastoidectomy approach proved effective to repair tegmen and dural defects. Surgical

repair prevents progression and meningitis. Advantages of this technique are the control of the floor of the MCF and reconstruct large-size bony defects even those located anteriorly without disrupting the ossicular chain.

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Complications in Chronic ear surgery (R746)

ID: 746.2

Labyrinthine fistulas management in chronic middle ear surgery

Presenting Author: **Manuel Jesús Manrique Rodríguez**

Manuel Jesús Manrique Rodríguez

University Clinic of Navarra

Learning Objectives: Summary abstract presentation in the conference: "Complications in chronic ear surgery".

One possible complication during cholesteatoma chronic middle ear surgery is labyrinthine fistula.

In this conference titled: "Complications in chronic ear surgery" a definition and classification of labyrinthine fistulas will be showed. Then, key aspects will be addressed such as: pre-surgical diagnosis and intraoperative management.

During first section we will focus on symptoms and physical signs suspicious of a labyrinthine fistula. Additionally, special attention will be given to pre-surgical radiological testing. Such evaluation should be mandatory in order to prevent auditory and vestibular complications during surgery.

During second section attention will be addressed to surgical treatment, showing an algorithm depending on cholesteatoma location, etiology and severity of the disease.

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Complications in Chronic ear surgery (R746)

ID: 746.3

How to avoid the complications of temporal bone surgery

Presenting Author: **David Andrew Moffat**

David Andrew Moffat

Addenbrookes, Cambridge University Teaching Hospitals NHS Foundation Trust.

Learning Objectives: To teach all of the factors that increase the risk of complications of surgery to the temporal bone.

This presentation is based on the importance of the development of good and safe technique in the surgical management of patients with temporal bone disease in order to minimise the risk of complications. An outline of the principles of surgery in chronic suppurative otitis media is followed by a demonstration of the anatomy of the temporal bone by comparing a coronal cadaveric section with the corresponding coronal CT scan. The importance of temporal bone dissection, supervision and training, high resolution imaging and

facial nerve monitoring in helping to avoid complications is discussed.

The careful auditing of the surgeon's own results and their utilisation in obtaining informed consent, intellectual honesty and the ability to know when not operate are then presented. The reasons for failure to obtain a dry ear, the unsatisfactory mastoid cavity and sites where bone removal may be inadequate are considered. The preoperative discussion with the patient and the risk of specific complications and how to avoid them are outlined. Finally newer techniques such as the use of the laser and endoscopy are discussed in relation to reducing risk.

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Mastoidectomy: How I do it (2) (V747)

ID: 747.1

Long term comparison of hearing results of LASER facilitated ossicular preservation versus ossiculoplasty in cholesteatoma surgery using a patient oriented outcome measure

Presenting Author: **John Hamilton**

John Hamilton

Gloucestershire Hospitals NHS Trust

Learning Objectives: To establish how ossicular preservation with the 'gold standard' for hearing treatment in cholesteatoma surgery. To compare the resilience of these techniques over a five year period.

Intro: This study compares the long term usefulness to patients of two different techniques of hearing reconstruction after cholesteatoma surgery: reconstruction using ossicular prosthesis on top of an intact, mobile stapes versus LASER facilitated ossicular chain preservation.

Method: At the end of surgery, ears with an intact ossicular chain were allocated to one group. Ears with a disrupted chain and an intact stapes superstructure onto which an ossiculoplasty had been performed were placed in the second group. All ears had primary cholesteatoma surgery using an intact canal wall technique with the use of a fibre-guided LASER.

Hearing after surgery was assessed with the Belfast rules of thumb. Audiograms were performed annually after surgery until the patient was discharged from regular follow-up or defaulted from follow-up.

The two sets of Belfast scores were assessed using survival analysis. The two groups were compared with the log-rank test.

Cox's model was used to investigate confounding influences.

Results: 80 ears with intact chains and 69 with an intact stapes and ossiculoplasty were included.

By five years, 76 per cent of patients with intact chains retained normal hearing, whilst 56 per cent in reconstructed ears.

Log-rank analysis gives $\chi^2 = 10.6$, $n = 1$, $p = 0.001$.

The intact ossicular chain (odds ratio: 2.78, CI 1.51–5.07, $p = 0.001$) and lower bone conduction hearing threshold (odds ratio: 1.1 per decibel, CI 1.07–1.13, $p < 0.001$) predicted the likelihood of maintaining socially useful hearing. A weaker effect of younger age (odds ratio 1.02, CI 1.00–1.04, $p = 0.04$) increasing the likelihood of loss of useful hearing was also detected.

Conclusions: Whenever the presentation permits, LASER facilitated preservation of the intact ossicular chain provides more durable useful hearing for our patients than 'gold standard' ossiculoplasty.

There is a gradual deterioration in outcomes in both groups which is more marked in the ossiculoplasty group.

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Mastoidectomy: How I do it (2) (V747)

ID: 747.2

Bone Obliteration technique in recidivistic cholesteatoma

Presenting Author: **Manoj M P**

M P Manoj

Mesiarc

Learning Objectives: Video presentation on the technique of using bone pate and Cortical bone chips for reconstructing the cavity in recidivistic cholesteatoma.

Introduction: Recidivistic cholesteatoma presents a serious surgical challenge. The demands to the surgical team is high- we are supposed to remove disease, improve hearing and give a dry, self cleansing ear. At our institute where we deal with a large amount of recidivistic cholesteatomas, the bone obliteration technique with scar tissue graft has helped us to give a fair result to most of our patients. The video demonstration is designed to give a step by step demonstration of the technique used in over a hundred cases over the past four years.

Methods: The case series is from a tertiary care otologic center in South India, all operated by a single surgeon, under general anesthesia. Standard post auricular method is adopted, with harvesting of the scar tissue graft initially, bone chips from the cortical bone and collection of bone pate by an indigenously developed apparatus. After a complete canal wall down mastoidectomy and removal of disease, the cavity is obliterated with bone pate mixed with antibiotic solution, and covered with the cortical bone chip carefully harvested. The middle ear is reconstructed with cartilage and grafted over with the dried and thinned out scar tissue. Ossiculoplasty is either performed at the same sitting or staged according to the disease.

Results: We have achieved the objectives of a dry, self cleansing mastoid cavity in a large majority of cases with acceptable hearing. Hearing results have been poor where the stapes superstructure was absent where staged ossiculoplasty was often performed. The number of post operative visits also were minimal with this technique.

Conclusions: The bone obliteration technique combined with scar tissue and cartilage grafting saves time and effort in giving a dry and clean ear after recidivism. Most of the problems in a wet mastoid cavity are solved with this technique.

Learning Objectives: the video presentation gives a clear demonstration of the technique to be adopted by surgeons handling recidivism.

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Update on bacteriology and the role of biofilms in chronic otitis media (K753)

ID: 753.1

Bacterial Biofilms & Chronic Otitis Media: Stuck in the middle

Presenting Author: **Luanne Hall-Stoodley**

Luanne Hall-Stoodley
The Ohio State University

Otitis media is a multifactorial disease, a result of complex host-microbial interactions. Understanding the pathogenesis of chronic otitis media (COM) is crucial for improving therapies. Direct detection of aggregated adherent otopathogenic bacteria on middle ear mucosal biopsies from children with COM demonstrated that biofilms were consistent with an infectious etiology in spite of culture-negative clinical data. This seminar will provide an overview of how biofilms contribute to chronic infections like COM, including problems in diagnosing the infectious agent in the polymicrobial context of the upper airway, the challenges of treatment and new therapeutic approaches on the horizon.

doi:10.1017/S0022215116003340

Biomaterials in middle ear reconstruction (R761)

ID: 761.1

Use of bone substitutes in mastoid obliteration

Presenting Author: **Daniele Bernardeschi**

Daniele Bernardeschi
Pitié-Salpêtrière Hospital

The purpose of this communication is to describe the indications, surgical technique and anatomical and function results of the mastoid and epitympanic obliteration using bone substitutes. This technique employed in our department since 2006, encompasses the use of synthetic biomaterials for the obliteration of mastoid and epitympanic spaces. Granules of biphasic ceramic have been used up to 2012 (n = 130) and, since 2013 (n = 74) we are using bioactive glass S53P4. Differences in composition and mechanism of action will be detailed, with particular attention to the antibacterial activity of the bioactive glass S53P4.

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Biomaterials in middle ear reconstruction (R761)

ID: 761.2

SerenoCem™ - glass ionomeric granules in mastoid obliteration, a hidden problem!

Presenting Author: **Ian Bottrill**

Ian Bottrill
John Radcliffe Hospital, Oxford

Introduction: A common problem with canal-wall down mastoidectomy procedures is a discharging cavity. Many techniques for mastoid obliteration to reduce the cavity size have been described. Different biomaterials have been tried on the basis that they should be non-resorbable, non-reactive and integrate. This study aimed to assess the effectiveness of SerenoCem granules, a glass ionomeric cement, as a suitable biomaterial for mastoid obliteration and to review its longterm effects.

Methods: 16 patients with chronically discharging mastoid cavities were selected for mastoid obliteration. The subsequent procedures were performed between 2001 and 2003. The two main outcome measures were the number of attendances for aural care and the Glasgow Benefit Inventory (GBI). A secondary measure was the comparison of pre- and post-operative hearing thresholds. These patients were assessed in 2006 providing a minimum of 3 years follow up. As a result of recent chance finding following late revision surgery, a further review of implanted patients was undertaken in 2015/16.

Results: The need for aural care reduced in all but one patient. There was a significant difference in the number of aural visits pre and post operation. Benefit in quality of life was assessed using the GBI. In only one patient was there a negative score. The mean values indicate that there has been a positive benefit in quality of life. Complete pure tone average results were available for 13/16 patients. In 8/13 patients the hearing was improved, as intended by additional ossiculoplasty procedures. Of importance a reduction of hearing was noted in only 5 patients, the worst of which was 7.5 dB for the 4-tone average.

Conclusions: The initial results of this technique were promising, however, the recent chance review of one of these patients showed the granules may be inducing bone lysis in. All patients have been reviewed and the results will be presented.

doi:10.1017/S0022215116003364

Biomaterials in middle ear reconstruction (R761)

ID: 761.3

Titanium in mastoid reconstruction

Presenting Author: **Konrad Schwager**

Konrad Schwager
Klinikum Fulda, Philipps University of Marburg - Campus Fulda

After cholesteatoma removal reconstruction of the canal wall is often necessary. There are several options. Autogenic tissue is first line, but cortical bone and the reimplantation of the posterior canal wall have doubtful results. Due to its bradytrophic nature cartilage has been used successfully in tympanoplasty and with its stability it is a well-established tissue for the reconstruction of the posterior wall. But adhesion forces in the diseased middle ear can cause retraction into the mastoid cavity. Amongst all different types of biomaterials titanium is one of the most accepted foreign materials. A titanium mesh can be formed into a "cage" to rebuild the mastoid and not only the posterior wall. This cage is covered with cartilage plates and chips. Nutritional support reaches the cartilage through the openings of the mesh. Wound healing and epithelialization are shown to be uneventful. The advantage of the cage over a pure canal reconstruction seems to be the anatomical restoration of the mastoid. Results show no exposure of the titanium construction, good epithelialization and acceptable functional results. Interestingly there is a notable risk of cholesteatoma recurrence in the former epitympanum at the typical place of cholesteatoma origin. In cases when major reconstruction is needed and an open cavity (radical cavity) is still not indicated, the mastoid reconstruction using a titanium cage is a good option in cholesteatoma surgery.

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Biomaterials in middle ear reconstruction (R761)

ID: 761.4

Tissue-reengineered bFGF-Repair of Chronic Tympanic Membrane Perforations

Presenting Author: **Gunesh Rajan**

Gunesh Rajan¹, Aanand Acharya², Harvey Coates²

¹*School of Surgery, University of Western Australia,* ²*TBC*

Background: In 2009, Kanemaru described a new concept of a minimally invasive tympanic membrane repair utilising bFGF (basic fibroblast growth factor), fibrin glue (Tisseel) and a gelatin foam (Gelfoam) scaffold. He recently published a 98% success rate using this technique on 53 patients. We report on our early experiences using his concept in adult and paediatric patients in Western Australia.

Objectives: To describe the scientific background and technique for regenerating the tympanic membrane of patients with chronic perforations utilising the tissue growth factor method devised by Kanemaru, and to report on the pilot study in Australia to validate and prove the safety of the Kanemaru technique.

Method: Adult and paediatric patients with chronic, dry tympanic membrane perforations undergo otoscopic and audiologic assessment to assess candidacy for the trial. After inclusion, the patients undergo the repair, which involves freshening of the perforation followed by the insertion of a gel foam plug soaked with genetically engineered bFGF;

the gel foam plug is then covered by commercially available fibrin glue (tisseel) to provide a waterproof seal. The tympanic membranes and their healing are monitored otoscopically and audiologicaly at one, two, four, eight and twelve weeks after the repair.

Results: 60 patients enrolled in the study, 88% attained a perforation closure with a 3-layered neotympanone and audiological improvement of hearing. Failures were related to postoperative water exposure; pre-existing middle ear infection and URTI post procedure. Mean operating time for the paediatric patients was six minutes (range three to ten minutes) under general anaesthetic and seven minutes in the adult patients (range four to ten minutes) under local anaesthetic.

Conclusion: The outcomes of the pilot study are promising with regard to closure rates, hearing outcomes and operating times. The advantages of this procedure are that it avoids invasive incisions, is possible in the majority of tympanic membrane perforations and is a short five to ten minute procedure. The next phase involves combining the bFGF with various scaffolds and compare outcomes and cost-efficiency.

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Free Papers (F762)

ID: 762.1

A multi-center randomized controlled trial of soft tissue preservation using a hydroxyapatite-coated abutment in percutaneous bone conduction hearing implant surgery – 1-year clinical outcomes

Presenting Author: **Marc van Hoof**

Marc van Hoof¹, Stina Wigren², Johan Ivarsson Blechert², Manuela Joore¹, Mattias Molin³, Janny Hof¹, Joost van Tongeren¹, Jan Wouter Brunings¹, Lucien Anteunis¹, Maria Ines Rincon Piedrahita⁴, M.P. Martinez-Beneyto⁴, D.J.M. Mateijsen⁵, S.J.H. Bom⁶, O. Deguine⁷, A.J.M. van der Rijt⁸, J. Marco Algarra⁴, R.J. Stokroos⁹

¹*MUMC+*, ²*Cochlear Bone Anchored Solutions AB*, ³*Statistiska Konsultgruppen, Göteborg, Sweden*, ⁴*ENT department, Clinical University Hospital, Valencia, Spain*, ⁵*ENT department, Catharina Hospital, Eindhoven, The Netherlands*, ⁶*ENT department, Deventer Hospital, Deventer, The Netherlands*, ⁷*ENT department, Purpan Hospital, Toulouse, France*, ⁸*ENT department, Amphia Hospital, Breda, The Netherlands*, ⁹*Maastricht University Medical Center, School for Mental Health and Neuroscience (MHENS), Department of ENT, Maastricht, The Netherlands*

Learning Objectives: To become aware of the clinical differences of soft tissue preservation surgery with a HA-coated abutment in comparison to the outcomes using the conventional technique.

Introduction: Soft tissue preservation using a hydroxyapatite-coated abutment may lead to a reduction in complications in percutaneous bone conduction hearing implant surgery. In this open multi-center, randomized(1:1), controlled clinical trial, eligible subjects were assigned to receive the conventional intervention, a titanium abutment (Cochlear™ Baha® BA300) with soft tissue reduction, or a new intervention, a hydroxyapatite-coated abutment(BA400) with soft tissue preservation. The primary outcome was a combined endpoint which included the secondary outcome measures pain, numbness, peri-abutment dermatitis and skin thickening/overgrowth.

Results: 106 subjects were randomized. The difference between the groups after one year of follow-up as measured by the primary efficacy variable was not statistically significant($p = 0.12$) in the ITT population($n = 103$), but was statistically significant($p = 0.03$) in the Per-protocol population($n = 96$). It showed an advantage for the test group, with over twice as many subjects(29%) with none of these important medical events during the first year compared to the control group(13%). Secondary outcome measures, such as surgical time (15 vs. 25 minutes, $p < 0.01$), numbness(90% vs. 69% of subjects experienced no numbness at one year, $p < 0.01$), neuropathic pain (mean score at 3 months, 1.06 ± 0.25 vs. 1.70 ± 1.53 , $p = 0.015$) and the overall opinion of the esthetic outcome were favourable for the test group. Five abutments with tissue overgrowth had to be changed in the control group versus one in the test group. No significant differences existed in the occurrence of peri-abutment dermatitis(Holgers index). One implant extrusion was recorded in each group.

Conclusion: Soft tissue preservation with a hydroxyapatite-coated abutment leads to a statistically significant and clinically meaningful reduction in numbness, neuropathic pain and surgical time, and improves cosmetic outcomes in comparison to soft tissue reduction surgery with a titanium abutment.

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Free Papers (F762)

ID: 762.2

Findings on 7000 magnetic resonance scans of the internal auditory meatus: To scan or not to scan?

Presenting Author: **Natasha Amiraraghi**

Natasha Amiraraghi, Shueh Lim, Georgios Kontorinis
NHS Greater Glasgow and Clyde

Learning Objectives: MRI IAM is a useful tool for the Neurotologist to clarify related symptoms or reassure the patient. Although the VS pick up rate is low, the potential risks of misdiagnosis justify the wide utilisation, as do the high rates of incidental and abnormal findings.

Introduction: Vestibular schwannomas (VS) account for up to 10% of intracranial neoplasms. Magnetic resonance imaging (MRI) of the internal auditory meatus (IAM) has been established as the gold standard in VS diagnosis. Numerous guidelines (Sunderland, Charing Cross and

Oxford) advise when to scan, with reported positive results ranging from 0.5% - 4.3%. We reviewed results of MRI IAM for a catchment area of two million over a three year-period.

Methods: Registration with the Caldicott guardian was made and permission given to obtain audit data from the radiology. The information and statistics team provided the MRI IAM episodes. We entered the report for each episode from the electronic patient record. This was coded to six separate outcomes. Normal, VS, Cholesteatoma, Incidental, Other and Incomplete.

Results: A total of 6978 exams were performed. 96% involved adult (>16 years) patients; 55% female and 45% male. In total, 66.5% ($n = 4640$) were reported as normal, a further 15.7% ($n = 1097$) had incidental findings. The number of new diagnosis of VS was 99 (1.6%), while 3.3% ($n = 231$) scans were incomplete. Additionally, 1.2% ($n = 89$) diffusion weighted scans for investigation of cholesteatoma and 10% ($n = 726$) surveillance of known VS were identified. Twenty-five scans were requested for surveillance of other disease such as facial nerve, external and middle ear lesions. We also noted inappropriate requests for morbidly obese or extremely claustrophobic patients.

Conclusions: This is one of the largest reported databases, demonstrating a VS pick up rate of 1.6%. With 66.5% scans reported as normal, the high incidence of abnormal findings, either incidental or not (33.5%) justifies the usage of MRI IAM.

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Free Papers (F762)

ID: 762.3

Congenital Aural Stenosis: Clinical Features and Long-term Outcomes

Presenting Author: **Tianyu Zhang**

Chenlong Li, Ying Chen, Yongzheng Chen, Yaoyao Fu,
Tianyu Zhang

Eye & ENT Hospital of Fudan University

Learning Objectives: There was no significant difference among different diameter of stenotic EAC for cholesteatoma formation, and stenosis of EAC (>4 mm) with cholesteatoma may be a special state of EAC, we named it as blockage of EAC.

Introduction: The aim of the present study was to evaluate the clinical features and long-term outcomes of CAS comprehensively.

Methods: It was a retrospective review of patients who underwent meatoplasty for CAS at a tertiary referral hospital, from April 2008 to August 2015. A structured form was used to obtain data from patients' anamneses, PTA, HRCT of the temporal bones, operation notes and videos, pathology reports and postoperative follow-up records.

Results: A total of 246 meatoplasty were performed on 232 patients in our study. There was no significant difference among different age groups for cholesteatoma formation,

$\chi^2 = 1.8$, $p > .05$. Chi square test detected no significant difference among subgroups of stenotic EAC for cholesteatoma formation, $\chi^2 = 2.5$, $p > .05$. Postoperative ABG less than 30 dB occurred in 77.3% (99/128) of the patients, and there was no significant difference between cholesteatoma and no cholesteatoma groups, $p > .05$. The complication rate of CAS was 13.8% (20/144), cholesteatoma group had a higher rate of complications, $\chi^2 = 5.49$, $p < .05$.

Conclusions: Our results indicate that meatoplasty was an effective surgical intervention for CAS, there was a stability hearing outcome with prolonged follow-up. Jahrsdoerfer score was one factor which affected the postoperative hearing, but age was not the crucial factor in surgical indication. There was no significant difference among subgroups of stenotic EAC for cholesteatoma formation, and no significant difference between cholesteatoma and no cholesteatoma groups for hearing outcomes. But cholesteatoma group had a higher rate of complications.

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Free Papers (F762)

ID: 762.4

Middle cranial fossa approach to repair of temporal bone encephaloceles and CSF leaks with over 18 years experience with future implications on driving regulations in the UK

Presenting Author: **Jeyanthi Kulasegarah**

Jeyanthi Kulasegarah, Emma Hoskison, Karam Narang, Scott Mitchell, Richard Irving
Queen Elizabeth Hospital Birmingham

Learning Objectives: Good hearing outcomes. Minimal risk of epilepsy. DVLA should reconsider band on driving for these patients.

Introduction: This paper details our experience in the management of 40 patients with temporal bone encephaloceles and cerebrospinal fluid (CSF) leaks, with the majority of patients managed via a middle cranial fossa approach (MCF) with bone graft, temporalis fascia and tisseal. DVLA imposes a driving band for 6 months for cars and 2 years for HGV on all patients undergoing craniotomy regardless of indication.

Objective: To investigate the long-term follow-up of patients who had CSF leak repair: looking at effectiveness of repair, intracranial complications specifically seizures and hearing outcomes.

Method: A retrospective chart review of 40 patients undergone middle cranial fossa craniotomy for the treatment tegmen defect in a tertiary referral center from 1997 to 2015 was performed.

Results: Forty patients were identified who had undergone surgical repair of the dural defects through a middle cranial fossa approach. The mean age was 52 years (range 16 to 74) with male to female ratio of 2:3. Defects were

almost equally right and left sided with over 80% were spontaneous leaks. Nearly 90% of patients were treated with MCF approach and 10% with a combination of MCF and transmastoid as the defect also involved the posterior fossa. Majority of patients exhibited an improvement in hearing. A patient developed epilepsy post-operatively with MRI confirmation of temporal lobe inflammation. One other patient with pre-operative epilepsy continued to have seizures.

Conclusion: The MCF approach is an excellent route to effectively repair CSF leaks and encephaloceles due to tegmen tympani and dural defect. It carries an extremely small risk of epilepsy. Therefore, the band on driving enforced by DVLA for patients with no preoperative epilepsy undergoing craniotomy for CSF leak repair should be reconsidered.

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Free Papers (F762)

ID: 762.5

Subtotal Petrosectomy With Blind Sac Closure of the External Auditory Canal – Indications and Results

Presenting Author: **Udi Katzenell**

Udi Katzenell¹, Doron Halperin²
¹Kaplan Medical Center, ²The Department of Otolaryngology Head and Neck Surgery | Kaplan Medical Center | Affiliated to the Faculty of Medicine of the Hebrew University of Jerusalem

Learning Objectives:

Introduction: Subtotal petrosectomy and blind sac closure of the auditory canal (STP) includes a canal wall down mastoidectomy with exenteration of all air cells, obliteration of the middle ear cleft with fat or temporalis muscle or a biocompatible material and closure of the external auditory canal. The indications for STP are weeping mastoid cavities, temporal bone malignancies, CSF leak and lateral base of skull surgeries. Hearing rehabilitation with a bone conduction hearing device or a cochlear implant can be offered. The aim of this study is to review the indications, results and hearing rehabilitation of the patients who underwent STP in our department.

Methods: All charts of patients who underwent STP between October 2011 and December 2015 were reviewed and analyzed.

Results: During this period 20 patients underwent STP. The average age was 46.9(13–81). 6 patients had cholesteatoma of them 5 were deaf in the operated ear. 1 patient had an encephalocele in a previously operated ear. 13 patients had a weeping mastoid cavity with no cholesteatoma. 4 patients had a Bone Anchored Hearing Aid and One patient had a Bonebridge implanted. 2 patients had a cochlear implant in a deaf ear. 1 patient had surgery for external auditory canal carcinoma. One patient with a weeping

cavity had a recurrent infection in the mastoid cavity, the miatus opened and discharge persisted. All other operated patients ears stopped discharging therefore the success rate in this series is 95%. There were no major complications after surgeries. All patients who had a bone anchored hearing device or a cochlear implant presented benefit from their devices.

Conclusion: Patients with weeping cavities are debilitated due to water precautions, vestibular effect, the reduced hearing and the discharge that can be extremely disturbing. A debilitating weeping cavity which does not respond to medical treatment is a surgical disease. In such patients STP with hearing rehabilitation should be suggested.

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Free Papers (F762)

ID: 762.6

Outcomes following trans-mastoid occlusion surgery for superior semicircular canal dehiscence

Presenting Author: **Suzanne Jervis**

Suzanne Jervis¹, Maarten de Wolf², Jeyanthi Kulasegarah¹, Karen Lindley¹, Richard Irving¹

¹University Hospitals Birmingham NHS Trust,

²Amsterdam

Learning Objectives:

Introduction: Semicircular canal dehiscence syndrome (SCDS) is caused by a bony defect of the superior semicircular canal, resulting in autophony, bone conduction of bodily sounds and pseudo conductive hearing loss. Vestibular manifestations include sound or pressure evoked vertigo. Occluding the dehiscence canal was originally described via the middle cranial fossa approach however, an alternative transmastoid approach has been used to avoid the morbidity associated with the former. The aim of this project was to determine clinical and audiological outcomes for those undergoing the transmastoid approach.

Methods: All patients suggestive of SCDS underwent CT scanning, cVEMP testing. All those with positive findings for both (dehiscent superior canal and cVEMP thresholds >35%) underwent surgery. Audiometric data were obtained and patients were sent questionnaires retrospectively regarding their symptoms.

Results: Twenty patients, with 22 affected ears underwent surgical occlusion. The commonest reported symptoms pre-operatively were hearing internal sounds, tinnitus, and fullness sensation (95%, 95%, and 82% respectively.) The symptoms most likely to show partial or complete improvement post operatively were hearing internal sounds, vertigo to loud sounds and imbalance (91%, 88% and 87% respectively.) Symptom deterioration occurred in two ears with respect to fullness. 9 patients developed new symptoms post operatively (of 'mild nature'), the most common being imbalance (3) and fullness (2). Overall, 15 ears (68%) showed partial or complete symptom improvement, 6 showed no change and 1 was worse. The mean Dizziness Handicap Inventory Scores improved from 43 pre-op to 24 post op ($p = 0.001$). The mean air conduction (Fletcher's index) improved from 13.2 dB to 11.1 dB.

Conclusion: The transmastoid approach to the superior canal appears to be well tolerated and is associated with low risk to hearing. Symptom improvement is seen in two thirds, but temporary imbalance post op is common.

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Free Papers (F763)

ID: 763.1

The Hong Kong Vascularized Temporalis Fascia Flap and its role in Cholesteatoma Surgery revisited

Presenting Author: **Andrew van Hasselt**

Andrew van Hasselt¹, Michael Tong², Kwok Chung Liu²

¹The Chinese University of Hong Kong,

²Chinese University of Hong Kong

Learning Objectives: When reconstructing large mastoid cavities, the surgeon's repertoire should include a technique that uses a vascularized lining to optimize patient outcomes.

Introduction: Complications following open cholesteatoma surgery arise when mastoid cavities fail to epithelialize. The Hong Kong flap is a fertile substrate of vascularized temporalis fascia lining that facilitates rapid epithelial lining. We have studied the long term outcome of this technique and reviewed its role in cholesteatoma surgery.

Methods: We analyzed data obtained from records of patients who have had cholesteatoma surgery in the Prince of Wales group of hospitals through the period from 1987 to 2015. The outcome measures included relevant clinical parameters such as time to achieve a dry ear, requirement for a second look procedure and the primary surgeon's level of experience.

Results: The Hong Kong flap reconstruction was not utilized in all of cholesteatoma operations over this period. In patients reconstructed with the Hong Kong flap, the median time to dry ear was 2 months. 20% needed a second look or more and 8% were found to have recurrent or residual cholesteatoma. Surgeons with varying levels of surgical experience successfully performed the procedure.

Conclusions: The Hong Kong vascularized temporalis fascia flap is a technique within the capability of average otologists. The post-operative course is categorized by rapid healing and long term healthy, trouble free cavities. The requirement for second look procedures is significantly reduced.

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Free Papers (F763)

ID: 763.2

Otology Questionnaire Amsterdam (OQUA); preliminary results on the development of a general otologic questionnaire

Presenting Author: **Paul Merkus**

Els Bruinewoud¹, Paul Merkus¹, Lisette van Leeuwen¹, Koen Viergever¹, Sophia Kramer¹, Elisabeth Laurens-Thalen², Rob van der Hulst³, L.T. Rothuizen⁴

¹VU University Medical Center Amsterdam, ²Isala hospital, ³Amstelland hospital, ⁴Erasmus University Medical Center

Learning Objectives: - Patient Related Outcome Measures are increasingly important in the evaluation of ear complaints. - Most patients with ear complaints suffer from multiple ear complaints or changing complaints after treatment. - The development and future implementation of a general otologic questionnaire will help to improve otologic care in all patients with ear complaints. - Multiple steps are needed to develop and validate a well-designed questionnaire.

Introduction: Most patients visiting an ENT-doctor because of an ear complaint suffer from multiple ear complaints. Patient Reported Outcome Measures (PROMs) are useful in the evaluation of these complaints. However, there is no well-validated, Dutch PROM available that contains items about all types of ear complaints.

Objectives: Development and validation of a questionnaire (OQUA), applicable to all adult patients visiting an ENT-doctor because of an ear complaint. The OQUA needs to cover all common ear complaints and all three parts of the questionnaire (severity, impact and change over time) must be able to be evaluated separately.

Methods: Patients over the age of sixteen who presented themselves to an ENT-doctor with an ear complaint were recruited for a series of studies. First, qualitative research through in depth interviews (N = 16) was carried out to identify the various domains of ear complaints. Then, a pilot study of the first and second draft of the OQUA (N = 32, N = 39) was performed. Finally, quantitative research was performed by field-testing (N = 352). Item reduction took place based on factor and reliability analyses.

Results: In the qualitative phase, eight domains of ear complaints were identified: earache, hearing loss, otorrhoea, dizziness, itch, tinnitus, pressure in ear and loss of taste. In the quantitative phase, ten out of fifty items were removed based on factor analysis, seventeen items were removed based on reliability analysis. Based on factor analysis, nine factors emerged. The current version of the OQUA comprises twenty-three items, covers all eight domains of ear complaints and contains eleven items about complaints that often occur in patients with cholesteatoma.

Conclusions: Many patients with an ear complaint report several ear complaints. The current version of the OQUA questionnaire serves as a good basis for the development of the final, validated version of this questionnaire.

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Free Papers (F763)

ID: 763.3

Otoendoscopy assisted Combined Approach Tympanoplasty: Can it replace posterior tympanotomy

Presenting Author: **Ahmed Allam**

Ahmed Allam¹, Panos Dimitriadis², Jadip Ray²

¹Otology/Neurotology Fellow in Sheffield Teaching Hospital, ²Regional Department of Neurotology, Sheffield Teaching Hospital, UK

Learning Objectives:

Background: The aim of combined approach tympanoplasty is to middle ear and mastoid eradicate the disease and obtain dry ear whilst preserving the structure and function of the middle ear as far as possible. Facial recess and sinus tympani are anatomic sites that are difficult to assess with a microscope. Hence a posterior tympanotomy is used by most surgeons as a standard step for clearance of these areas. Otoendoscopy also allows excellent visualization of these areas and reduces surgical steps and time.

Aim of the study: To compare between the recurrence rate of secondary cholesteatoma following CAT surgery using either posterior tympanotomy or otoendoscopy.

Study design: Retrospective case review over a period of 10 years at a single centre.

Setting: Regional Department of Neurotology, Sheffield Teaching Hospital, UK.

Inclusive criteria: We included every CAT that was performed in adults (>16 yr), by a single surgeon (senior author), for acquired cholesteatoma between 2006 and 2015, with a 12-month disease-free interval.

Results: A total number of 152 CAT (stage 1) procedures done between 2006 and 2015 by a single surgeon were included. Of these 25 (16%) cases (ears) showed evidence recurrent cholesteatoma as demonstrated by imaging (T2 weighted non EPI MRI) needing a second look procedure. 17 of them could be retained as a closed cavity (CAT stage 2) while 8 cases were converted into an open mastoid cavity (Modified Radical Mastoidectomy). Analysed in their own subgroups the recurrence rate in those with a posterior tympanotomy was 26% (18/70 cases) whilst it was 8% (7/82 cases) in those where the otoendoscope was used.

Conclusion: Otoendoscopy provides a simple and reliable approach for managing cholesteatoma in facial recess area in combined approach tympanoplasty. When used carefully and meticulously it can be used in place of a posterior tympanotomy approach with comparable results.

doi:10.1017/S0022215116003479

Free Papers (F763)**ID: 763.4****Surgical treatment of cholesteatoma: Criteria for the selection of the surgical technique**Presenting Author: **Alejandro Harguindey Antolí-Candela**Alejandro Harguindey Antolí-Candela¹,
Francisco J. Olarieta Soto², Francisco Antolí-Candela Cano²¹Instituto Otorrinolaringológico De Madrid (IOM), ²Instituto Otorrinolaringológico de Madrid (IOM)*Learning Objectives:**Introduction:* The surgical technique in cholesteatoma is decided on the bases of the following criteria:

- 1.- Anatomical characteristics of the mastoid.
- 2.- Clinical type of cholesteatoma:
 - Congenital.
 - Primary acquired.
 - Secondary acquired.
- 3.- Surgical type of cholesteatoma:
 - Encapsulated and non-encapsulated.
- 4.- The estate of the mucose membrane.
 - Absent, cholesterol granuloma, polyps in the middle ear, etc....
- 5.- Extension of the cholesteatoma.

Material and method: The above described criteria is revised in 380 consecutively operated. The different techniques and their results are described.

At present the most frequent technique is Intact Canal Wall tympanoplasty (210 ICW, 60%) followed by different types of Canal Wall Down (140 CWD 40%) tympanoplasties. In 350 (92%) a tympanoplasty was performed.

The incidence of Radical Mastoidectomies (RM), middle ear exclusion (MEE) and Subtotal petrosectomies (STP) are very infrequent (8%) and are performed mostly in revision surgery in cases with a failure of CWD tympanoplasty.

Results: The failures are subdivided in recurrent and residual cholesteatoma:

- We have five percent of recurrent cholesteatoma in the adult and eight percent in children.
- In 20% of the cases there is a residual cholesteatoma. Only 2% of them in CWD tympanoplasty, RM, MEE or STP.

The hearing results can be summarized saying that in 60% of the patients there is useful hearing without the need for a hearing aid. These results are closely related to the technique used for surgery.

Conclusions: Adequate selection of the surgical technique for each individual case is the first goal to obtain best

results both to minimize recurrences and to obtain the best possible hearing results.

There is not a surgical technique that is best for all cases.

Diffusion MRI is very useful to follow cases of MEE and STP and has made us to indicate these techniques more often.

doi:10.1017/S0022215116003480

Free Papers (F763)**ID: 763.5****Functional results and quality of life in patients undergoing surgery for cholesteatoma: Canal Wall Down versus Canal Wall Up technique**Presenting Author: **Bruno Sergi**

Bruno Sergi, Daniela Lucidi

*Catholic University School of Medicine and Surgery, Rome, Italy**Learning Objectives:* Canal Wall Down Mastoidectomy has traditionally been associated with a poorer Quality of Life, based on the limitations and restrictions resulting from the wide neo-mastoid cavity. However, according to our results, a substantial difference in the subjective perception of the post-operative outcomes between CWD and CWU should not be taken for granted.*Introduction:* The benefits and disadvantages of Canal Wall Up (CWU) versus Canal Wall Down (CWD) mastoidectomy in cholesteatoma surgery have been debated for decades: comparison is mostly based on auditory results and recurrence rate. However, the most common complaint among cholesteatoma patients is daily social impediment (ear discharge, water restriction, pain, doctor visits). The aim of our study was to assess the quality of life (QOL) and hearing function in CWD vs. CWU technique.*Methods:* We enrolled 81 patients subjected to mastoidectomy for cholesteatoma, at Department of Head and Neck Surgery, Catholic University, Rome (Jan 2010-Dec 2013). In 50 patients a CWD technique, without "obliteration" of the mastoid cavity, was performed (Group A) whereas 31 patients underwent a CWU technique. Pure tone audiometry (PTA) was performed 24 hours pre- and 12 months post-operatively. Chronic Ear Survey (CES) was administered 3 months after surgery. Twelve months after surgery patients were subjected to re-administration of CES together with a second questionnaire: Chronic Otitis Media Outcome Test-15 (COMOT-15).*Results:* The difference between mean postoperative PTA in Group A and Group B was statistically significant (respectively 72 dB vs. 45 dB; $p < 0.05$). The mean CES scores were not significantly different between groups ($p < 0.05$), except for the subscale "Symptoms". Also, mean COMOT-15 results didn't not significantly

differ between groups ($p < 0.05$), except for the subscale "Hearing function". Partial association was found between questionnaire scores and objective parameters, such as age, PTA and sex.

Conclusions: A unanimous consensus on indications and limits of CWD versus CWU technique has not yet been established. We demonstrated in our study the absence of a significant difference in terms of QOL in CWU vs. CWD.

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Free Papers (F763)

ID: 763.6

The new technique of Reconstruction of Posterior Canal Wall by using Skin-Musculo-periosteal Flap on Canal Wall Down Tympanomastoidectomy

Presenting Author: **Soekirman Soekin**

Soekirman Soekin

ENT Hns Proklamasi Institute

Learning Objectives:

Introduction: most of large cholesteatomas have been done by Canal Wall Down (CWD) Tympano mastoidectomy. The problem is wet ear, a large ear canal or mastoid cavity, hearing gain, recurrency or recidief problems.

Objective: to introduce a new technique of Posterior Canal Wall(PCW) have been reconstructed by using skin musculo periosteal flap on CWD Tympano-mastoidectomy. Normal ear canal size, dry , less recurrency or recidief and hearing gain be achieved.

Method: during 2010–2014(5 years) among 752 ear surgery has been done reconstruction PCW on 67 ears during CWD Tympano-mastoidectomy as simultaneously surgery . The age of patient among 5- 73 years old, most among 20–40 years old . Soft connective tissue that is skin musculo periosteum have been use as material of PCW.

The middle ear such as ossiculoplasty be done by cartilage autograft or polymers teflon prostheses. This technique be classified as closed technique on management of cholesteatomas Chronic Otitis Media.

Result: most cases dry ear 3–4 weeks after surgery, ear canal on normal size , depends of the foot plate stapes movement and the audiogram pre- operative, hearing gain was 0–30 dB.

Complication: infection be founded 2 cases and can be cure by oral antibiotic untill 4 month after surgery. Recurrent 2 cases be revisioned by endoscopic middle ear surgery.

Conclusion: Reconstruction PCW by using skin musculo periosteum is better as an new technique surgery for to get normal ear on CWD tympano mastoidectomy.

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Bone conduction hearing devices in CSOM (R764)

ID: 764.1

The place of Bonebridge in the management of hearing loss in CSOM

Presenting Author: **Stephen Jones**

Stephen Jones

Ninewells Hospital & Medical School

Learning Objectives: The Bonebridge is viable and popular alternative to conventional hearing aids and other implantable devices in suitable patients.

Introduction: The Bonebridge is a semi-implantable transcutaneous bone conducting device that was introduced in 2012. The device consists of an internal Bone Conducting Implant device, consisting of a magnet, receiver coil, demodulator and Bone Conducting – Floating Mass Transducer (BC-FMT), and the external Samba sound processor. It is suitable for conductive and mixed hearing losses or for single-sided deafness (SSD). The manufacturers recommend BC thresholds no greater than 45 dB in conductive or mixed hearing loss.

Methods: Since the first surgery was carried out in Tayside in 2012 we have now carried out 16 implantations on 15 patients for a range of indications including ear canal atresia and stenosis, SSD and following CSOM surgery. The procedure requires pre-operative planning on CT due to the size of the BC-FMT, as the dura, ear canal and sigmoid sinus must be avoided or managed. Due to the amount of drilling required and the length of the procedure all cases in Tayside have been carried out under general anaesthesia.

We are able to offer suitable patients the choice between Bone Anchored Hearing Aids (BAHAs) from both manufacturers, BAHA Attract and Bonebridge. The majority choose Bonebridge. Due to the limited gain we recommend BAHA Attract rarely.

Results and Conclusions: The patients who have chosen Bonebridge generally do so because of cosmetic reasons and because of the avoidance of feedback. Hearing outcomes for BAHA and Bonebridge appear similar. Local patient satisfaction surveys have demonstrated a high level of satisfaction with Bonebridge.

doi:10.1017/S0022215116003510

Bone conduction hearing devices in CSOM (R764)

ID: 764.2

Technique and long-term results of the semi-implantable transcutaneous bone conduction hearing device Sophono

Presenting Author: **Ralf Siegart**

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.

Results and Conclusions: The operative technique is relatively simple. With the new "Up-Side-Down-Technique" bone does not have to be removed at all anymore. The 2.6 mm thin implants are hardly palpable. The hearing improvement is similar to other bone conducting hearing aids. This semi-implantable transcutaneous bone conduction hearing device is another option for patients with CSOM, air-bone-gaps, mixed hearing loss or single sided deafness.

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Bone conduction hearing devices in CSOM (R764)

ID: 764.3

Bone conducting hearing devices for chronic suppurative otitis media – which device should we should?

Presenting Author: **James Tysome**

James Tysome

Cambridge University Hospitals

Learning Objectives: To understand the factors influencing choice of BCHD in the context of a conductive or mixed hearing loss found in patients with CSOM.

Introduction: Bone conduction hearing devices (BSCD) are well established for use in patients with chronic suppurative otitis media (CSOM). The rationale for using BCHD over conventional hearing aids when surgical reconstruction is not effective will be discussed, the factors important in choosing between them discussed and the options available introduced. The remaining speakers in this session will describe these in detail.

Methods: Structured review of options for BCHD in CSOM including maximum power output (MPO) and feasibility.

Results: The MPD of BCHD varies and should be taken into account when choosing a device to use in patients with CSOM.

Conclusions: All BCHD are suitable for use in patients with CSOM that cannot otherwise be improved by middle ear surgery, although the device choice depends on the degree of conductive or mixed hearing loss, MPO as well as feasibility, availability and patient choice.

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Bone conduction hearing devices in CSOM (R764)

ID: 764.4

Outcomes of implantation and willingness of BAHA candidates to undergo BAHA implantation

Presenting Author: **Michal Luntz**

Michal Luntz, Amjad Tubia, Riad Khnifes, Amit Wolfowitz, Talma Shpak, Noam Yehudai

Bnai Zion Medical Center, Technion – The Bruce Rappaport Faculty of Medicine, Haifa, Israel

Learning Objectives: To evaluate hearing and medical outcomes with contemporary BAHA implants as well as willingness of BAHA candidates who suffer from chronic otitis media to undergo BAHA implantation.

Introduction: Osseo-integrated bone-anchored hearing implants are used in patients with conductive/mixed complex hearing loss, when other rehabilitation alternatives are not feasible.

Methods: The study included two groups of patients: 62 candidates with COM who were referred for BAHA during 2012–2015 and 34 BAHA implantees. Information in the first group was collected regarding the willingness of these individuals to receive a BAHA implant. In the second group, hearing thresholds before and after implantation were analyzed and patients were asked to complete a questionnaire regarding their habitual daily use of the system and medical issues related to the implant.

Results: Out of 62 BAHA candidates, only 21 (34%) decided on BAHA surgery. Of the 34 BAHA implantees, 30 (88%) are using their devices. Recurrent local infection surrounding the abutment have led 4 patients with older generation BAHA connect to stop using their device, and two of them had it surgically removed. The other two are scheduled for replacement to a BAHA attract device. Hearing outcomes with BAHA implants mirror bone conduction thresholds in the BAHA Connect group and are slightly below bone conduction thresholds in the BAHA Attract group. Pre-implantation thresholds with the BAHA Soft Band predict post-implantation BAHA Connect as well as BAHA Attract thresholds.

Conclusions: Hearing outcomes with BAHA implants are good and predictable. The only reason for non-use is medical issues concerning the abutment in older generations BAHA Connect systems. Despite excellent experience among BAHA users and professionals, these technologies

are still under-utilized, even in those for whom BAHA is the only hearing solution.

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Diagnostic Dilemmas of CSOM (R766)

ID: 766.1

Diagnosis and Treatment Strategy of Necrotizing Otitis Externa

Presenting Author: **Takashi Nakagawa**

Takashi Nakagawa

Kyushu University Graduate School of Medical Sciences

Learning Objectives: Although necrotizing otitis externa is life-threatening disease, it is difficult to be diagnosed and treated. Several points for diagnosis and the results of treatment would be reported.

Necrotizing otitis externa is osteomyelitis of skull base originated from the floor of external auditory canal. Most of them are optimizing infection, mainly DM. Main pathogen is *Pseudomonas Aeruginosa*. Although clinical features are clear, it is difficult to reach a correct diagnosis. Symptoms are sometimes masked by anti-biotics and analgesic drug. Severe pain, patient background such as DM, and granulation formation could be clue for suspicion. Both CT and MRI are useful for diagnosis and estimation for the extent of disease. Biopsy leads to definite diagnosis. First line of treatment is conservative approach. Appropriate antibiotics should be chosen and patient background disease would be controlled. Surgical intervention is useful when well-pneumatized mastoid is infected.

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Diagnostic Dilemmas of CSOM (R766)

ID: 766.2

Pathogenesis and diagnosis of Otitis media with ANCA-associated vasculitis (OMAAV)

Presenting Author: **Naohiro Yoshida**

Naohiro Yoshida

Jichi Medical University Saitama Medical Center

Learning Objectives: Antineutrophil cytoplasmic antibody (ANCA)-associated vasculitis (AAV) is histologically characterized by systemic necrotizing vasculitis and is clinically classified into two phases, systemic or localized. Recently, otological symptoms such as otitis media and hearing loss, not previously often associated with AAV, have been reported in AAV cases. Delayed diagnosis of AAV occasionally leads to progression to the irreversible phase; therefore, diagnosis at the early-localized stage is important for treating AAV. In this session, the current understanding of this newly proposed concept of OMAAV is discussed.

Antineutrophil cytoplasmic antibody (ANCA)-associated vasculitis (AAV) is histologically characterized by systemic necrotizing vasculitis and is clinically classified into two phases, systemic or localized. Recently, otological symptoms such as otitis media and hearing loss, not previously often associated with AAV, have been reported in AAV cases. By reviewed previous case reports, such disease was proposed to be categorized as “otitis media with AAV (OMAAV).”

Nationwide survey (total 235 cases) performed between December 2013 and February 2014 by the Japan otological society presented the following features: 1) otitis media following sudden progressive hearing loss almost in one month; 2) intractable otitis media not effected by antibiotics and tympanic tube insertion; 3) mostly PR3- and/or MPO-ANCA positive but 16% showed both ANCAs-negative; 4) occasionally clinical complications such as facial palsy (36%) or hypertrophic pachymeningitis (28%); 5) tympanic membrane showing a dull appearance similar to OME and vessel dilatation of tympanic membrane ‘OME type’, otitis media with granulation ‘OMG type’, or normal appearance only with sensorineural hearing loss; 6) effectiveness of corticosteroid and immunosuppressive therapy using cyclophosphamide or methotrexate. By analysis of these clinical features, four factors such as facial palsy, hypertrophic pachymeningitis, both ANCAs-negative phenotype, and disease relapse were related to an unfavorable clinical course for patient’s hearing and prognosis. Delayed diagnosis of AAV occasionally leads to progression to the irreversible phase; therefore, diagnosis at the early-localized stage is important for treating AAV.

In this session, the current understanding of this newly proposed concept of OMAAV is discussed.

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Diagnostic Dilemmas of CSOM (R766)

ID: 766.3

Clinical characteristics and diagnostic criteria of eosinophilic otitis media

Presenting Author: **Yukiko Iino**

Yukiko Iino¹, Yoshihiko Esu², Hiromi Kanazawa², Naohiro Yoshida²

¹Tokyo Kita Medical Center, ²Jichi Medical University Saitama Medical Center

Learning Objectives:

Introduction: Eosinophilic otitis media (EOM) is an intractable otitis media characterized by the presence of a highly viscous yellow effusion containing eosinophils. It mainly occurs in patients with bronchial asthma and is resistant to conventional treatments for otitis media.

Methods: We reviewed 138 patients with EOM and 134 age-matched patients with common type of otitis media to analyze their clinical characteristics and to make diagnostic criteria of EOM.

Results: EOM predominantly affects females and occurs most often in patients in their 50s. EOM is often complicated by rhinosinusitis and nasal polyposis, which is called

eosinophilic rhinosinusitis. High tone loss is more frequently found and more severe in EOM patients than in COM control patients. According to the clinical data, we proposed the diagnostic criteria of EOM. Major criterion is that otitis media with effusion or chronic otitis media with eosinophil dominant effusion. It is necessary to prove the accumulation of eosinophils in the effusion histologically or cytologically. Minor criteria are as follows; 1) highly viscous middle ear effusion, 2) resistance to conventional treatment for otitis media, 3) association with bronchial asthma, 4) association with nasal polyposis. The definite case is defined as positive for major and two or more minor criteria. However, eosinophilic granulomatous polyangitis (Churg-Strauss syndrome) and hyper eosinophilic syndrome are excluded.

Discussion and conclusion: Our basic treatment for EOM is the intratympanic instillation of triamcinolone. Most of the patients have been well-controlled by this treatment. We further discussed the risk factors of severity and inner ear damage in patients with EOM. Patients with ear symptoms should have the proper diagnosis of EOM using the proposed diagnostic criteria, and then can receive adequate treatment, resulting in prevention of deterioration of hearing and quality of life.

doi:10.1017/S0022215116003571

Diagnostic Dilemmas of CSOM (R766)

ID: 766.4

The Variable Clinical Presentation of Tuberculosis Otitis Media and the Importance of Early Detection

Presenting Author: **Franco Louie Abes**

Franco Louie Abes¹, Generoso Abes², Joselito Jamir³

¹Manila Doctors Hospital; University of Santo Tomas Faculty of Medicine and Surgery; Asian Hospital and Medical Center; University of the Philippines National Institutes of Health Philippine National Ear Institute, ²Manila Doctors Hospital; University of the Philippines Philippine General Hospital - Department of Otorhinolaryngology; University of the Philippines National Institutes of Health Philippine National Ear Institute, ³University of the Philippines Philippine General Hospital Department of Otorhinolaryngology

Learning Objectives:

Introduction: Tuberculosis (TB) is a rare cause of otitis media. This study aims to increase awareness on the clinical presentation of TB otitis media and illustrate how early detection affects treatment outcome.

Methods: Chart review of 12 patients (13 ears) from a tertiary-hospital in Manila, Philippines, seen from 2004 to 2009. Clinical predictors of the disease were summarized. Clinical, radiologic, and audiometric outcomes after treatment were compared between treatment groups.

Results: The 5 otoscopic presentations were multiple perforations, single perforation with refractory otorrhea and

exuberant granulation tissue formation, single perforation with minimal otorrhea and no granulation tissue formation, intact tympanic membrane with middle ear effusion, and intact tympanic membrane with tumorlike tissue in the middle ear. Clinical predictors of the disease were history of pulmonary TB, work-related contamination of the infection, positive purified protein derivative test, positive chest radiographic finding and intraoperative granulation tissue with cheesy material, and temporal bone computed tomographic scan findings. Patients who had no middle ear surgery showed significantly better clinical, radiologic, and audiometric outcomes than those who were diagnosed late and had more complicated surgical procedure.

Conclusion: The clinical presentation of TB otitis media is variable. Early detection of the early forms entail less surgical intervention and favors better treatment results.

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Useful tips in ear surgery (V767)

ID: 767.1

Tympanoplasty using Medio-Lateral Graft and Anterior Canal Skin for Anterior or Subtotal Tympanic Membrane Perforation

Presenting Author: **Timothy Jung**

Timothy Jung

Loma Linda University School of Medicine

Learning Objectives:

Introduction: Reconstruction of anterior or subtotal tympanic membrane perforation is challenging. The objectives of this study are to describe a medio-lateral graft tympanoplasty technique and use of anterior canal skin for reconstruction of anterior or subtotal tympanic membrane (TM) perforation and to analyze 20 years of experience using this graft method.

Method: This is a retrospective study of 400 patients who underwent the medio-lateral graft tympanoplasty for reconstruction of anterior or subtotal TM perforation during the past twenty years. The main outcome measure was intact TM. In this method temporalis fascia or perichondrium is grafted medial to posterior TM, malleus handle and posterior half of the perforation and lateral to anterior half of the de-epithelialized TM perforation up to the annulus. Anterior canal skin is rotated as superiorly based flap to cover fascia graft and TM perforation as a second layer closure. Outcome was considered successful if TM is intact.

Results: There were twelve failures (97% success rate) due to a postoperative infection, anterior blunting, or recurrent cholesteatoma.

Conclusion: The medio-lateral graft method is superior to the traditional medial or lateral graft technique for the large anterior or subtotal TM perforation taking advantage of both medial and lateral grafting method while avoiding their pitfalls.

doi:10.1017/S0022215116003595

doi:10.1017/S0022215116003601

Useful tips in ear surgery (V767)**ID: 767.2****For the Video Sessions: The MO-meatocanalplasty of the external auditory canal: a modification of the M-meatoplasty to address the superior quadrants of the lateral canal**Presenting Author: **Joost van Dinther**

Joost van Dinther, Andrzej Zarowski, Thomas Somers, Erwin Offeciers

European Institute for ORL-HNS, Sint Augustinus Hospital Antwerp Belgium

Learning Objectives: The meatoplasty of the external auditory canal is a frequently performed otologic procedure. Indications include recurrent otitis externa refractory to medical treatment, eczema and/or frequent accumulation of cerumen due to a narrow meatus of the external ear canal. In canal wall down surgery for chronic otitis media it is an essential step to achieve a dry and easily cleanable cavity. Numerous surgical techniques have been described on how to do a meatoplasty. In our department, we used to perform the M-meatoplasty technique, described by Mirck in 1996. This procedure has proven to be easy to perform, adjustable to the individual patient, efficient and aesthetically acceptable. However, in several cases, we found that the M-meatoplasty did not sufficiently enlarge the external ear canal. This is specifically the case in patients where ear canal narrowing was most prominent in the postero- and/or anterosuperior quadrants of the lateral meatus. In this video presentation we teach the “M-Oblique” modification of the M-meatoplasty to adequately address ear canal narrowing in these difficult cases.

The meatoplasty of the external auditory canal is a frequently performed otologic procedure. Indications include recurrent otitis externa refractory to medical treatment, eczema and/or frequent accumulation of cerumen due to a narrow meatus of the external ear canal. In canal wall down surgery for chronic otitis media it is an essential step to achieve a dry and easily cleanable cavity. Numerous surgical techniques have been described on how to do a meatoplasty. In our department, we used to perform the M-meatoplasty technique, described by Mirck in 1996. This procedure has proven to be easy to perform, adjustable to the individual patient, efficient and aesthetically acceptable. However, in several cases, we found that the M-meatoplasty did not sufficiently enlarge the external ear canal. This is specifically the case in patients where ear canal narrowing was most prominent in the postero- and/or anterosuperior quadrants of the lateral meatus. In this video presentation we teach the “M-Oblique” modification of the M-meatoplasty to adequately address ear canal narrowing in these difficult cases.

Free Papers (F772)**ID: 772.1****Comparison of CT vs CT-MRI Fusion Imaging in Assessment of Mastoid Cavity Involvement by Cholesteatoma: Implications for Endoscopic Ear Surgery**Presenting Author: **Alexander Saxby**Alexander Saxby¹, Laughlin Dawes², Christina Cheng³, Samantha Wills⁴, Nicholas Jufas¹, Jonathan Kong¹, Nirmal Patel¹, Simon Greenberg³*¹Sydney Endoscopic Ear Surgery Research Group, ²Spectrum Medical Imaging, Sydney, Australia, ³Liverpool Hospital, Sydney, Australia, ⁴Royal Prince Alfred Hospital, Sydney, Australia**Learning Objectives:*

- Pre-operative CT scan for cholesteatoma overestimates mastoid involvement.
- CT-MRI Fusion imaging permits definition of cholesteatoma matrix from sequestered fluid, potentially avoiding an unnecessary mastoidectomy.

Introduction: Pre-operative assessment of cholesteatoma traditionally involves non-contrast temporal bone CT imaging. This can demonstrate opacification of the mastoid cavity but does not define the boundary between cholesteatoma and sequestered fluid. Non-EPI DWI MRI sequences identify the presence of cholesteatoma but do not allow precise anatomical localisation. Fusion of the two images permits estimation of the cholesteatoma/fluid interface. Minimally invasive ear surgery techniques benefit from accurate evaluation of mastoid penetration.

Methods: We retrospectively assessed 6 years of CT-MRI Fusion imaging for cholesteatoma. We included any primary pre-operative cholesteatoma which had both plain CT and CT-MRI Fusion imaging. Two reviewers assessed the scans independently, in a randomized blinded fashion to determine cholesteatoma extension into the mastoid for each imaging modality.

Results: 58 cases met inclusion criteria. Plain CT imaging demonstrated mastoid involvement in 42 of these cases, thus demonstrating 28% had cholesteatoma which did not reach the mastoid cavity, predicting feasibility for total endoscopic removal. CT-MRI Fusion imaging increased this to 60%. Information from CT-MRI Fusion changed pre-operative evaluation of whether open mastoidectomy was necessary in 45% of cases. Overall, the extent of cholesteatoma involvement in the mastoid was overestimated by plain CT in 47% of cases.

Conclusions: Cholesteatoma extension beyond the lateral semicircular canal into the mastoid is more accurately predicted by CT-MRI fusion imaging than plain CT. This tool has high clinical utility, especially in preoperative planning, potentially avoiding unnecessary mastoidectomy with a totally endoscopic (or permeal) approach.

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Free Papers (F772)

ID: 772.2

Is high-resolution computed tomography of the temporal bones now the “gold standard” for pre-operative evaluation of otosclerosis? Our experience in a tertiary centre

Presenting Author: **Edward Noon**

Edward Noon¹, Maira Hameed², Jonathan Fishman³, Gitta Madani⁴, Abhijeet Parikh⁴

¹St Mary's Hospital, London, ²Oxford University Medical School, Oxford, UK,

³Clinical Lecturer, Ear Institute, University

College London, ⁴St Mary's Hospital, London, UK

Learning Objectives:

Introduction: Otosclerosis is a treatable cause of hearing loss. However, the clinical diagnosis may be challenged by high-resolution computed tomography (HRCT) of the temporal bone which may demonstrate factors that might alter the expected outcome of surgery. Using a case series of 101 patients with clinically suspected otosclerosis, we demonstrate how HRCT of the temporal bone may be considered the “gold standard” in the pre-operative work-up for otosclerosis patients.

Methods: A retrospective search of our institution's Patient Archive and Communication System for all HRCT scans of temporal bones that were performed for suspected otosclerosis over a five year period (March 2010 - June 2015). The radiological disease pattern was compared to the clinical findings. Alternative diagnoses were recorded.

Results: 101 scans were performed for suspected otosclerosis. Otosclerosis was confirmed in 43 patients, with normal scans reported in 34 cases and alternative diagnoses revealed in 21 patients. A further 3 patients had possible otosclerosis.

Discussion: The diagnostic sensitivity and specificity of HRCT has been reported to be high. HRCT may identify oval window or pericochlear involvement, which may reduce the effectiveness of surgery; it may also demonstrate anatomical factors that may make surgery more challenging.

Conclusion: We believe that HRCT of the temporal bones is an essential tool as part of the work-up of all patients with suspected otosclerosis and that the benefits of this investigation outweigh the risks associated with a modest radiation dose.

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Free Papers (F772)

ID: 772.3

A Functional 3D Printed Human Middle Ear Model

Presenting Author: **Ismail Kuru**

Hannes Maier¹, Ismail Kuru², Tim C. Lueth², Thomas Lenarz¹

¹Medical School Hannover, ²Technische Universität München

Learning Objectives:

- A 3D-printed functional middle ear model with essential anatomical structures segmented from μ CT-data.
- The middle ear model had similar transmission characteristic as the human middle ear.
- The middle ear model can be used for evaluation of middle ear prostheses.

Introduction: Middle ear (ME) prostheses are usually evaluated in human temporal bone preparations. However, their characteristics change with time and vary between individuals. Thus, it is a time consuming process to evaluate prostheses using such preparations. Although synthetic models for reproducible conditions exist, they are mostly simplified models. Here we describe a 3D printed ME model with essential features and near natural transmission properties.

Methods: The shapes of the essential anatomical structures were segmented from μ CT-data. The unique form of the tympanic membrane (TM) was reproduced with silicone rubber (SR) casting into 3D printed molds. The ossicles were 3D printed, coated and attached together with SR for elastic articulation. The simplified inner ear was built as a closed tube filled with saline. The shapes of the 3D printed ear canal and the tympanic cavity as well as the SR tendons were also simplified.

Results: Our model had sound transmission characteristics similar to the human ME according to the ASTM standard F2504–05. The displacement response to sound had a plateau region ≤ 1 kHz and a roll-off above. However, the roll-off-slope was steeper than desired. The stapes footplate response was dominated by tympanic cavity's vibrations at frequencies ≥ 4 kHz. By systematic variation of the SR material of the TM, the ossicle coating and the tendons, we were able to shift the plateau region to higher and lower values compared to ASTM standard. Furthermore, we have performed clinically standard tympanometry, which showed that the compliance of the model was similar to a healthy ME. Finally we have used this model for preliminary evaluations of a new self-adapting ME prosthesis.

Conclusion: Here we developed a functional 3D printed ME model. The construction makes it possible to isolate parts of the ME and integrate sensors for different purposes. Thus, the model provides a flexible and reproducible environment for ME prosthesis evaluation.

doi:10.1017/S0022215116003637

Free Papers (F772)**ID: 772.4****Correlation between hearing results, CT-scan images and intraoperative findings in cholesteatoma related labyrinthine fistula**Presenting Author: **Soledad Boleas-Aguirre**

Soledad Boleas-Aguirre, Iñigo Ruiz de Erenchun, Manuela Del Carmen, María Uzcanga, Pamela Salas, Almudena Rodríguez

Complejo Hospitalario de Navarra

Learning Objectives: Learning objectives: In this study there was no association between fistula size on CT-scan and hearing level before cholesteatoma surgery. The type of fistulae found intraoperatively did not correspond to postoperative hearing.

Introduction: To compare audiological results before and after surgery in subjects suffering from horizontal semicircular canal (HSC) fistulae due to cholesteatoma. To assess whether there was any relationship between 1) fistulae size according to preoperative CT-scan and pre-operative bone-conduction hearing, and 2) type of fistulae found during surgery and post-operative bone-conduction hearing.

Methods: Retrospective evaluation including 21 adults suffering from cholesteatoma with preoperative CT-scan images. Intervention: open mastoidectomy with identification of HSC fistulae. Outcomes: to compare bone conduction thresholds before and after surgery and, to assess for correlation between 1) fistulae size on preoperative CT scan and preoperative bone conduction hearing loss, and 2) type of fistulae identified during surgery and postoperative bone conduction hearing loss. The study protocol was approved by the Ethical Committee on Clinical Research of our institution.

Results: After surgery we detected a decline in bone conduction thresholds. We could not establish correlation between fistulae size on CT-scan and bone conduction hearing in the preoperative setting. Similarly, there was no correlation between fistulae type found during surgery and postoperative bone conduction hearing.

Conclusions: In this series of subjects presenting with HSC fistulae due to cholesteatoma, we verified an increase in hearing loss after surgery. Correlation between fistula size on CT-scan and hearing level prior to surgery was not established. There was no correlation between the type of fistulae found during surgery and postoperative bone conduction hearing.

doi:10.1017/S0022215116003649

Free Papers (F772)**ID: 772.5****Lessons learned from false positive diffusion weighted MRI findings in the follow-up after cholesteatoma surgery**Presenting Author: **Willem Berkovits**Willem Berkovits¹, Michele Costa², Pim de Graaf³, Erik Hensen³, Frits Smit³, Paul Merkus³¹VU University Medical Center, ²Spirito Santo Hospital, Pescara, Italy, ³VU University Medical Center, Amsterdam

Learning Objectives: It is advisable to combine non-EPI DW MRI findings with ADC mapping and interpretation using all clinical and radiologic information available. After use of fat obliteration techniques extra care in interpretation is required as fat necrosis can be a cause of false positivity. When in doubt one should not be hesitant to repeat scanning.

Introduction: Non-Echo-Planar Diffusion-weighted magnetic resonance imaging (non-EPI DW MRI) is increasingly proposed to replace the standard second look surgery in the follow-up after cholesteatoma surgery because of its high sensitivity and specificity. However, we have encountered several cases of positive MRI results in patients, in whom no recurrent or residual disease was found during subsequent surgery. We like to discuss our lessons learned.

Methods: Retrospective analysis of all false positive cases in our center during non-EPI DW MRI follow-up, after initial cholesteatoma surgery.

Results: Six patients underwent ear surgery, based on positive non-EPI DW MRI findings, during which no cholesteatoma was found. Case history and all available imaging of these cases were re-evaluated and compared to histologic results. The subsequent causes for false positive non-EPI DW MRI's were fat necrosis (after fat obliteration), fibrous connective tissue, foreign body reaction, calcified material and bone dust.

Conclusion: Non-EPI DW MRI is a reliable method for follow-up but can result in both false-negative as well as false-positive results.

doi:10.1017/S0022215116003650

Free Papers (F772)**ID: 772.6****Accuracy of PROPELLER DW MRI in diagnostics of middle ear cholesteatoma**Presenting Author: **Suzan Al Kole**Suzan Al Kole¹, Kjell Tveterås², Yousef Yavarian³, Michael Gaihede²¹Aalborg University Hospital, Denmark, ²Department of Otolaryngology, Head&Neck Surgery, ³Department of Radiology

Learning Objectives: In my experience, when you get a group of professionals together and give them the opportunity to determine what they'd like to talk about, you'll end up with enough viable.

Introduction: Various techniques of diffusion-weighted (DW) magnetic resonance imaging (MRI) have shown valuable in diagnosing middle ear (ME) cholesteatoma high accuracy. PROPELLER (periodically rotated overlapping parallel lines) is one of these techniques and the purpose of this study was to investigate its accuracy in detection of primary acquired ME cholesteatomas.

Methods: In a prospective study 37 cases with clinically suspected primary acquired ME cholesteatoma underwent DW PROPELLER MRI scannings prior to surgery. One neuro-radiologist with expertise in Head & Neck Imaging evaluated the images without knowing the surgical findings. The surgical findings were compared with the radiology findings, and outcome measures included sensitivity, specificity, positive and negative predictive values.

Results: Cases with cholesteatoma demonstrated hyperintense foci on PROPELLER DW MRI. In 37 patients, surgery revealed cholesteatoma in 31 cases; 29 of these were MRI positive, whereas two were negative; these cases were between 2–3 mm in diameter. Surgery revealed no cholesteatoma in six cases, and these were all MRI negative. Sensitivity, specificity, and positive and negative predictive values were 94%, 100%, 100%, and 75%, respectively. In the 29 cases with positive radiological findings, the extent and location of the cholesteatoma correlated well with the surgical findings.

Conclusion: DW PROPELLER MRI imaging is an effective and reliable technique in the diagnosis of cholesteatoma diagnosis with high sensitivity and specificity as well as high correlation between the extension of the disease and surgical findings. Thus, this technique is a promising radiologic tool, however further studies are warranted with more patients.

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Free Papers (F772)

ID: 772.7

Repeated postoperative follow-up diffusion-weighted Magnetic Resonance Imaging to detect residual cholesteatoma

Presenting Author: **Emmanuel Mylanus**

Emmanuel Mylanus¹, Stefan Steens², Wulphert Venderink², Dirk Kunst³, Anton Meijer²

¹Radboudumc, ²Radiology,

³Otorhinolaryngology

Learning Objectives:

Aim: In many clinics non-EPI DWI has replaced second look surgery because of its high negative predictive value. In our institution, follow-up DWI is performed at least twice after surgery. Aim of this study was to determine the yield of the second follow-up MR-DWI (MR-DWI2) after in patients with a negative first follow-up MR-DWI (MR-DWI1) and an absence of clinical otoscopic suspicion of recurrence or residual cholesteatoma.

Methods: Between 2006 and 2013 we retrospectively included 45 ears in 44 patients which had undergone cholesteatoma surgery, had a negative MR-DWI1 performed 6–24 months after surgery, an MR-DWI2 performed at least 6 months after MR-DWI1 and an absence of clinical suspicion of recurrence or residual cholesteatoma between surgery and MR-DWI2. Two radiologists independently scored MR-DWI1 and MR-DWI2. Descriptive analysis were used for determining the yield of MR-DWI2. Interobserver agreement was calculated using Cohen's kappa statistics.

Results: In 14 of 45 ears (31%) MR-DWI2 was equivocal (n = 6, 13%) or positive (n = 8, 18%). Interobserver agreement indicated substantial agreement ($\kappa = 0.75$). Patients with a positive MR-DWI2 were younger of age compared to those with an equivocal or negative MR-DWI2. In the group of 8 patients with positive MR-DWI2, 6 were operated on with surgical confirmation of cholesteatoma in 5 of these patients. In 1 patient only fatty tissue was found.

Conclusion: The most important finding of this study is that 31% of MR-DWI2 showed equivocal or positive evidence of cholesteatoma despite clinical and MR-DWI1 follow-up. Given the known high sensitivity and specificity of non-EPI DWI, good quality of the included DWI examinations and high interobserver agreement in our study, it seems very unlikely this can be explained by a missed cholesteatoma larger than 2–3 mm on MR-DWI1. It is also striking that patients with a positive follow-up MR-DWI2 are younger of age. This may influence follow-up strategies in the future.

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Cholesteatoma Management in the XXI Century (N773)

ID: 773.1

Management of the facial nerve in cholesteatoma surgery: Multidisciplinary approach in a Facial Paralysis Unit

Presenting Author: **Luis Lassaletta**

Luis Lassaletta, Julio Peñarrocha, Teresa Gonzalez, Susana Moraleda, Javier Gavilan

La Paz University Hospital

Learning Objectives: Upon completion of this presentation, the attendant should be able to: Learn the main aspects to consider when dealing with a facial nerve surrounded or invaded by cholesteatoma. Have a general idea about facial nerve reconstruction depending the status of the nerve, the time of evolution and patient's preferences.

Introduction: The incidence of facial paralysis in patients with middle ear cholesteatoma is generally low but still present in 2016. Particular situations such as petrous bone cholesteatoma, in which facial nerve involvement is reported to be as high as 45% to 65% of cases, or revision cases may lead to facial nerve problems more frequently.

In most cases, prompt nerve decompression is enough to achieve recovery. However, facial nerve reconstruction may be needed in certain patients.

Regarding the management of the facial nerve in temporal bone surgery, some aspects are still controversial:

1. Should we use intraoperative facial nerve monitoring in a routine basis?
2. How should the compressed nerve be managed intraoperatively?
3. What is the best reinnervation technique for a particular situation?

Methods: A series of cholesteatoma cases with difficult management of the facial nerve will be presented in a step-by-step manner. Pictures and videos with the key aspects will be shown.

Results: Different surgical techniques including nerve decompression, nerve grafting, and reinnervation procedures were included. Eye care including eyelid surgical procedures, as well as botox injection and neuromuscular retraining were also needed for some patients. All the patients improved facial function following different therapeutic options.

Conclusions: Facial paralysis is still a possible complication of cholesteatoma and chronic ear surgery. Early management with the appropriate technique is mandatory. The preoperative facial nerve grade, the duration of symptoms, and the intraoperative findings, including the location and type of facial nerve injury are the main factors to consider. A multidisciplinary approach in a Facial Paralysis Unit is the key to achieve the best results for a particular patient.

doi:10.1017/S0022215116003686

Cholesteatoma Management in the XXI Century (N773)

ID: 773.2

Preventing Cholesteatoma

Presenting Author: **Manuel Jesús Manrique Rodríguez**

Manuel Jesús Manrique Rodríguez

University Clinic of Navarra

Learning Objectives: Summary abstract presentation in the session: "Cholesteatoma management in the XXI century".

Nowadays health and technological development allow for prevention strategies in order to reduce cholesteatoma incidence.

This session is titled "Cholesteatoma management in the XXI century". Attention will be addressed to present an algorithm to prevent the development of a cholesteatoma.

Starting point will be Eustachian tube obstructive dysfunction how to evaluate and treat it so as to reduce chronic disease in middle ear. If eardrum perforation or atelectasia occur, what is the expected attitude to prevent cholesteatoma. Novel technologies and knowledge will be shown to explain its role preventing cholesteatoma.

doi:10.1017/S0022215116003698

Cholesteatoma Management in the XXI Century (N773)

ID: 773.3

Cholesteatoma in children: Actual situation

Presenting Author: **Jaime Marco**

Jaime Marco

Hospital Clinico Universitario/University of Valencia

Learning Objectives: Cholesteatoma surgery is always in the edge for different decisions but when the disease takes place in children the situation is critical in many instances; preservation of hearing, surgical approach, surgical technique and diagnostic tools.

We will be presenting you, based upon our experience, the actual situation that cholesteatoma in children faces regarding diagnosis, surgical approach and results.

68 consecutive cases of cholesteatoma in children have been studied 71% underwent a closed technique and 29% an open technique. The most frequent clinical symptom was otorrhea and hearing loss (54%) followed by otorrhea (28%). 50% of the cases had an attic perforation and 26% a posterior marginal perforation. 83% of the cases had an sclerotic or diploic mastoid. The contralateral ear was normal in 70% of the cases. In the cases of cholesteatoma the mucosa was hiperplasic or polipoid in 92%. Cholesteatoma extended to attic in 79%, antrum 58%, posterior recess 38% and to mastoid 23%. The ossicles where damaged in 92% of the cases, being the incus the most frequently involved (70%). Residual or recurrent cholesteatoma appeared in 37% of the cases of closed surgery and 12% of the cases of open surgery. Recurrence of the cholesteatoma took place between 1 and 2 years postsurgery in 75% of the cases.

A critical review of the literature is made regarding diagnostic tools, recurrences in relation with open or closed techniques, functional results and a discussion about wether to perform single or second look surgery in closed techniques.

doi:10.1017/S0022215116003704

Cholesteatoma Management in the XXI Century (N773)

ID: 773.4

Diffusion MRI in cholesteatoma control. Advantages and pitfalls

Presenting Author: **Constantino Morera**

Constantino Morera¹, Manuel Mateos², Fernando Mas³

¹La Fe University Hospital. University of Valencia, ²La Fe University Hospital. ENT Department, ³La Fe University Hospital. Radiology Department. Eresa

Introduction: Diffusion-weighted magnetic resonance imaging has been proven to be a very effective technique for the follow up and diagnosis of cholesteatoma. Non-ecoplanar techniques offer the best results as far as sensibility and specificity are concerned. However, one of the main problems of these techniques is the appearance of false positives.

Objective: The aim of this study is to review the number of patients diagnosed of cholesteatoma since 2008 and evaluate sensitivity, specificity, positive predictor value and negative predictor value of PROPELLER diffusion-weighted magnetic resonance imaging in cholesteatoma diagnosis, with special attention to false positive and false negative cases.

Results: In a sample of 146 patients since 2008 we have found a sensitivity of 95'12%, specificity of 83'09%, positive predictive value of 86'66% and negative predictive value of 93'65%. We have found that the main cause for false positives to be the presence of middle ear infections. False negative cases are due to auto-evacuation or suction cleaning in the clinic before MRI is performed.

Conclusions: TI and diffusion sequences, and diffusion coefficient are useful in differentiating cholesteatoma from inflammatory/granulation tissue in order to avoid unnecessary surgical procedures due to false positive results. Suction cleaning is not recommended before radiological examination to avoid false negative cases.

doi:10.1017/S0022215116003716

Middle ear implants in chronic ears (R774)

ID: 774.1

Long-term Results and Revision Surgery of the Vibrant Soundbridge

Presenting Author: **Robert Mlynski**

Robert Mlynski¹, Nora Weiss², Wilma Grossmann³, Ruediger Dahl², Rudolf Hagen³, Sebastian Schraven³

¹University Medical Center Rostock,

²Department of Oto-Rhino-Laryngology, Head and Neck Surgery "Otto Koerner", University Medical Center Rostock, Rostock, Germany,

³Department of Oto-Rhino-Laryngology, Plastic, Aesthetic and Reconstructive Head and Neck Surgery, Comprehensive Hearing Center, University of Wuerzburg, Wuerzburg, Germany

Learning Objectives:

The number of patients treated with the Vibrant Soundbridge (VSB) has increased since its approval for conductive and mixed hearing loss. Patients with history of chronic otitis and cholesteatoma have subsequently been rehabilitated with the VSB. The revision rate in chronic otitis media and cholesteatoma patients is around 10% to 30% depending on the surgical technique used. Aim of this presentation is to analyze the long-term results of the VSB with focus on revision surgery. 238 VSB were implanted in two centers and revision cases reviewed. In 48 (20%) of the cases, a revision surgery was necessary to improve functional performance of the VSB or treat recurrent COM or cholesteatoma. A revision to a cochlea implant was necessary in 5 (2%) cases due to

insufficient rehabilitation with a VSB. Two (1%) patients were reimplanted with a Bonebridge. Seven (3%) patients had recurrent disease without functional impairment of the implant. The highest revision rate was found with FMT coupling to the round window not using couplers. A peak number of revision surgeries were observed 3 years after the initial surgery.

The rate of revision surgery is comparable to conventional tympanoplasty techniques. Fibrosis, insufficient aeration or recurrent perforations can be observed similarly. Revision surgery can be performed safely in patients with a VSB and recurrent middle ear disease.

doi:10.1017/S0022215116003728

Middle ear implants in chronic ears (R774)

ID: 774.2

Middle ear implants – technique and outcome

Presenting Author: **Katsumi Doi**

Katsumi Doi

Kinki University

Learning Objectives: video instruction session

Introduction: Middle ear implants (MEIs) such as VSB[®] (Vibrant soundbridge) are attractive and alternative treatments for patients with conductive, sensorineural, and mixed hearing loss who do not benefit from, or who choose not to wear, conventional hearing aids (HA). Recent studies suggest that MEIs can provide better improvements in functional gain, speech perception, and quality of life than HA, while there certain risks associated with the surgery should be taken into consideration, including facial nerve or chorda tympanica nerve damage, dysfunctions of the middle and inner ears, and future device failure/explantation.

Materials and Methods: In our institute, twelve patients received VSB implantation. The cause of conductive or mixed hearing loss was middle ear diseases in all cases. Round window vibroplasty via transmastoid approach was conducted. The bony lip overhanging round window membrane (RWM) was extensively but very carefully drilled to introduce the Floating Mass Transducer (FMT). Perichondrium sheets were used to stabilize the FMT onto RWM.

Results: Significant improvements of free-field Pure Tone Audiogram (PTA) from 250 Hz to 8000 Hz were confirmed ($P < 0.001$). Hearing gain up to 40 dB was achieved from 1000 Hz to 4000 Hz range. No deterioration in both air conduction and bone conduction at PTA was noted at 20 weeks after the surgery. Monosyllable speech perception in both quiet and noise conditions improved significantly ($P < 0.001$). Speech discrimination score in both quiet and noise conditions improved significantly too ($P < 0.001$).

Discussion: In the future, it is likely that there will be an increasing population even in Japan that will meet the criteria for MEIs such as VSB. However, the long-term efficacy and safety of these devices should be established.

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Middle ear implants in chronic ears (R774)**ID: 774.3****Coupling strategies of active middle ear implants**Presenting Author: **Stefan Dazert**Stefan Dazert¹, Jan Peter Thomas², Stefan Volkenstein²¹Ruhr-University of Bochum, St. Elisabeth-Hospital, ²Ruhr-university of Bochum, Department of Otorhinolaryngology, Head & Neck Surgery*Learning Objectives:* Active middle ear implants.

The indication range for implantable hearing devices such as active middle ear implants (AMEI) dramatically changed over the last years. While AMEI were primarily implanted to rehabilitate sensory neural hearing loss, new coupling strategies opened the way to also treat conductive and mixed hearing loss. Today, AMEI are also indicated in cases such as chronic otitis media and/or ear malformations etc.

Using current coupling systems, AMEIs may be adapted to ears with an intact ossicular chain and in cases with partially or complete missing ossicles. According to the remaining middle ear structures, the mechanical transducers of AMEIs may be adapted to different ossicles (incus, stapes) or to structures such as the oval or the round window. We will discuss advantages and disadvantages of different implants such as systems with one or two point fixation. Also, the various surgical techniques to place and adapt the transducers to middle ear structures will be addressed. Finally, we will present the post-operative outcome and want to discuss our experiences with the audience who might have had patients with similar conditions or different pitfalls.

doi:10.1017/S0022215116003741

Middle ear implants in chronic ears (R774)**ID: 774.4****Management of mastoid cavities with Vibrant Soundbridge**Presenting Author: **Javier Gavilan**Javier Gavilan, Luis Lassaletta
La Paz University Hospital*Learning Objectives:* To document the usefulness of VSB placed in the round window in adults with open cavities.

Introduction: The Vibrant Soundbridge (VSB) middle ear implant is a treatment option for patients with a variety of middle ear conditions such as open cavities. The VORP 503 and new couplers have been introduced to expand the possibilities of treatment.

Methods: 12 patients with mixed hearing loss, all with previous middle ear surgery underwent RW vibroplasty.

Intraoperative electrocochleography was completed during surgery to ensure the FMT coupling to the RW. Subjective benefit was evaluated using the Nijmegen Cochlear Implant Questionnaire (NCIQ), Glasgow Benefit Inventory (GBI) and Hearing Implant Sound Quality Index (HISQUI₂₉) tests.

Results: RW vibroplasty: mean follow-up was 42mo. Mean functional gain was 34 dB and speech discrimination score at 65 dB (SDS) improved from 14 to 83%. All NCIQ domains improved following surgery. All patients had a positive overall GBI score. The mean quality of sound was defined as "very good".

Conclusion: The VSB represents a safe and reliable solution of hearing restoration in adults with open cavities suffering from mixed/conductive deafness.

doi:10.1017/S0022215116003753

Middle ear implants in chronic ears (R774)**ID: 774.5****How to avoid complications in middle ear implantable hearing aids**Presenting Author: **Levent Olgun**
Levent Olgun

Izmirbozyaka Teaching Hospital

Learning Objectives: Implantable hearing aids recently began to widely use for conductive or mixed hearing losses. Abnormalities or altered anatomy due to chronic otitis media may be a risk factor for complications. In this presentation important points in avoiding complications would be stressed.

Introduction: Implantable hearing aids have been developed to use in sensorineural hearing loss cases. However usage of this active middle ear implants in conductive and/or mixed hearing loss recently popularised. Majority of these cases are either chronic otitis media cases who do not get satisfactory hearing after tympanomastoidectomy or congenital outer and/or middle ear abnormality cases. Altered anatomy due to previous surgeries or abnormalities may be a risk factor for complications in middle ear implant surgeries.

Method: Twenty nine cases implanted with an electromagnetic implant (Vibrant MED-EL or Otologics Carina) at Izmir Bozyaka Teaching and Research Hospital were retrospectively evaluated. Complications, adverse events and revision or reimplantation surgeries were noted.

Results: Four out of 29 cases required a revision surgery. Two cases gradually lost the hearing and we had to use a cochlear implant 2 and 6 years after first surgery. Possible factors leading to complications were evaluated.

Conclusions: Usage of middle ear implants for chronic otitis media or outer and/or middle ear abnormalities necessitates some modifications in surgical technique.

Learning Objectives: Middle ear implants can be successfully used for rehabilitation conductive/or mixed hearing

losses. However surgery should be individually tailored in majority of the cases.

doi:10.1017/S0022215116003765

Middle ear implants in chronic ears (R774)

ID: 774.6

Middle ear implants in chronic ears (R774)

Presenting Author: **Joachim Mueller**

Joachim Mueller¹, Stefan DAZert², Robert Mlynski³, Javier Gavilan⁴, Katsumi Doi⁵, Levent Olgun⁶

¹Section Otology and Cochlear Implants, ²Ruhr Universität Bochum, ³Klinik und Poliklinik für Hals-, Nasen-, Ohrenheilkunde, Kopf- und Halschirurgie „Otto Körner“

⁴Universitätsmedizin Rostock, ⁵Hospital Universitario La Paz Madrid, ⁶Department of Otolaryngology and Sensory Organ Surgery Osaka University Graduate School of Medicine,

⁶ENT Clinic of Izmir Bozyaka Teaching & Research Hospital

Learning Objectives: To learn how active middle ear implants can contribute to hearing restoration in reconstructive middle ear surgery, especially in chronic ears and mastoid cavities. The RT discusses the coupling strategies to deliver vibrations to the cochlea, compares different coupling methods and reports on the experience in different countries. Also experience with Revision Surgeries, and strategies how to avoid complications are discussed.

During the round table the panelists comment and discuss in a structured way with the audience, how active middle ear implants can contribute to hearing restoration in reconstructive middle ear surgery, especially in chronic ears and mastoid cavities. The RT discusses the coupling strategies to deliver vibrations to the cochlea, compares different coupling methods and reports on the experience in different countries. Also experience with Revision Surgeries, and strategies how to avoid complications are discussed.

doi:10.1017/S0022215116003777

Basic research on the otological fields (N775)

ID: 775.1

Regulation of osteoclasts is required to maintain morphology and function of ossicles in middle ear

Presenting Author: **Sho Kanzaki**

Sho Kanzaki¹, Kaoru Ogawa², Koichi Matsuo³
¹School of Medicine, Keio University, ²Scholl of Medicine, Keio University, ³Laboratory of Cell and Tissue Biology, Scholl of Medicine, Keio University

Little is known about how bone-resorbing osteoclasts play a role in the vibration of auditory ossicles. Osteoclasts are specialized multinuclear macrophages that resorb bone. Once bones develop through endochondral and intramembranous ossification (bone modeling), osteoclastic bone resorption in adults is usually followed and balanced by osteoblastic bone formation through “coupling” mechanisms, which maintain bone integrity (bone remodeling). Turnover of temporal bones including the otic capsule and ossicles is much slower than that of the long bones because the former contain high levels of osteoprotegerin (Opg), which inhibits osteoclast formation. We analyzed hearing function and morphology of ossicles in both osteoporotic and osteopetrotic mice. Ossicles in Opg deficient (*Opg*^{-/-}) mice are massively resorbed by abundant osteoclasts, resulting in impaired hearing function. In *Opg*^{-/-} mice, the ligament at the junction of the stapes and the otic capsule is lost by bony ankylosis. In addition, administration of the anti-resorptive drug bisphosphonate prevents not only erosion of auditory ossicles but also progression of hearing loss, suggesting that excessive bone resorption underlies impaired hearing in *Opg*^{-/-} mice. Conversely, osteopetrotic mice, which lack osteoclasts due to either c-Fos or RANKL deficiency, show a smaller volume of the tympanic cavity but larger ossicles compared to controls. The malleal processus brevis thus touches the medial wall of the tympanic in osteopetrotic mice. These data demonstrate that regulation of osteoclastic bone resorption is required to maintain morphology of ossicles and normal hearing function.

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Basic research on the otological fields (N775)

ID: 775.2

N775 (Basic Research on the Otological Fields), Middle Ear Mucosal Regeneration by Nasal Mucosal Epithelial Cell Sheets Transplantation

Presenting Author: **Hiromi Kojima**

Hiromi Kojima, kazuhisa Yamamoto
Jikei University

Learning Objectives: Postoperative regeneration of the middle ear mucosa and pneumatization of the middle ear cavity are of great importance after middle ear surgery. This study developed a new method to transplant autologous nasal mucosal epithelial cell-sheets into the damaged middle ear cavity. The aim of this study was to evaluate postoperative healing after the transplantation of the cell sheets in rabbits. Rabbit nasal mucosal epithelial cell-sheets were fabricated from a temperature-responsive culture dish and transplanted into the damaged middle ear of rabbit, which was surgically created. The healing of middle ears was evaluated with histological methods and computed tomography findings at 8 weeks after transplantation. Functional evaluation was performed by measuring the maximum middle ear total pressure reflecting a trans-mucosal gas exchange function. Two control groups were used: the normal control group and the mucosa-eliminated control group. Transplantation of nasal mucosal epithelial cell-sheets

suppressed the bone hyperplasia and the narrowing of pneumatic space in the middle ear cavity more clearly than the mucosa-eliminated control group. The mucosal gas exchange function was also found to be good in the cell sheet-transplanted group. These results suggested that post-transplanted middle ear cavity was not only morphologically but also functionally similar to the normal middle ear cavity. Nasal mucosal epithelial cell-sheet was confirmed to be useful as an effective graft material after middle ear surgery and hopefully become a novel therapy in the future.

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Basic research on the otological fields (N775)

ID: 775.3

Novel biomarker to detect perilymph leakage, CTP (Cochlin tomo-protein, an isoform of Cochlin)

Presenting Author: **Tetsuo Ikezono**

Tetsuo Ikezono¹, Han Matsuda², Tomohiro Matsumura³, Shinnichi Usami⁴, Mamoru Suzuki⁵, Kaoru Ogawa⁶, Yasuhiro Kase⁷

¹Saitama Medical University Faculty Of Medicine, The PLF Study Group, Japan, ²Department of Otorhinolaryngology, Saitama Medical University Faculty Of Medicine, The PLF Study Group, Japan, ³Department of Biochemistry & Molecular Biology, Nippon Medical School, ⁴Department of Otorhinolaryngology, Shinshu University, the Genetic And Anomalous Ear Diseases Study Group, Japan, ⁵Department of

Otorhinolaryngology, Tokyo Medical University, the Peripheral Vestibular Disorder Research Committee, Japan, ⁶22. Department of Otorhinolaryngology, Keio University, the Acute Severe Hearing Loss Study Group, Japan, ⁷Department of Otorhinolaryngology, Saitama Medical University Faculty Of Medicine

Learning Objectives: Perilymphatic fistula (PLF) is an abnormal connection between the inner and middle ear. A procedure for obtaining definite proof of a PLF remains elusive, and methods of diagnosis remain controversial. CTP is a novel biochemical marker that allows a definitive diagnosis of the etiology of PLF-related hearing loss and vestibular disorders. The science of PLF will be discussed in this talk.

Introduction: Numerous biomarkers for dizziness and hearing-loss has been suggested including autoantibodies, inflammatory cytokines, CRP. Among these, CTP (Cochlin tomo-protein, an isoform of Cochlin), perilymph specific protein, is a novel and unique biomarker. We have reported a biochemical test for perilymph leakage detecting CTP in middle ear lavage (MEL, lavaging the middle ear cavity using 0.3 ml saline).

Methods: Recently we could establish a highly reliable ELISA-kit to detect CTP. The Japanese PLF diagnosis criterion is now based on the visual identification of the fistula (not a leakage) and/or detecting CTP. With a help of private clinical test enterprise (SRL inc.) in Japan, CTP test is widely available nationwide, in 170 hospitals.

Diagnostic Accuracy of the test is very high. If there is 2ul of leaked perilymph in the MEL, the test is positive. The diagnostic performance of the test has a high reliability, and the AUC in ROC analysis was greater than 0.90.

Results: The pattern of hearing loss of CTP positive PLF cases varies, including sudden onset, progressive, fluctuating or recurrent. In some patients with positive CTP test, dizziness is their chief complaint not hearing loss.

Conclusions: What We Could Learn from the CTP Test in hearing loss and/or dizzy patients. We believe CTP test will give the answer to the long-standing debate about the existence of PLF.

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Basic research on the otological fields (N775)

ID: 775.4

Molecular mechanisms and fundamental therapies for a mouse model of Gjb2-related deafness

Presenting Author: **Katsuhisa Ikeda**

Katsuhisa Ikeda
Juntendo University Faculty of Medicine

Learning Objectives: Hearing loss is the most widespread sensory disorder, with an incidence of congenital genetic deafness of 1 in 1,600 children. For many ethnic populations, the most prevalent form of genetic deafness is caused by recessive mutations in the gene gap junction protein, beta 2, 26 kDa (*GJB2*), which is also known as connexin 26 (*Cx26*). For more than 15 years, we have developed and evaluated a mouse model of *Gjb2*-related deafness as follows, i) a dominant-negative *Gjb2* R75W transgenic mouse model shows incomplete development of the cochlear supporting cells, resulting in profound deafness from birth (Kudo et al., Hum Mol Genet 2003; Inoshita et al., Neuroscience 2008), ii) the outer hair cells (OHCs from the dominant-negative mutation of *Gjb2* are deformed, but reveal normal development and maturation (Minekawa et al., Neuroscience 2009), iii) *Cx26* dysfunction is associated with delayed apoptosis and retention of the greater epithelial ridge cells (Inoshita et al., BMC Genet 2014), iv) the disruption of the cochlear gap junction plaques is associated with the *Gjb2*-related deafness and the the assembly of cochlear gap junction plaques is dependent on *Cx26* (Kamiya et al., J Clin Invest 2014), vi) the deformation of OHCs and the accumulation of caveolin-2 in the organ of Corti plays a crucial role in the progression of, or secondary OHC loss in, *Gjb2*-associated deafness (Anzai et al., Plos One 2015). In the next, we focused on the development of fundamental therapies for *Gjb2*-related deafness. Successful transgene expression was obtained through the round window membrane in the supporting cells of the neonatal mouse cochlea using adeno-associated viral (AAV) vectors without causing additional damage to the cochlear function (Iizuka et al., Hum Gen Ther 2008). Perinatal cochlear delivery of *Gjb2* using an AAV significantly improved the auditory responses and development of the cochlear structure (Iizuka et al., Hum Mol Genet 2015).

doi:10.1017/S0022215116003819

Ossicular Reconstruction (R776)

ID: 776.1

The use of the Dresden partial clip prosthesis in ossicular reconstruction

Presenting Author: **Christopher Aldren**

Christopher Aldren

Wexham Park Hospital

Learning Objectives: To demonstrate the use of the Dresden partial clip prosthesis and show results.

The Dresden partial clip prosthesis is a titanium prosthesis used for ossicular reconstruction in the presence of a mobile stapes. Video will be shown to demonstrate its ease of application. Results will be presented and compared to the authors experience with other prostheses. Cases requiring revision will be discussed with video illustration.

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Endoscopic Ear Surgery: Concept and Technique (1) (V777)

ID: 777.1

Direct Cost Comparison of Totally Endoscopic versus Open Ear Surgery

Presenting Author: **Nirmal Patel**

Nirmal Patel¹, Aydin Mohammadi², Nicholas Jufas²

¹*Macquarie University, Sydney,* ²*Kolling Deafness Research Centre| Macquarie and Sydney University*

Learning Objectives: Objective: The introduction of new surgical techniques requires not only an evaluation of safety and clinical efficacy but also cost justification. Totally Endoscopic Ear Surgery (TEES) is a relatively new technique for managing chronic ear disease. The cost of specialised equipment required may be a barrier to implementation of the technique. This study aims to test the null hypothesis that open and endoscopic approaches have similar direct costs for the management of attic cholesteatoma in an Australian private hospital setting. Study Design: A retrospective direct cost comparison from a hospital perspective, of TEES and traditional canal wall up mastoidectomy for the management of attic cholesteatoma in the private tertiary setting was undertaken. Indirect and future costs were excluded. Methods: A cost comparison of anaesthetic set up and resources, operative set up and resources, average cost of running an operating theatre and cost of overnight admission was performed between the two techniques. Results: TEES has a mean reduction of AUD\$2998.63 per operation from the hospital perspective when compared to an open procedure for attic cholesteatoma. Conclusion: Once the learning curve is achieved, TEES is more cost effective from a hospital perspective, than canal wall up mastoidectomy for attic cholesteatoma. When indirect and future costs are considered as well, the economic gain of managing attic cholesteatoma endoscopically could possibly be even greater.

Objective: The introduction of new surgical techniques requires not only an evaluation of safety and clinical efficacy but also cost justification. Totally Endoscopic Ear Surgery (TEES) is a relatively new technique for managing chronic ear disease. The cost of specialised equipment required may be a barrier to implementation of the technique. This study aims to test the null hypothesis that open and endoscopic approaches have similar direct costs for the management of attic cholesteatoma in an Australian private hospital setting.

Study Design: A retrospective direct cost comparison from a hospital perspective, of TEES and traditional canal wall up

mastoidectomy for the management of attic cholesteatoma in the private tertiary setting was undertaken. Indirect and future costs were excluded.

Methods: A cost comparison of anaesthetic set up and resources, operative set up and resources, average cost of running an operating theatre and cost of overnight admission was performed between the two techniques.

Results: TEES has a mean reduction of AUD\$2998.63 per operation from the hospital perspective when compared to an open procedure for attic cholesteatoma.

Conclusion: Once the learning curve is achieved, TEES is more cost effective from a hospital perspective, than canal wall up mastoidectomy for attic cholesteatoma. When indirect and future costs are considered as well, the economic gain of managing attic cholesteatoma endoscopically could possibly be even greater.

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Endoscopic Ear Surgery: Concept and Technique (1) (V777)

ID: 777.2

Protympanum: Endoscopic Anatomy, Variations and Applications

Presenting Author: **Nicholas Jufas**

Nicholas Jufas, Nirmal Patel, Alexander Saxby, Jonathan Kong

Sydney Endoscopic Ear Surgery Research Group

Learning Objectives:

The protympanum is a middle ear space lying anterior to the mesotympanum. Historically, the region has often been overlooked due to its difficulty to visualize microscopically, despite optimum tissue and bone removal. Angled endoscopes with attached high definition cameras have meant that this region is now able to be fully appreciated.

This presentation will revisit the anatomical boundaries of this region, which will be demonstrated using endoscopic visualization. It will also detail and explain the newly defined classification systems for the region, including: (1) the protympanum conformation; (2) the protiniculum, a bony ridge from the promontory to the medial wall, separating the hypotympanum from protympanum; and (3) the sub-tensor recess, an area of pneumatization inferomedial to the tensor tympani canal.

The presentation will utilise high definition endoscopic video and photographs taken during human cadaveric and live surgery. Normal anatomy will be demonstrated, as well as management of pathology in the area. Particular emphasis will be given to relevance of the region in both the development and surgical management of cholesteatoma.

doi:10.1017/S0022215116003844

Endoscopic Ear Surgery: Concept and Technique (1) (V777)

ID: 777.3

Transcanal Endoscopic Ear Surgery for Pediatric Population with a Narrow External Auditory Canal

Presenting Author: **Tsukasa Ito**

Tsukasa Ito, Toshinori Kubota, Tomoo Watanabe, Kazunori Futai, Takatoshi Furukawa, Seiji Kakehata
Yamagata University Faculty of Medicine

Learning Objectives: To confirm that TEES with optional transcanal atticotomy can be used for pediatric patients with a narrow EAC.

Introduction: Transcanal endoscopic ear surgery (TEES) is less invasive and functional procedure that offers the wide angle view of surgical field, higher magnification of fine anatomical structures and better visualization of hidden anatomical areas. We demonstrated the feasibility of TEES for the pediatric population with a narrow external auditory canal (EAC).

Methods: Thirty-nine patients ranging in age from 2 to 14 years old (median: 7.9 yrs) underwent TEES between November 2011 and March 2015. Twenty-one of these patients had surgery for cholesteatomas; fifteen for chronic otitis media; and five for malformation of the middle ear. A preoperative CT scan was performed to evaluate the middle ear disease. We evaluated the bony EAC retrospectively using ImageJ as the image processing program. The EAC bony portion was defined as the bone which surrounds the canal in sagittal CT images. The minimum and maximum Feret diameters were used as the EAC minor and major axis respectively. Transcanal endoscopic tympanoplasty was performed with a rigid endoscope with an outer diameter of 2.7 mm coupled to the full HD system. Transcanal atticotomy was also performed, as necessary, on some patients to remove cholesteatomas in the antrum. We will show a video of the surgical procedure for cholesteatomas.

Results: The minor axis ranged from 3.2 to 5.9 mm (mean: 4.7 mm), while the major axis ranged from 4.8 to 10.2 mm (mean: 7.8 mm). TEES was successfully performed on each patient without having to make a retroauricular incision. Postoperative hearing levels and air-bone gap fell into an acceptable range and are comparable to those results obtained by microscopic ear surgery.

Conclusions: TEES is feasible using rigid endoscopes with an outer diameter of 2.7 mm and is effective and less invasive for pediatric patients with a narrow EAC.

doi:10.1017/S0022215116003856

Paediatric Cholesteatoma (R811)**ID: 811.1****From Retraction Pocket to Cholesteatoma:
A Continuum in Pediatric Ears**Presenting Author: **Cuneyt Alper**

Cuneyt Alper

*Children's Hospital of Pittsburgh of UPMC,
University of Pittsburgh*

Learning Objectives: Cholesteatoma is not a static condition, and does not develop instantly, changing from the definition of no cholesteatoma to a cholesteatoma all of a sudden. There is gradual transition, from state of cholesteatoma prone conditions to pre-cholesteatoma to cholesteatoma, during which an ear may not fit to the clear definitions. Awareness of this transition may be helpful in identifying the ears that has the risk for cholesteatoma development, and perhaps interventions may moderate or prevent this process.

There is a continuum of conditions from Eustachian tube (ET) dysfunction (ETD) to tympanic membrane (TM) retraction, TM retraction pocket, cholesteatoma prone retraction pocket, pre-cholesteatoma, cholesteatoma, recurrence of ET retraction pocket, recurrence of cholesteatoma. Although this progression of conditions is limited with primary acquired cholesteatoma, it represents majority of the pathogenesis of cholesteatoma cases in both children and adults. While this may be seen as theoretic/logical progression, this transition is observed more clearly in children with recurrent and chronic otitis media with likely underlying ETD followed up by pediatric otolaryngologists through their growth and development.

Current presentation is on the experience with the cholesteatoma prone ears, discussing the definitions, risk factors, management of risk factors, methods of prevention, and the decision making process in assessment and management of ears with retraction pocket, pre-cholesteatoma and early cholesteatoma states that are in transition to cholesteatoma formation.

There is a need for consensus on definitions and classification of these transitional conditions and diagnostic criteria for the underlying ETD, a grading system sensitive in capturing the changes in the state of ears as well as ETD, so that prospective close follow-up generates comparable data for future analysis, making analysis of results from multiple centers and hypothesis driven trials possible.

doi:10.1017/S0022215116003868

Paediatric Cholesteatoma (R811)**ID: 811.2****The Utility of Diffusion Weighted
Magnetic Resonance Imaging in
Identifying Cholesteatoma in Children**Presenting Author: **Kenneth Lee**Kenneth Lee¹, Tiffany Pham², Walter Kutz²,
Brandon Isaacson², Tim Booth²¹University of Texas, Southwestern Medical
Center, ²UT Southwestern Medical Center

Learning Objectives: 1) Understand the rationale of DW MRI for identifying presence of cholesteatoma 2) Understand the limits of DW MRI for identifying presence of cholesteatoma 3) Understand the accuracy and utility of DW MRI in determining the presence of cholesteatoma in children.

Cholesteatoma has a significant rate of recidivism. Children in particular are at higher risk of residual disease due to the aggressive nature of congenital cholesteatomas as well as recurrent disease due to ongoing Eustachian tube dysfunction. As a result, historically, "second look" procedures were routinely performed and considered standard of care. Recently, oblique planned revision tympanomastoidectomy procedures have become challenged due to concerns of repeated risks of anesthesia and surgery as well as added health care costs. While the diagnosis of cholesteatoma is primarily made clinically, imaging, particularly computed tomography, has been used as a tool to assist in confirming the diagnosis and determining the extent of the disease. In patients who have previously undergone primary cholesteatoma surgery, diffusion weighted magnetic resonance imaging (DW MRI) has become a useful imaging modality to assist in deciphering the presence of cholesteatoma vs. mere fluid or inflammation in the middle ear and mastoid. Since 2012, we have performed nearly 100 DW MRI studies in children to determine the presence of cholesteatoma. The results of these studies in comparison to subsequent surgical findings will be presented to review the accuracy of DW MRI in identifying cholesteatoma in our pediatric patient population.

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Paediatric Cholesteatoma (R811)**ID: 811.3****Predictive factors for recurrent
cholesteatoma**Presenting Author: **Adrian James**

Adrian James

University of Toronto

Learning Objectives: To enhance understanding of the factors which contribute to development of recurrent cholesteatoma in children as part of the Round Table session on Paediatric Cholesteatoma.

Predictive factors for recurrent cholesteatoma

Recurrent cholesteatoma (i.e. development of new disease after previous surgical clearance) may be a consequence of persistent pathogenetic factors and perhaps also of surgical technique. Cholesteatoma is commonly considered to behave more aggressively in children than adults. A clear understanding of factors that predispose to recurrent disease in children may help selection of optimal surgical

technique for disease control for example between canal wall up (CWU) or down (CWD) and mastoid preservation or obliteration.

In an attempt to clarify this relationship between disease, patient and surgery, a single-surgeon prospective database of consecutive cholesteatoma surgeries was analysed. Analysis was restricted to cases with no prior history of cholesteatoma surgery. Out of 368 paediatric cases, 328 (89%) were completed with CWU of which 69 were totally endoscopic (TEES), and 40 were completed with CWD of which 10 had primary obliteration. Overall 34 (9%) were found to develop recurrent cholesteatoma. Kaplan Meier survival (KM) analysis was used to control for the cumulative increase in recurrence with time, giving an overall recurrence rate of 12% at 5 years and 18% at 10 years. Perhaps surprisingly, KM analysis suggests that gender and younger age had no impact on likelihood of recurrence. Similarly the same rate of recurrence was found for congenital and acquired cholesteatoma and whether disease was acquired from pars tensa or pars flaccida retraction. The most significant pre-operative determinant of outcome was extent of cholesteatoma, with cholesteatoma involving 4 sub-sites (meso- and epitympanum, antrum and mastoid) having significantly greater risk of recurrence than smaller disease (30% at 5 years; KM log rank statistic $p = 0.002$).

While canal wall down surgery (CWD) is commonly considered to have a lower risk of recurrence than intact canal wall surgery (CWU), in this series, KM analysis showed no difference in rate of recurrent cholesteatoma between these different techniques. Subgroup analysis, in which the sample sizes are small, suggests (a) the same recurrence rate with TEES and (b) no difference in revision surgery for uncontrolled disease for CWD cases with or without obliteration of the mastoid. In contrast to the perhaps unreachable gold-standard of a randomized prospective trial to control for differences between patients, it must be noted that selection of surgical technique was allocated according to patient and disease factors, for example CWD surgery was used more often for larger cholesteatoma.

Careful recording and analysis of surgical intervention and outcome provides valuable insight into the effectiveness of otologic intervention for cholesteatoma.

Survival analysis is required to control for the increasing incidence with longer follow up. It is also important to control for other risk factors such as the extent of cholesteatoma. Understanding of the mechanisms of recurrent cholesteatoma is confounded by selection of surgical technique according to the extent of disease.

Nevertheless, as it seems that “*Bad ears do badly and good ears do well*” it is arguably most important maximise strategies to prevent recurrent disease in those thought to be most at risk.

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Paediatric Cholesteatoma (R811)

ID: 811.4

Management of Pediatric Cholesteatoma: The Gruppo Otologico Experience in the Management of 618 Cases

Presenting Author: **Enrico Piccirillo**

Enrico Piccirillo, Enrico Piccirillo, Flavia D’Orazio, Melissa Laus, Sampath Chandra Prasad Rao, Mario Sanna

Gruppo Otologico

Learning Objectives: Management of pediatric cholesteatoma and the long term outcomes of canal wall up mastoidectomy.

The objective of this study is to report the Gruppo Otologico experience in the surgical treatment of paediatric cholesteatoma. This is a retrospective study wherein 572 charts of young patients who underwent surgery between 1983 and 2015 were analysed. 46 patients had bilateral disease and the average age was 10.6 years old. The extension of cholesteatoma was defined using Sanna and Zini’s cholesteatoma classification. The most commonly surgical procedure used in children were Canal Wall Up and a Canal Wall Down tympanoplasty. Canal Wall Up Tympanoplasty (CWU) was performed in 263 patients, while, Canal Wall Down Tympanoplasty (CWD) that includes Modified Bondy Technique (BT) and Radical Mastoidectomy (RM), was used in 258 patients. There were more numbers of revision surgeries in CWU (34%) than CWD (10%) tympanoplasty. In all surgeries put together, we had an improvement of hearing of a mean of 8.5 dB HL. The mean follow-up was 10 years. In conclusion, the technique of choice for pediatric cholesteatoma is CWU tympanoplasty. However, the use of a CWD approach to surgically treat extensive cholesteatoma in children results in a low recurrence rate with a high rate of trouble-free ear in the long term.

doi:10.1017/S0022215116003893

Paediatric Cholesteatoma (R811)

ID: 811.5

Long term functional and hearing outcomes of surgery in pediatric cholesteatoma

Presenting Author: **Enrico Piccirillo**

Enrico Piccirillo, Flavia D’Orazio, Sampath Chandra Prasad, Gianluca Piras, Mario Sanna

Gruppo Otologico

Learning Objectives: The aim of this study is to retrospectively analyze the functional and hearing outcomes of surgery for cholesteatoma in pediatric population.

Study Design: Retrospective study

Setting: Gruppo Otologico, a quaternary referral center for Otolaryngology and Skull Base Surgery in Italy.

Materials & methods: A retrospective analysis is presented of 664 cases of cholesteatoma in pediatric population who were treated by surgery. The surgical approach was chosen according to the hearing loss, symptoms, status of tympanic membrane and radiological finding. Surgical procedures included Canal Wall Down mastoidectomies, Modified Bondy mastoidectomies, Canal Wall Up mastoidectomies, Radical mastoidectomies, revision surgeries and Subtotal Petrossectomies. In some of these patients

additional procedure included Cochlear Implants or Bone-anchored hearing aids. Charts were analysed for type of cholesteatoma, surgical procedures, hearing results, recurrence and follow up.

Results: Charts of 664 patients were analysed. Of these patients, 39% underwent CWD surgery, 38% CWU surgery, 4.9% CWD with Bondy's technique, 4.3% radical CWD, 0.75% subtotal petrosectomy and 13% of patients underwent a revision tympanoplasty. For long-term functional and hearing outcomes, 552 patients with a follow-up of > 1 year were analyzed separately. Our experience shows an incidence of recurrent cholesteatoma of 19% during 10 years of follow up. In most of these cases CWU procedure was converted into a CWD mastoidectomy. Hearing results will be discussed upon presentation.

Conclusion: Surgery for cholesteatoma is especially challenging in a pediatric population because of the need for hearing preservation. Hence canal wall up mastoidectomy in a single or two stages should be the approach of choice in the pediatric population. The modified Bondy technique is a very useful hearing preservation procedure in limited epitympanic cholesteatomas. Radiological follow-up by DWI is mandatory in children for more than 5 years as recurrences can be seen even after 5 years.

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Free Papers (F812)

ID: 812.1

External auditory canal pathology and Cholesteatoma complication. Management

Presenting Author: **Marcel Cosgarea**

Marcel Cosgarea, Alma Maniu, Violeta Necula
ENT Clinic Cluj- Napoca

Learning Objectives:

External auditory canal (EAC) pathology very often is not a simple pathology. To resolve these ear problems: malformations, infections, tumors etc., it is necessary to have good medical and surgical knowledge. Cholesteatoma remains one of the most challenging ear diseases, its evolution leading sometimes to serious complications (facial palsy, vestibular disorders, meningitis, intracranial abscesses, sigmoid sinus thrombosis etc.). Surgical treatment is always required.

Methods: We reviewed the operative reports of 534 cases treated in the ENT clinic from Cluj between 1998–2005. Patients' ages ranged from 3 to 81 years, with a mean age of 30. The surgical procedure was to follow the cholesteatoma extension from the tympanic cavity to the mastoid cavity. We used for ossicular chain reconstruction incus body without osteitis, head of the malleus, and temporal cortical bone. For the reconstruction of the eardrum and the canal wall we used perichondrium, cartilage with

perichondrium (palisade technique), or only cartilage. Patients with complications underwent the canal wall-down technique.

Results: Recurrence of supuration was noticed in 28% of cases, requiring a second intervention.

Hearing improvement was obtained in 58% of cases, satisfactory results 19% of the patients, and 23% showed no improvement of the hearing.

The best outcomes in the hearing recovery were obtained by using the head of the malleus or the incus as a PORP prosthesis (40%). Tragal cartilage was used as the columella between the eardrum and the stapes with good results (15%). We also used temporal cortical bone grafts as TORP prosthesis with good results (13%).

Conclusions: In EAC disease infections need medical treatment, the tumour surgery and the malformation restoring of hearing and sometime of aesthetics surgery.

Reconstructive techniques using autologous materials proved to be valuable procedures for the recovery of the patient's hearing.

The cholesteatoma must always be operated, the technique being individualized from case to case.

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Free Papers (F812)

ID: 812.2

Studies to establish the safety of middle ear pellets using auditory brainstem response, cytochrome c and histology

Presenting Author: **Emma Hoskison**

Emma Hoskison¹, Mat Daniel², Mike Mulheran³, David Furness⁴, Roger Bayston⁵, John Birchall⁵
¹City Hospital, Birmingham, ²Nottingham University Hospitals, ³University of Leicester, ⁴Keele University, ⁵Nottingham University

Learning Objectives: Otitis Media with Effusion (OME) is the commonest cause of paediatric hearing impairment globally. Primary treatment is ventilation tube insertion with a 25% recurrence rate. Antibiotic laden pellets placed in the middle ear present a potential novel treatment strategy. This study aims to establish the safety of these pellets *in vivo*.

Introduction: Otitis Media with Effusion (OME) is the commonest cause of paediatric hearing impairment globally (Mandel et al 2008). Primary treatment is ventilation tube insertion (NICE Guidelines 2008) with a 25% recurrence rate (Gates et al 1987). Antibiotic laden pellets placed in the middle ear present a potential novel treatment strategy. This study aims to establish the safety of these pellets *in vivo*.

Methods: Rifampicin and Clindamycin loaded pellets made of poly lactic-co-glycolic acid were surgically placed in guinea pig middle ears. Auditory Brainstem Responses

doi:10.1017/S0022215116003947

doi:10.1017/S0022215116003959

Free Papers (F812)**ID: 812.5****Biodesign as a graft material in paediatric ear surgery- endoscopic and open approach**Presenting Author: **Paramita Baruah**

Paramita Baruah¹, Konstance Tzifa²
¹West Midlands Deanery, ²Birmingham
 Children's Hospital

Learning Objectives:

Introduction: Biodesign is an artificial graft material. This work assesses the feasibility of performing middle ear reconstruction with biodesign and the short and long-term results on closure of perforations and hearing.

Methods: We performed a retrospective study of 18 children who had middle ear reconstruction using biodesign during endoscopic and conventional ear surgery for chronic suppurative otitis media. The surgeries were performed between February 2014 and February 2015 by the senior author.

Results: Nine surgeries were endoscopic tympanoplasty, 3 were endoscope-assisted tympanoplasty, 2 were conventional microscope tympanoplasty, two were endoscopic tympanoplasty for cholesteatoma and remaining two were combined approach tympanoplasty (CAT) for cholesteatoma. At 3 months follow up 17 (94%) of the grafts were intact while one had a pin-hole perforation. Over the period of follow-up of 12 months, one patient with cholesteatoma (endoscopic tympanoplasty) underwent a mastoidectomy for recurrence. One patient who underwent a CAT had a second look procedure while the other presented with recurrent disease. One patient (endoscopic myringoplasty) underwent a revision endoscopic myringoplasty. The patient who had a pin hole perforation at 3 month follow up went on to develop a retraction and a tympanoplasty with cartilage grafting is planned. Rest of the patients (72%) have had no further trouble with their ears.

Conclusion: The early results with biodesign in the reconstruction of middle ear are very good (94% intact graft rate). The biodesign graft continues to do well in the group of patients undergoing myringoplasty even after a follow up of 12 months with intact grafts in 11 of 14 patients (78%).

Learning points: Biodesign is a good substitute for temporalis fascia, obviates the need for a separate scar with endoscopic ear surgery and is very useful in repeat mastoid surgeries where temporalis fascia may be scarce.

Free Papers (F812)**ID: 812.6****Development of noninvasive techniques for tympanic membrane regeneration; animal study**Presenting Author: **Yun-Hoon Choung**

Yun-Hoon Choung¹, Beomyong Shin¹, Kyoung-Je Jang²,
 Hoon Seonwoo², Oak-sung Choo¹, Jeong Hun Jang¹,
 Jong Hoon Chung²

¹Ajou University School of Medicine, ²Seoul
 National University

Learning Objectives: Tympanic membrane (TM) perforation, in particular chronic otitis media, is one of the most common clinical problems in the world and can present with sensorineural hearing loss. Here, we explored an approach for TM regeneration where the latent progenitor or stem cells within TM epithelial layers may play an important regulatory role. We showed that potential TM stem cells present highly positive staining for epithelial stem cell markers and are present at low levels in all areas of normal TM tissue. Additionally, they are present at high levels in perforated TMs, especially in proximity to the holes, regardless of acute or chronic status, suggesting that TM stem cells may be a potential factor for TM regeneration. Finally, we propose a new therapy using stem cell growth factors for chronic TM regeneration. We developed an insulin-like growth factor-binding protein-releasing chitosan patch to promote TM stem cell growth toward TM regeneration in the chronic TM perforation model. Complete regeneration resulting in an intact TM occurred in 43.8% of chronically perforated animals; healing was dependent on perforation size in that small lesions (<50% area) were resolved in 66.7% of cases. Our study suggests that latent TM stem cells could be potential regulators of regeneration, which provides a new insight into this clinically important process and a potential target for new therapies for chronic otitis media and other eardrum injuries.

Tympanic membrane (TM) perforation, in particular chronic otitis media, is one of the most common clinical problems in the world and can present with sensorineural hearing loss. Here, we explored an approach for TM regeneration where the latent progenitor or stem cells within TM epithelial layers may play an important regulatory role. We showed that potential TM stem cells present highly positive staining for epithelial stem cell markers and are present at low levels in all areas of normal TM tissue. Additionally, they are present at high levels in perforated TMs, especially in proximity to the holes, regardless of acute or chronic status, suggesting that TM stem cells may be a potential factor for TM regeneration. Finally, we propose a new therapy using stem cell growth factors for chronic TM regeneration. We developed an insulin-like growth factor-binding protein-releasing chitosan patch to promote TM stem cell growth

toward TM regeneration in the chronic TM perforation model. Complete regeneration resulting in an intact TM occurred in 43.8% of chronically perforated animals; healing was dependent on perforation size in that small lesions (<50% area) were resolved in 66.7% of cases. Our study suggests that latent TM stem cells could be potential regulators of regeneration, which provides a new insight into this clinically important process and a potential target for new therapies for chronic otitis media and other eardrum injuries.

doi:10.1017/S0022215116003960

Population-based studies in otologic epidemiology (N813)

ID: 813.1

Increased Risk of Depression in Patients with Cholesteatoma: A Nationwide Study

Presenting Author: **Chin-Lung Kuo**

Chin-Lung Kuo¹, An-Suey Shiao², Wei-Pin Chang³

¹HsinChu Armed Forces General Hospital,

²Taipei Veterans General Hospital, ³Taipei Medical University

Learning Objectives: Cholesteatoma is a locally invasive condition; however, a comorbidity of depressive disorder could be a risk factor of systemic morbidity and mortality. A relationship between cholesteatoma and depressive disorder has been observed in clinical practice; however this link has not been firmly established in the literature. To the best of our knowledge, this is the first study to demonstrate a prospective link between cholesteatoma and subsequent depressive disorder within a three-year followup. Clinicians should keep this critical but neglected issue in mind and carefully investigate the possibility of subsequent psychological problems among cholesteatoma patients.

Objective: Cholesteatoma is a locally invasive condition; however, a comorbidity of depression could be a risk factor of systemic morbidity and mortality. A relationship between cholesteatoma and depression has been observed in clinical practice; however this link has not been firmly established in the literature. This study sought to estimate the risk of developing depressive disorder (DD) following diagnosis with cholesteatoma.

Methods: In the study, we analyzed data from the Longitudinal Health Insurance Database of Taiwan. A total of 599 patients newly diagnosed with cholesteatoma between 1997 and 2007 were included with a comparison cohort of 2,995 matched non-cholesteatoma enrollees. Each patient was followed for 3 years to identify the subsequent development of DD. Cox proportional hazard regression analysis was performed to compute adjusted 3-year hazard ratios.

Results: Of the 3,594 patients in the sample, 20 individuals (3.3%) from the cholesteatoma cohort, and 52 (1.7%) from the comparison cohort were subsequently diagnosed with DD during the 3-year follow-up. The incidence of DD per

thousand person-years was approximately twice as high among patients with cholesteatoma (11.32) as among those without cholesteatoma (5.85). After adjusting for potential confounders, patients with cholesteatoma were 1.99 times (95% CI = 1.18–3.34, $P = 0.010$) more likely to suffer from DD within 3 years compared to those without cholesteatoma.

Conclusions: This is the first study to demonstrate a link between cholesteatoma and subsequent DD within a three-year followup. We suggest that clinicians keep this critical but neglected issue in mind and carefully investigate the possibility of subsequent psychological problems among cholesteatoma patients.

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Population-based studies in otologic epidemiology (N813)

ID: 813.2

Epidemiology of Pediatric Otitis Media with Effusion in Taiwan

Presenting Author: **Mao-Che Wang**

Mao-Che Wang

Taipei Veterans General Hospital

Learning Objectives: By using the population based database NHIRD, we can accurately report the epidemiology of pediatric otitis media with effusion with ventilation tube insertions as a surrogate. We can also conduct studies to find out risk factors and prevention methods for pediatric otitis media with effusion by using the population based database NHIRD.

Introduction: Otitis media with effusion is a very common pediatric otologic problem. We try to report the epidemiology of pediatric otitis media with effusion and common comorbidities by using ventilation tube insertions as a surrogate.

Methods: We retrieved study objects from Taiwan National Health Insurance Research Databank (NHIRD). We analyzed characteristics and comorbidities of all children received ventilation tube insertion from July, 2000 to December 2009. We also analyzed the recurrent pattern by following the year 2000 and 2001 birth cohort for 8 or 9 years.

Results: From July, 2000 to December 2009, 11042 ventilation tube insertions were done in Taiwan. For all children received ventilation tube insertion, the mean age of tube insertion was 5.4 ± 3.3 years. Thirty six percent of them had concurrent adenoidectomy, 15.4% with cleft palate, 7% with Down syndrome. For 2000 and 2001 birth cohort, 1755 (0.393%) children received ventilation tube insertions and 111 (6.3%) had tube reinsertions before 8 or 9 years old.

Conclusion: We have around 1200 children received ventilation tube insertions in Taiwan, and a good portion of them had comorbidities such as cleft palate, Down syndrome.

Six point seven percent of children may have tube reinsertions.

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Population-based studies in otologic epidemiology (N813)

ID: 813.3

Sudden sensorineural hearing loss: evidence from Taiwan

Presenting Author: **Chuan-Song Wu**

Chuan-Song Wu

Department of Otolaryngology, Taipei City Hospital, Taipei, Taiwan. College of Science and Engineering, Fu-Jen Catholic University, New Taipei City, Taiwan. Graduate School of Business Administration, Fu-Jen Catholic University, New Taipei City, Taiwan.

Learning Objectives: Using the The National Health Insurance research Database to explore the risks of sudden hearing loss in Taiwan.

Taiwan's National Health Insurance program was implemented in March 1995. The National Health Insurance research Database contains registration files and original claim data for reimbursement. The databases are provided to researchers in Taiwan for study proposes. The Taiwan National Health Research Institute has validated the representativeness of the LHID2000 relative to the whole population of NHI enrollees in terms of gender distribution. In addition, several studies have demonstrated the high validity of the data taken from the NHI programme.

Possible causes of SSNHL may include viral or bacterial infection, circulatory disturbance in the area of the anterior inferior cerebellar artery, acoustic tumor, peri-lymphatic fistula, environment, diet or weather. SSNHL is also occasionally preceded by a common cold or upper respiratory tract infection, as reported in patients with vestibular neuritis or Ménière's disease.

We find that for the period under examination, gender-specific incidence rates per 100,000 of the population were 8.85 for males, and 7.79 for females, and that there was an increase in age-specific SSNHL incidence with age. After adjusting for seasonality, months and trends, there is no significant relationship between monthly SSNHL incidence rates and weather conditions. There is indeed a relationship between physician and hospital characteristics and the LOS for SSNHL patients. Risk of sudden sensorineural hearing loss did not increase following a recent herpes zoster attack. Male patients with SSNHL had a higher proportion of prior OSA than non-SSNHL-diagnosed controls. There was an association between AMI and prior SSNHL.

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Population-based studies in otologic epidemiology (N813)

ID: 813.4

Risk of Sudden Sensorineural Hearing Loss in Stroke Patients: A 5-year Nationwide Investigation of 44,460 Patients

Presenting Author: **Nancy Chang**

Nancy Chang¹, Chin-Lung Kuo², An-Suey Shiao³

¹Taipei Veterans General Hospital,

²Department of Otolaryngology, Hsinchu Armed Force Hospital, ³Department of Otolaryngology, Taipei Veterans General Hospital

Learning Objectives: Post-stroke sudden sensorineural hearing loss (SSNHL) can hinder communication between patients and healthcare professionals, thereby restricting participation in rehabilitation programs and limiting improvements in physical performance. However, the relationship between stroke and SSNHL remains unclear. This study employed a nationwide population-based dataset to investigate the relationship between stroke and SSNHL.

Objective: Post-stroke sudden sensorineural hearing loss (SSNHL) can hinder communication between patients and healthcare professionals, thereby restricting participation in rehabilitation programs and limiting improvements in physical performance. However, the relationship between stroke and SSNHL remains unclear. This study employed a nationwide population-based dataset to investigate the relationship between stroke and SSNHL.

Methods: The Taiwan Longitudinal Health Insurance Database was used to compile data from 11,115 stroke patients and a comparison cohort of 33,345 matched non-stroke enrollees. Each patient was followed for 5 years to identify new onset SSNHL. Stratified Cox proportional-hazard regression analysis was used to examine the association of stroke with subsequent SSNHL.

Results: Among the 44,460 patients, 66 patients (55,378 person-years) from the stroke cohort and 105 patients (166,586 person-years) from the comparison cohort were diagnosed with SSNHL. The incidence of SSNHL was approximately twice as high among stroke patients than among non-stroke patients (1.19 and 0.63/1000 person-years, respectively). Stroke patients had a 71% increased risk of SSNHL, compared to non-stroke patients (adjusted hazard ratio (HR) = 1.71, 95% CI = 1.24–2.36). We also observed a remarkable increase in risk of SSNHL in stroke

patients (1) within one-year follow-up (adjusted HR = 5.65, 95% CI = 3.07–10.41) or (2) under steroid therapy during hospitalization (adjusted HR = 5.14, 95% CI = 2.08–12.75).

Conclusions: Patients with stroke had a higher risk of subsequent SSNHL compared to patients without stroke. In particular, stroke patients within one-year follow-up and those undergoing steroid therapy during hospitalization should be treated with the utmost caution, considering that the risk of SSNHL increases by more than 5-fold.

doi:10.1017/S002221511600400X

What is new in Otolaryngology (R814)

ID: 814.1

What is New in Otolaryngology (R814): Intranasal surfactant treatment for Eustachian tube dysfunction and Otitis Media

Presenting Author: **Sujana Chandrasekhar**

Sujana Chandrasekhar

New York Otolaryngology; Hofstra-Northwell School of Medicine

Learning Objectives: 1. Know the role of surfactants in normal Eustachian tube function 2. Know that there is reduction of surfactant in the nasopharyngeal ET in cases of OM 3. Learn the potential for using intranasal surfactant for the treatment of ETD and OM.

It has long been understood that endogenous surfactants play a significant role in the normal functionality of the Eustachian tube (ET) and that there is a reduction in surfactants at the nasopharynx (NP) and the nasopharyngeal end of the Eustachian tube in humans with secretory otitis media. The site of ET obstruction in chronic middle ear disease appears to be at the protympanic portion of the ET more so than at the NP cartilaginous portion, which is the portion affected by balloon Eustachian tuboplasty. Previous researches have used nebulized pulmonary surfactants and shown a trend or actual improvements in ET passive opening pressure in animal models. However, due to the physicochemical properties of surfactants, nebulizing them dramatically reduces their ability to 'de-stick' apposed mucosal surfaces. Additionally, animal-derived medical surfactants are expensive and pose potential risks. We have developed a fully synthetic surfactant delivered intranasally as an aerosol via a metered dose inhaler. In normal ears, our surfactant dramatically reduced passive opening pressure of the ET in mouse and gerbil models. In gerbils with otitis media with effusion, once-daily surfactant spray reduced days of effusion from 16 to 10; twice-daily surfactant spray and once-daily surfactant with steroid spray reduced it to 8 days; and twice-daily surfactant with steroid spray reduced it further to 6 days. There was no recurrence of effusion after stopping treatment. In chinchillas with acute bacterial otitis media, intranasal surfactant spray significantly reduced effusion, severity of disease and bacterial burden without concomitant administration of antibiotics. We postulate that our synthetic, dry powder, aerosolized surfactant spray when delivered intranasally in humans will ameliorate many cases of Eustachian tube dilatory dysfunction and a range of cases of otitis

media. Clinical studies to evaluate surfactant effects in humans with middle ear disease are planned.

doi:10.1017/S0022215116004011

What is new in Otolaryngology (R814)

ID: 814.2

Regeneration therapy for closing chronic tympanic membrane perforation using basic fibroblast growth factor combined with an atelocollagen

Presenting Author: **Nobuhiro Hakuba**

Nobuhiro Hakuba

Teikyo University School of Medicine, University Hospital Mizonoguchi

Learning Objectives: Various attempts have recently been made to achieve perforated tympanic membrane closure using minimally invasive ambulatory surgical procedures. Since 2000, we have introduced a treatment procedure to promote regeneration of the tympanic membrane and closure of perforations using a synthetic graft material instead of autografts such as temporal fascia. In that procedure, a perforated tympanic membrane is filled with a synthetic graft material (atelocollagen sponge/silicon membrane; TERUDERMIS[®]), to which human fibroblast growth factor is applied to promote wound healing (bFGF preparation; Fibrast Spray[®]). This study describes the details of this treatment procedure and discusses the outcome of patients who presented to our outpatient clinic and underwent the procedure for tympanic membrane regeneration over a 2-year period between July 2009 and December 2011 and who were followed for at least 1 year with respect to the preoperative factors that affect closure outcome. Complete closure was achieved in 105 (66.5%) patients after 1 year of postoperative follow up. The incidence of residual perforation was significantly higher in patients with the following four factors than in those without: 1) unidentified perforation margin, 2) severe calcification of the tympanic membrane, 3) marginal perforation, and 4) large perforation. Logistic regression analysis adjusted for the effects of each factor identified marginal perforation as significant factors affecting the outcome of tympanic membrane closure. Tympanic membrane regeneration therapy can be applied to all patients. However, in patients whose perforation margin cannot be identified, in those with severe calcification of the tympanic membrane, and in those with marginal or large perforation, the therapy should be performed prudently after obtaining consent following sufficient explanation that tympanic membrane regeneration may not be achieved.

Various attempts have recently been made to achieve perforated tympanic membrane closure using minimally invasive ambulatory surgical procedures. Since 2000, we have introduced a treatment procedure to promote regeneration of the tympanic membrane and closure of perforations using a synthetic graft material instead of

autografts such as temporal fascia. In that procedure, a perforated tympanic membrane is filled with a synthetic graft material (atelocollagen sponge/silicon membrane; TERUDERMIS®), to which human fibroblast growth factor is applied to promote wound healing (bFGF preparation; Fibrast Spray®). This study describes the details of this treatment procedure and discusses the outcome of patients who presented to our outpatient clinic and underwent the procedure for tympanic membrane regeneration over a 2-year period between July 2009 and December 2011 and who were followed for at least 1 year with respect to the preoperative factors that affect closure outcome. Complete closure was achieved in 105 (66.5%) patients after 1 year of postoperative follow up. The incidence of residual perforation was significantly higher in patients with the following four factors than in those without: 1) unidentified perforation margin, 2) severe calcification of the tympanic membrane, 3) marginal perforation, and 4) large perforation. Logistic regression analysis adjusted for the effects of each factor identified marginal perforation as significant factors affecting the outcome of tympanic membrane closure.

Tympanic membrane regeneration therapy can be applied to all patients. However, in patients whose perforation margin cannot be identified, in those with severe calcification of the tympanic membrane, and in those with marginal or large perforation, the therapy should be performed prudently after obtaining consent following sufficient explanation that tympanic membrane regeneration may not be achieved.

doi:10.1017/S0022215116004023

What is new in Otology (R814)

ID: 814.3

Turner syndrome: Translational research concerning ear and hearing

Presenting Author: **Malou Hulcrantz**

Malou Hulcrantz

CLINTEC, Karolinska Institutet

Learning Objectives: Translational research concerning a syndrome with new information added stepwise.

Background: In Turner syndrome (loss of one X-chromosome) a female phenotype is presented with ear and hearing problems. These women lack ovaries and do not produce any estrogen. Both the outer, the middle and the inner ear are commonly affected in this syndrome. These women have massive otitis media problems, middle ear problems and a rapid hearing decline already at the age of 35. Males in general have a slow decline over time (from age 20), while females in general have a good hearing until time for menopause, when estrogen levels are low. What impact does estrogen have on hearing?

A Turner mouse, lacking one x-chromosome, has been developed and underlying immunological causes to explain the frequent otitis media problems have been ruled out. Estrogen receptors, a prerequisite for estrogen acting in the inner ear, have been demonstrated in mice, rats, pigs and humans in the hearing nuclei where the hearing pathways are switched. There are two estrogen receptors present, an alpha and a beta receptor in the inner ear and if the beta receptor is knocked-out, mice gets deaf early at the age of 1 year.

A rapid decline in hearing is seen just at the time for menopause in the general population of women and hearing decline can improve if estrogen substitution is given. Estrogen substitution given to rats after ovaries having been surgically removed, hear better.

Methods: Experimental animal studies using immunohistochemistry, ABR measurements, genetic manipulations and hormone substitution have been performed as well as human longitudinal studies following hearing over time.

Results and Conclusion: It has been proven in animal and human studies that estrogen has an impact on hearing and can be regulated. Prednisolone does not show any receptors in the inner ear. Would it be possible to stimulate selective receptors with estrogen substitution to diminish the infections and hearing problems in the future?

doi:10.1017/S0022215116004035

What is new in Otology (R814)

ID: 814.4

What is new in Otology (R814), The new technology: canal wall up tympanoplasty with transplantation of tissue-engineered cell sheets

Presenting Author: **Hiromi Kojima**

Hiromi Kojima, Kazuhisa Yamamoto

Jikei University

Learning Objectives:

Objectives: The likelihood of recurrent retraction and adhesion of newly formed tympanic membrane is high when normal middle ear mucosa is extensively lost during intractable middle surgery. If rapid postoperative regeneration of the mucosa on the exposed bone surface can be achieved, prevention of recurrent tympanic membrane adhesion and cholesteatoma formation can be expected. The aim of this study was to develop a new method to transplant autologous cell-sheets to promote postoperative regeneration of the middle ear mucosa.

Methods: We harvested 10-by-10-mm specimens of inferior turbinate mucosal tissue from the patient with acquired middle ear cholesteatoma. Tissue-engineered epithelial-cell sheets were fabricated ex vivo by culturing harvested cells for three weeks on temperature-responsive culture dishes in a cell-processing center (CPC) according to good manufacturing practice guidelines. After canal wall up tympanoplasty with mastoidectomy had been performed, sheets of cultured autologous cells that had been harvested with a simple reduced-temperature treatment were transplanted directly into the exposed bone surface of middle ear cavity from which normal mucosa had been defect.

Results: Autologous cell sheets were successfully transplanted to human middle ear. Postoperative tympanic membrane findings showed that there was no retraction of tympanic membrane. Furthermore postoperative CT findings showed that aeration were seen in attic and mastoid cavity

where the cell sheet were transplanted. No recurrence of choleateatomas were seen.

Conclusion: This is the first clinical study approved from the Ministry of Health, Labour and Welfare in Japan. Furthermore this is a first-in-man study in the world that the cultured cells were transplanted to the human ear. This novel technology of transplantation might be an effective alternative to the surgical operation on intractable otitis media in the near future.

doi:10.1017/S0022215116004047

What is new in Otology (R814)

ID: 814.5

Management of patients with symptoms related to raised intracranial pressure

Presenting Author: **Patrick Axon**

Patrick Axon

Cambridge University Hospitals

Learning Objectives: Understanding the relationship between raised intracranial pressure and oto-neurological symptoms.

Raised intracranial pressure (ICP) is often managed by neurologists and neurosurgeons based on the severity of symptoms. Patients who have very high ICP (idiopathic intracranial hypertension - IIH) are dominated by headache, lethargy and visual disturbance. Closer questioning, however, reveals a multitude of ENT symptoms including pulsatile tinnitus, imbalance, facial pain and hearing disturbance.

This presentation discusses management of the otological manifestations of raised ICP and presents early evidence that raised ICP not only is a cause of meningoencephalocele and CSF otorrhoea but could also play a role in the development of superior semicircular canal dehiscence.

doi:10.1017/S0022215116004059

Implantable hearing devices (N815)

ID: 815.1

Treatment of Single-Sided Deafness and Asymmetric Hearing Loss in Adults

Presenting Author: **Susan Arndt**

Susan Arndt, Frederike Hassepas, Thomas Wesarg, Antje Aschendorff, Roland Laszig

Medical Center - University of Freiburg

Learning Objectives: Cochlear implantation treatment is significantly superior to alternative therapy options (Bi-/CROS and BCI) in terms of speech comprehension in background noise and sound localization.

In the past, unilateral hearing loss had not been perceived as a severe handicap. However, our research results show that, despite a normal hearing capacity in one ear and the ability to understand language in quiet surroundings, patients suffering from single-sided deafness (SSD) and asymmetric hearing loss (AHL) experience significant challenges in various everyday situations. This is particularly evident when the language reaches the deaf ear in additional background noise.

The limitation of the auditory function may result in a fatigue due to increased listening effort and can have a major impact on psychosocial factors. Furthermore, the localization capacity is significantly limited, as bilateral hearing is mandatory for spatial hearing. Thus, treatment of single-sided deafness has to become a relevant issue.

Patients with SSD and AHL can be rehabilitated with conventional CROS or Bi-CROS systems (contra-lateral routing of signal), bone anchored hearing systems or with a cochlear implant (CI). The indications and results of the different treatments are presented.

doi:10.1017/S0022215116004060

Implantable hearing devices (N815)

ID: 815.2

Indications and surgical coupling techniques of active middle ear implants

Presenting Author: **Stefan Volkenstein**

Stefan Volkenstein¹, Jan Peter Thomas², Stefan Dazert²

¹*Ruhr-University of Bochum, St. Elisabeth-Hospital,* ²*Ruhr-University of Bochum, St. Elisabeth-Hospital, Department of Otorhinolaryngology, Head & Neck Surgery*

Learning Objectives: Active middle ear implants; Hearing loss.

During the last years, indication range for active middle ear implants (AMEI) has been widely extended. Originally, AMEI were indicated in patients with sensory neural hearing loss. Due to new coupling strategies, these days also patients with conductive and mixed hearing loss can be provided with AMEI. Therefore, these systems are also indicated in cases such as chronic otitis media and/or ear malformations etc.

Using recently introduced coupling techniques, AMEIs may be adapted to ears with an intact ossicular chain and in cases with partially or complete missing ossicles. According to the remaining middle ear structures, the mechanical transducers of AMEIs may be adapted to different ossicles (incus, stapes) or to structures such as the oval or the round window. We will discuss advantages and disadvantages of different implants such as systems with one or two point fixation. Also, the various surgical techniques to place and adapt the transducers to middle ear structures will be addressed.

The post-operative outcome will be presented and we will finish up with a discussion of our experiences with the audience who might have had patients with similar conditions or different pitfalls.

doi:10.1017/S0022215116004072

Current surgical approach to CSOM (R816)**ID: 816.1****Evidence based approach and quality control in management of otitis media with effusion and recurrent acute otitis media**Presenting Author: **Anna Granath**

Anna Granath

*Karolinska University Hospital**Learning Objectives:*

In Sweden approximately 10 000 children per year have surgery with tube insertion. The Swedish National Register for Tube Treatment includes children with otitis media with effusion (OME) or recurrent acute otitis media (rAOM). Clinics participate on a voluntary basis. The first version (1997–2008) of the register collected about 40000 cases. Data showed that a majority (75%) of the registered cases had tubes inserted due to OME. More boys (52%) than girls (42%) were included, supposedly mirroring the clinical situation. In 2008 the Swedish Council on Health Technology Assessment (SBU) initiated a systematic review on tube treatment in rAOM and OME. Based on this report national guidelines for tube treatment were drawn up, and the register was revised and later rebooted in 2013. The treatment guidelines include recommendations for hearing tests before and after tube insertion in cases of OME. Pre- per- and postoperative questionnaires are submitted by the participating clinics and there is also a postoperative questionnaire answered by the parents (6 months postoperatively). Data extracted from the new registry on hearing results and patients satisfaction are now being reviewed. At present the new register contains about 7000 cases. Resent analysis indicate that the rate of pre-operative hearing tests is to low according to treatment guidelines. The gender difference with a majority of cases being male remains. The group of children with rAOM is younger than the OME-group. There is room for improvement concerning pre- and post-operative hearing tests, improved collections rates for the parent's questionnaires and the total rate of clinics participating in the register. A consultant group works on solutions for improvement, together with Centre of Registers Västra Götaland, which is the national hub for all the ENT-registers. Methods for using the register in clinical research are being developed, in order to answer relevant clinical questions.

doi:10.1017/S0022215116004084

Current surgical approach to CSOM (R816)**ID: 816.2****Systematic approach to the surgical management of chronic suppurative otitis media and cholesteatoma**Presenting Author: **Joe Kutz**

Joe Kutz

University of Texas Southwestern Medical Center

Learning Objectives: 1. Describe a systematic approach for the surgical management of CSOM and cholesteatoma 2. Explain management options for challenging intraoperative findings 3. Discuss the decision making process on staging surgery.

Chronic suppurative otitis media (CSOM) and cholesteatoma are perhaps the most common surgical conditions encountered by the otologist. Surgical management is challenging because of the variability in the extent of the disease and the potential for recurrence. In this presentation, I will present a systematic approach to the surgical management of CSOM and cholesteatoma. In addition, the management of particularly challenging intraoperative findings and potential solutions will be discussed. Finally, the decision process for staging surgery will be discussed.

doi:10.1017/S0022215116004096

Current surgical approach to CSOM (R816)**ID: 816.3****One-stage transcanal atticotomy for epitympanic and mesotympanic cholesteatoma in adults: surgical techniques, anatomical and functional results**Presenting Author: **Daniele Bernardeschi**

Daniele Bernardeschi, Olivier Sterkers

*Pitié-Salpêtrière Hospital**Learning Objectives:*

Objectives/Hypothesis: Surgical management of cholesteatoma limited to the attic and/or mesotympanum remains controversial. The aim of this study was to evaluate the anatomical and the functional results of transcanal atticotomy (TA) in this pathological situation.

Study design: Retrospective medical record review.

Methods: Records of 27 adult patients treated from 2008 to 2014 who underwent TA for primary cholesteatoma surgery were reviewed. Preoperatively, physical examination, audiometry, and CT-scan have been analyzed. Intraoperative findings have been described as well as the surgical technique. Anatomical and functional results have been evaluated with a mean follow up (FU) of 24 ± 12.2 months and the results of CT-scan imaging performed 1 year after surgery to evaluate the presence of residual disease.

Results: Surgeries were uneventful. During the FU, 1 patient (4%) experienced retraction of the attical reconstruction, all the other patients had a well-healed tympanic drum with stable attical reconstruction. The mean air-bonag was 19 ± 12.2 dB and 10 ± 7.3 dB pre-operatively and post-operatively, respectively (mean \pm SD, $p = 0.001$, paired t-test). Twenty-two patients (81%) had no opacity suggesting residual cholesteatoma in CT-scan. Four patients (15%) presenting opacity at CT-scan underwent MRI study that was negative for residual

cholesteatoma. One patient (4%) had displacement of the ossicular prosthesis.

Conclusion: Cholesteatomas restricted to the attic and/or mesotympanum can be removed in a one-stage technique with no residual visible at 1 year and closure of ABG by 50%.

doi:10.1017/S0022215116004102

Inflammation in the middle ear: initiation, regulation and pathophysiology (K823)

ID: 823.1

Inflammation in the middle ear: Initiation, regulation and pathophysiology

Presenting Author: **Allen F. Ryan**

Allen F. Ryan

University of California, San Diego

Learning Objectives: Inflammatory reactions in the middle ear (ME) are significant contributors to otologic disease, including cholesteatoma and otitis media. A major source of ME inflammation is the activation of pattern recognition receptors (PRRs), either by bacteria, viruses or damage-associated molecules patterns (DAMPs) released from dying cells. Ligand binding to PRRs, including Toll-like (TLR), NOD-like (NLR) and C-type lectin receptors, in turn activates pro-inflammatory signaling pathways including the NFκB and JNK cascades. This leads to the production of pro-inflammatory cytokines, chemokine leukocyte chemoattractants, and growth factors that enhance tissue hyperplasia. Studies in mice with deletion of genes encoding PRRs, downstream signaling molecules and their major transcriptional targets clarify the relative roles of PRRs in mediating ME inflammation. These studies implicate TLR signaling via MyD88 and NOD receptor signaling via RIPK2 as major mediators of ME inflammation. They further indicate that the cytokines TNF alpha and IL-1 beta, and the chemokine CCL3, are critical effector molecules downstream from PRRs. Transcriptome analysis of the ME following activation of PRRs further clarifies the nature and timing of ME inflammatory events, with a large number of PRRs and pro-inflammatory mediators rapidly up-regulated. Expression profiles also highlight the role of anti-inflammatory genes, which are activated in response to PRR activation with similar kinetics to that observed for pro-inflammatory mediators. These serve to blunt inflammation and prevent bystander injury to ME tissues. Inflammation also down-regulates tissue growth suppression genes in the ME, including the transmembrane oncogene *ecrg4*. ECRG4 protein is also enzymatically cleaved in response to inflammation, further eliminating growth suppression and releasing an extracellular fragment with growth-promoting activity. In addition, the fragment complexes with the TLR4/CD14/MD2 endotoxin receptor, forming another link between tissue growth and inflammation. The inflammatory pathways activated in cholesteatoma include up-regulation of TLRs, NLRs and their downstream signaling molecules. This includes TLR4, which has been linked to cholesteatoma pathogenesis. TLR4 functions not only as a receptor for bacteria that may disperse from

cholesteatoma biofilms but also for DAMPs released from necrotic cells, such as S100A and HMGB1 both of which are up-regulated in cholesteatoma. Understanding the complex intracellular web that regulates ME inflammation provides potential targets for manipulation as pharmacological interventions. Supported by grants DC000129 and DC012595 from the US NIH/NIDCD.

Inflammation in the middle ear (ME) contributes to disease including cholesteatoma and otitis media. Activation of pattern recognition receptors (PRRs) by bacteria, viruses or damage-associated molecules patterns (DAMPs) activate PRRs, including Toll-like (TLR), NOD-like (NLR) and C-type lectin receptors. These in turn activate pro-inflammatory signaling including the NFκB and JNK cascades, inducing pro-inflammatory cytokines, chemokines, and growth factors that contribute to pathogenesis.

Studies in gene deletion mice clarify the roles of various PRR signaling molecules in ME inflammation, while transcriptome analysis following PRR activation further reveals the nature and timing of ME inflammatory events, with a large number of PRRs and pro-inflammatory mediators rapidly up-regulated. Anti-inflammatory genes are activated with similar kinetics, to blunt inflammation and prevent bystander injury to ME tissues. Inflammation also down-regulates tissue growth suppression genes in the ME, including the transmembrane oncogene *ecrg4*. The ECRG4 protein is also enzymatically cleaved in response to inflammation, further eliminating growth suppression and releasing an extracellular fragment with growth-promoting activity. In addition, the fragment complexes with the TLR4/CD14/MD2 endotoxin receptor, forming another link between tissue growth and inflammation.

Inflammatory pathways in cholesteatoma include TLRs, including TLR4 which has been linked to cholesteatoma pathogenesis, NLRs and their downstream signaling molecules. TLR4 functions not only as a receptor for bacteria but also for DAMPs released from necrotic cells, such as S100A and HMGB1 both of which are up-regulated in cholesteatoma.

Understanding the complex intracellular web that regulates ME inflammation provides potential targets for manipulation as pharmacological interventions.

Supported by grants DC000129 and DC012595 from the US NIH/NIDCD.

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Genetics in Otology (R831)

ID: 831.1

Genetics of Cholesteatoma Project

Presenting Author: **Peter Prinsley**

Peter Prinsley¹, Barbara Jennings², Carl Philpott², Mahmoud Bhutta³

¹James Paget University Hospital, ²Norwich Medical School, ³University College London

Learning Objectives: The support of BSO to identify affected families is sought.

Introduction: This research project seeks to identify genetic pathways predisposing to cholesteatoma. Familial clustering of cholesteatoma has been observed in East Anglia (Prinsley 2009). DNA sequencing has advanced so that whole exome sequencing of affected and unaffected individuals is now feasible.

Methods: A database of East Anglian families with cholesteatoma forms the core recruitment group for this study. However, the British Society of Otolaryngology (BSO) network could help identify other families. Pedigree charts and blood/saliva samples will be obtained from affected families for DNA extraction.

In the second stage, exome sequencing will be coupled to a linkage analysis in the families in which cholesteatoma is segregating. In conjunction with the pedigree mapping, we will have an opportunity to identify genetic polymorphisms predisposing to formation of cholesteatoma, and by using multiple affected families, to identify recurrent pathways or genes identified through this methodology.

Results: A research team of clinicians and scientists has been assembled and a systematic literature review has been carried out. Data extracted from the literature review will be used to identify pathways to focus on during the filtering steps to identify variants of interest that co-segregate with the disease phenotype. Funding has been secured from the Royal College of Surgeons of England and from the Rosetrees Foundation. The project will be adopted on to the NIHR Portfolio subject to Research Ethics Approval. The whole exome sequencing and analysis will be performed at The Genome Analysis Centre in Norwich.

Conclusions: A project has been created to identify genetic causes of cholesteatoma.

By selecting the right families, the project has potential to yield information that may widen our understanding of the disease pathophysiology.

doi:10.1017/S0022215116004126

Genetics in Otolaryngology (R831)

ID: 831.2

Gene expression profiling reveals expression of tumor-relevant

Presenting Author: **Johannes Greiner**

Johannes Greiner, Janine Müller, Jörg Ebmeyer, Holger Sudhoff

Klinikum Bielefeld Mitte

Learning Objectives: Cholesteatoma is a destructive, potentially life-threatening lesion of the middle ear. Cholesteatoma tissue expresses tumor markers SERPINB3 and SERPINB4. Oncogenes like Lipocalin 2 are upregulated in cholesteatoma tissue, while tumor suppressor genes are downregulated.

Introduction: Cholesteatoma is a gradually expanding destructive epithelial lesion within the middle ear, which leads to extensive tissue destruction in the temporal bone

followed by conductive and sensorineural hearing loss and facial nerve palsy. To develop new treatment strategies, gaining further insights into the complex gene regulation and signaling underlying the formation and progression of cholesteatoma are mandatory.

Methods: Gene expression profiling of cholesteatomas and regular external auditory skin from 17 patients via full genome micro-arrays containing 19,596 human genes followed by validation using real time PCR analysis.

Results: Full genome micro-arrays showed significantly increased expression of 811 genes in cholesteatoma tissue compared to regular external auditory skin, while 334 were found to be downregulated. Next to matrix metalloproteinases MMP9, MMP10 and MMP12, the anti-apoptotic genes BCL2L1 and A20 were upregulated in cholesteatoma tissue. Providing a further linkage to tumorigenic tissue, expression of the tumor markers SERPINB3 and SERPINB4 as well as the oncogene Lipocalin 2 was increased in cholesteatoma tissue in comparison to external auditory skin. Accordingly, downregulation of the cell adhesion molecule cadherin 18 as well as the tumor suppressor gene inhibitor ID4 was observed in cholesteatoma tissue. Linking the characteristic expression of tumor-relevant genes in cholesteatoma to inflammation, the inflammation-related calcium binding protein S100A7A was found to be highly upregulated.

Conclusions: The Expression profile of cholesteatoma was found to be similar to a tumorigenic and chronically inflamed tissue, giving new insights in the complex biology of cholesteatoma.

doi:10.1017/S0022215116004138

Genetics in Otolaryngology (R831)

ID: 831.3

Molecular pathology of cochlear gap junction in GJB2 associated hearing loss

Presenting Author: **Kazusaku Kamiya**

Kazusaku Kamiya, Ichiro Fukunaga, Katsuhisa Ikeda
Juntendo University Faculty of Medicine

Learning Objectives:

Introduction: Hereditary deafness affects about 1 in 2000 children and GJB2 gene mutation is most frequent cause for this disease. GJB2 encodes connexin (Cx) 26, a component in cochlear gap junction. We recently demonstrated that the drastic disruption of gap junction plaque (GJP) macromolecular complex composed of Cx26 and Cx30 are critical pathogenesis starting before hearing onset (Kamiya *et al.*, 2014, *J Clin Invest* 124, 1598–1607). To develop the effective therapy for GJB2 associated hearing loss, restoration of gap junction plaque (GJP) macromolecular complex using virus vectors or multipotent stem cells such as induced pluripotent stem (iPS) cells and mesenchymal stem cell (MSC) are expected to rescue the hearing function of GJB2 related hearing loss.

Methods: Mouse induced pluripotent stem cells (iPS) were used for generation of Cx26-expressing cells with proper gap junction plaque between the cells. Adeno associate virus (AAV) were used for the GJB2 gene transfer and restoration of GJP.

Results: By differentiation of iPS cells, we generated the Cx26-expressing cells with large gap junction plaque as cochlear cells. Cochlear delivery of Gjb2 using AAV significantly improved the auditory responses and development of the cochlear structure of Cx26f/tp0Cre mice (Iizuka, *Hum Mol Genet*, 2015, 24(13):3651–61).

Conclusions: Using cell therapy or gene therapy to restore hearing in the mouse models of Gjb2-related deafness may lead to the development of effective therapies for human hereditary deafness.

doi:10.1017/S002221511600414X

Genetics in Otolaryngology (R831)

ID: 831.4

Is Cholesteatoma heritable and how can we find the genes involved?

Presenting Author: **Mahmood Bhutta**

Mahmood Bhutta

Royal National Throat Nose and Ear Hospital

Learning Objectives: To review evidence that cholesteatoma is heritable, and to discuss methods that can be used to ascertain genetic pathways involved.

Abstract is for the round table on “Genetics in otology”

The aetiology of cholesteatoma remains elusive. Those with a history of chronic mucosal disease are susceptible, but only a few such individuals will develop cholesteatoma. What evidence is there that cholesteatoma is a heritable disorder, and what methods can we use to elucidate genetic susceptibility?

I will discuss evidence from a recent systematic review of the heritability and genetics of cholesteatoma. This evidence includes reports of familial clustering of disease, and family history in the Kibutz population of Israel. Presence of disease in certain syndromes, in particular congenital malformation syndromes of the head or ear, also suggests genetic pathways are perturbed in cholesteatoma, and that a relatively small number of loci may be relevant.

I will introduce the other speakers for this session, and outline epidemiological and laboratory methods that can be exploited to further research molecular and genetic pathways involved in cholesteatoma. I will discuss how the discovery of such pathways could lead to potential clinical benefit.

doi:10.1017/S0022215116004151

Free Papers (F832)

ID: 832.1

Anatomical understanding in canal wall down mastoidectomy using a medical image processing system – simulation and education of ear surgery

Presenting Author: **Kazunori Nishizaki**

Kazunori Nishizaki¹, Yuko Kataoka², Yoriyoshi Orita², Shin Kariya²

¹Okayama University, ²Okayama University

Learning Objectives: To understand surgical anatomy of the temporal bone using a medical imaging processing system.

Introduction: Although canal wall down mastoidectomy still plays an important role in treatment of cholesteatoma, the chance of performing this procedure appears to be decreasing by appropriate intervention for ear diseases that develop cholesteatoma. The decreasing chance to master this technique should be compensated by other methods. As one of the alternatives we introduce a simulation and education method of ear surgery using a medical image processing system.

Methods: Sagittal 2 and 3 dimensional reconstructive images (DRI) of the temporal bone CT scan are made for this purpose using a three-dimensional image analysis system volume analyzer (SYNAPSE VINCENT, Fuji Film Co, Tokyo, Japan).

Results: Sagittal 3DRIs introduced here show, in the order from lateral to medial, the antrum cavity, the prominence of the lateral semicircular canal, the incus body, the malleus head, the bridge being formed, the second genu of the facial nerve canal, the bridge resected at the level of the malleus neck, the mastoid segment of the facial nerve canal, the completely resected bridge, the lateral semicircular canal, and the completely opened facial recess. These images also show that the lateral wall of the attic has anterior-posterior and superior-inferior slants. 2DRIs parallel to the lateral wall of the attic show that the resection of the bridge parallel to the lateral wall is safe without risk of injury to the ossicles, the facial nerve, and the inner ear. However, sagittal 2 and 3DRIs should be evaluated for each patient due to individual differences in the temporal bone anatomy and bone structural changes affected by the disease.

Discussion and Conclusions: Since ear surgery usually progresses from lateral to medial, sagittal 2 and 3DRIs from lateral to medial simulate ear surgery including canal wall down mastoidectomy. Medical imaging processing systems are a useful and inexpensive tool to

understand complicated anatomy about ear surgery, especially for novice surgeons.

doi:10.1017/S0022215116004163

Free Papers (F832)

ID: 832.2

Intraoperative Assessment of Ossicular Fixation

Presenting Author: **John Peacock**

John Peacock¹, Joris Dirckx¹, Magnus von Unge²

¹University of Antwerp, ²Dept. of Otorhinolaryngology, Akershus University Hospital and University of Oslo, Center for Clinical Research, University of Uppsala

Learning Objectives: The middle ear ossicles can be driven with a coil and magnet and the tiny vibration amplitudes can be measured with a laser vibrometer. Some information on the degree of ossicular mobility can be extracted by measuring the velocity ratios between different measurement points.

Introduction: Pathologies such as otosclerosis and sequels of chronic otitis media may cause fixation of the middle ear ossicles, leading to hearing impairment. Knowledge of the degree of ossicular mobility is useful in order to determine the best course of surgical treatment. Routine assessment of mobility is often performed by manual palpation during surgical exploration, but this is subjective and imprecise, and a more objective method would be welcome.

Methods: A method was developed that makes use of a small magnet and coil to vibrate the ossicles in surgery after the tympanic membrane has been elevated. The method allows the ossicles to be driven at acoustic frequencies while simultaneously allowing free visual access for a laser vibrometer.

The method was evaluated with measurements on human temporal bones. Ossicular fixation was simulated by applying glass ionomer cement to the anterior malleolar ligament, and to the stapes footplate. Measurements were made of the vibration response of the umbo, the incus long process, and at points on the stapes, before and after artificial fixation.

Results: The velocity ratios between different measurement points varies with the severity of the fixation. In the unfixed state the velocity ratios remain fairly consistent between temporal bones, but with increased fixation of the footplate the ratios diverge further from the unfixed.

The ratio of stapes to umbo velocity decreases when the degree of fixation increases, and may reduce by as much 40 dB in case of complete footplate fixation.

Conclusions: It is possible to drive the ossicles with a magnet and coil and measure ossicular motion with a laser vibrometer. Information on the degree of ossicular fixation could be gathered by examining the velocity ratios between different points on the ossicular chain. Since the results can be

displayed immediately after the measurements, the method may even be used to assess the results of an intervention intraoperatively.

doi:10.1017/S0022215116004175

Free Papers (F832)

ID: 832.3

Tympanoplasty: does dry or wet temporalis fascia graft matter?

Presenting Author: **Gautam Singh**

Gautam Singh

Lady Hardinge Medical College & Associated Hospitals, New Delhi

Learning Objectives: To evaluate whether dry or wet temporalis fascia graft influences the outcome of tympanoplasty. Recent review of literature cites shrinkage of temporalis fascia graft as an important cause for failed tympanoplasty i.e. a dry graft rehydrates in the physiological environment of middle ear and shrinks. This might lead to alteration in the anatomical position of the placed graft, thereby surgical failure.

Objective: To evaluate the success rate of tympanoplasty type I by underlay technique using dry and wet temporalis fascia graft and to determine the role of fibroblasts.

Study design: A prospective, randomized study with control. Hundred adult cases of either sex of Chronic Suppurative Otitis Media-mucosal disease were divided into two groups of 50 each - Group A [underwent dry graft tympanoplasty] & Group B [underwent wet graft tympanoplasty]. Fibroblast count was also calculated in dry and wet grafts.

Results: An overall surgical success rate of 82% and 90% was observed in Group A and Group B respectively which was not found to be statistically significant. Further, a statistically significant high fibroblast count was observed in wet grafts, but it did not correlate with surgical success.

Conclusions: The nature of the graft, whether dry or wet does not influence the outcome of tympanoplasty type I.

doi:10.1017/S0022215116004187

Free Papers (F832)

ID: 832.4

MRI evaluation of endolymphatic hydrops for middle ear surgery

Presenting Author: **Michihiko Sone**

Michihiko Sone, Tadao Yoshida, Satofumi Sugimoto
Nagoya University Graduate School of Medicine

Learning Objectives:

Introduction: Visualization of endolymphatic hydrops (EH) has recently become possible using MRI with contrast agents. EH could be found in cases of candidates for middle ear surgery, such as otosclerosis or ossicular anomaly. Preoperative EH could be a risk factor for inner ear disturbances following surgery. We investigated the presence of EH on MRI in ears with clinical otosclerosis or ossicular anomaly, and evaluate the efficacy of such MRI evaluation for the management of middle ear surgery.

Subjects and methods: Subjects diagnosed as having otosclerosis and agreed to MRI examination were randomly recruited in the study. Ears were evaluated by MRI performed 4 h after intravenous injection of gadolinium. The degree of EH in the vestibule and cochlea was classified into three grades (none, mild, and significant). Imaging data were compared with clinical findings. In ears operated, imaging data concerning the degree of EH were compared with postoperative clinical findings.

Results: Varying degrees of cochlear EH and vestibular EH were observed. Episodes of acute sensorineural hearing loss with rotatory vertigo occurred in some ears that showed severe EH in the cochleae and vestibules. Severe EH, however, was also observed in ears without such symptoms. The postoperative course in all ears with no EH in the vestibule was uneventful, with successful improvement of hearing levels, but a case with severe EH in the vestibule had postoperative nystagmus and long period of dizziness.

Conclusions: The presence of EH in ears with otosclerosis was clearly visualized in the present patient series. Moreover, the presence of EH in the vestibule on MRI might be a high risk factor in ears that are candidates for stapes surgery. Such MRI evaluation could provide useful information for managing symptoms related to EH.

doi:10.1017/S0022215116004199

Free Papers (F832)**ID: 832.5****A New Postoperative Adjustable Middle Ear Prosthesis**

Presenting Author: **Ismail Kuru**

Ismail Kuru¹, Hannes Maier², Thomas Lenarz², Tim C. Lueth¹

¹Technische Universität München, ²Hannover Medical School

Learning Objectives: • A new concept of a self-adapting middle ear implant for ossicular chain reconstruction in Tympanoplasty • The prosthesis has a spring-damper-element, that conducts the sound and adapts the length of the prosthesis • The spring-damper-element is made of implantable silicone material.

Introduction: The Tympanoplastic-III is a common method to treat conductive hearing loss by reconstructing the ossicular chain with a passive prosthesis. However, the state-of-art prostheses can only be adjusted intraoperatively and cannot adapt to the postoperative changes. Hence, suboptimal tensions on the tissues and hearing may result. Furthermore, these changes may cause prosthesis luxation, if the prosthesis is too short, or extrusion, if it is too long. Both complications require revision surgery.

Methods: We propose a new postoperative adjustable prosthesis for ossicular chain reconstruction with a spring-damper-element (SDE). The SDE conducts the sound waves from the prosthesis head to the prosthesis foot, while it can adapt the distance between them. The SDE consists of a closed elastic cover (spring) and a fluid fill (damper), both made of implantable silicone material. Under dynamic loads (e.g. sound waves) the damper stiffens and conducts. Under static loads (e.g. ambient pressure variations), the damper yields to a constant force when the spring contracts or extends the prosthesis.

Results: We have built a prototype as total ossicular replacement prosthesis (TORP). We have tested our prototype in our custom middle ear model. The prototype was built too long for the model, so that we could simulate a suboptimal reconstruction. Our preliminary measurements on the stapes footplate response to sound showed that the sound conduction of our prototype was approx. 4.5 dB higher compared to a commercial TORP of the same length. In a second experiment, we could show that the prototype could reduce the tension on the stapes footplate under varying ambient pressure compared to the commercial TORP.

Conclusion: Our results show, that an implantable SDE can be manufactured and it is a promising way to limit the preload, to prevent extrusion, stabilize the prosthesis against luxation and maximize sound conduction, so that the complications can be reduced to a minimum.

doi:10.1017/S0022215116004205

Free Papers (F832)**ID: 832.6****Tissue engineered mastoid air cells' regeneration for intractable otitis media**

Presenting Author: **Shin-ichi Kanemaru**

Shin-ichi Kanemaru¹, Rie Kanai¹

¹Medical research institute, Kitano Hospital

Learning Objectives: How to regenerate middle ear gas exchange function.

Aim: Most chronic otitis media(OMC) are observed poor development of mastoid air cells(MACs) and poor function of Eustachian tube. In order to a complete recovery from intractable otitis media, regeneration of the MACs' gas exchange functions is thought to be need. In this study, we implanted autologous bone fragments as a scaffold and gelatin sponge soaked in basic-fibroblast growth factor (b-

FGF) as a regulatory factor to the newly opened mastoid cavity and assessed whether these promote regeneration of MACs or not.

Material and Method: In this study, 10 cases with severe chronic otitis media (n = 3), cholesteatoma (n = 5), and adhesive otitis media (n = 2) were selected. At the 1st stage of operation, before mastoidectomy, cortex bone lid was harvested. Harvested autologous bone fragments with gelatin sponge soaked in b-FGF were implanted into the newly opened mastoid cavity and they were fixed by fibrin glue. Cortex bone lid was returned to the original position and was fixed by autologous bone pate.

By the images of high resolution computed tomography (HRCT), whether MACs were regenerated or not were estimated. The Eustachian tube function were measured before and 9 to 12 months after the 1st stage operation.

Results: Regeneration of MACs was observed 7 out of 10 cases (70%). In 6 out of 7 cases (86%) in the successful cases of regeneration of MACs in both group, Eustachian tube functions were improved. On the other hand, in the failure cases of regeneration of MACs, Eustachian tube functions were not improved.

Conclusions: Implanted autologous bone fragments and gelatin sponge soaked in b-FGF to the newly opened mastoid cavity contribute to regeneration of MACs in both HRCT images and gas exchange function.

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Free Papers (F833)

ID: 833.1

Transcochlear approach for temporal bone cholesteatoma with facial weakness

Presenting Author: **Zhaoyan Wang**

Zhaoyan Wang, Hao Wu

Shanghai Jiaotong University School of Medicine

Learning Objectives:

Objective: To evaluate the application of transcochlear approach for temporal bone cholesteatoma with facial weakness.

Methods: We reviewed our institutional experience in the management of patients with temporal bone cholesteatoma. The surgical approaches and techniques were discussed.

Results: 6 temporal bone cholesteatoma patients with facial weakness were reviewed. Transcochlear approach was used for these patients. Immediately post-operative facial function was as the same level as pre-operatively. During follow-up, facial function was recovered in 4 cases and no recurrence was detected by annually MRI scan.

Conclusion: adequate explosion is important for total removal of the temporal bone cholesteatoma. recurrence can be avoid with eliminate all the debris and matrix of cholesteatoma. in

case with facial nerve involved, transcochlear approach with facial nerve rerouting can got enough vision of lesion.

Key words: temporal bone cholesteatoma, treatment strategy, transcochlear approach

doi:10.1017/S0022215116004229

Free Papers (F833)

ID: 833.2

Diagnosis and surgical management of 23 cases of petrous bone cholesteatoma

Presenting Author: **Haibo Wang**

Haibo Wang, Yuechen Han, Pengcheng Sun, Dong Chen, Li Li, Zhaomin fan

Eye & Ear Infirmary of Shandong Provincial Hospital Group

Learning Objectives:

Objective: To report the experience on the diagnosis and treatment of petrous bone cholesteatoma (PBC) in our clinic.

Methods: The medical records of 23 patients with PBC who underwent surgery between 2013 and 2015 in our department were retrospectively analyzed with respect to the classification, surgical approach, facial nerve function and its management, auditory function, and recurrence.

Results: The median age of these patients was 32 years old. Otorrhea, hearing loss and facial nerve palsy were the most common symptoms. All of these patients presented with hearing loss and 16 patients with facial nerve palsy. 18 cases were supralabyrinthine, 1 was infralabyrinthine-apical, 2 were massive and 2 were apical. Three patients had undergone previous mastoid surgery. The surgical approaches varied according to the classification, and transcochlear approach was chosen for 15 cases (one patient operated with the endoscope assistance), transmastoid approach was chosen for 7 cases, combination of middle cranial fossa and translabyrinth approach was chosen for 1 case. The median follow-up was 14 months. Postoperatively, 17 patients were total deafness. Recurrence of cholesteatoma was found in 2 cases, and revision surgery was performed.

Conclusion: The surgical approach should be decided according to the classification, extent of the lesion, hearing level, and facial nerve function. Complete removal of cholesteatoma should be prioritized over the preservation of residual hearing level and facial nerve function.

doi:10.1017/S0022215116004230

Free Papers (F833)

ID: 833.3

Where is it safe to leave residual Vestibular Schwannoma during surgery?

Presenting Author: **Anand Kasbekar**

Anand Kasbekar¹, Guleed Adan², Alaina Beacall²,
Ahmed Youssef², Catherine Gilkes², Tristram Lesser²

¹Cambridge University Hospitals NHS
Foundation Trust, ²Aintree University Hospital,
Liverpool, UK

Learning Objectives:

Objectives: To identify whether certain locations at the cerebellopontine angle (CPA) and internal auditory meatus (IAM) predispose to growth of medium and large unilateral Vestibular Schwannoma (VS) residual tumour left behind at surgery.

Methods: A retrospective review of case notes and radiology scans was undertaken at the Liverpool Skull Base unit. Measurements conformed to the 2003 Consensus meeting on VS reporting.

Results: 67 unilateral sporadic VS were surgically treated between the years 2006 and 2010 of which 52 had residual tumour left behind available for analysis. Of these, 20 grew [these had previous excisions which were 4 near-total excisions (less than 5% residual tumour left), and 16 sub-total excisions (more than 5% residual tumour left)]. Follow-up was for a median of 6.4 years (6.4 to 8.1 years). Residuum was left at various locations: the CPA had 48 residuals, 21 grew (44%); the IAM had 47 residuals, 14 grew (30%). Within the IAM the porus had 47 residuals, 11 grew (23%); and the fundus had 12 residuals, 2 grew (14%). Time to growth varied between 1.75 years and 5.5 years (average 3.1 years). Of the 20 growing residuum, 17 required treatment (13 had radiotherapy, 3 had surgery followed by radiotherapy, 1 had just surgery).

Conclusions: Along with other patient, tumour, and surgical factors, the less than 95% excision of VS predisposes to regrowth of the residual tumour, and such patients should be monitored closely for at least 10 years. The data suggests that the CPA is the most likely site for residual tumour to grow and that the IAM is a safer site to leave tumour behind, if necessary. The larger the VS, the greater the size of the residual tumour left at surgery and thus the greater the chance of regrowth. These factors should be borne in mind when deciding on when to intervene in patients with growing tumours. There is a need for standardised reporting of residual tumour outcomes, which will allow accurate comparison, and pooling of data.

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Free Papers (F833)

ID: 833.4

Reconstruction of tegmen defect by transmastoid approach

Presenting Author: **Rie Kanai**

Rie Kanai, Shin-ichi Kanemaru
Medical Research Institute, Kitano Hospital

Learning Objectives: To discuss about the procedure of reconstruction of tegmen defect by transmastoid approach to prevent meningo-encephalocele.

Objective: Tegmen defect is caused by progression of middle ear disease. Sometimes, meningo-encephalocele (MEC) occur into the middle ear through tegmen defect, which can cause serious complications: meningitis, cerebro spinal fluid (CSF) leakage, epilepsy. Hearing loss also can cause by MEC pressing ossicular chain. We discuss about the procedure of reconstruction of tegmen defect by transmastoid approach to prevent MEC.

Design: Retrospective study

Subjects and method: Seven cases (2 male 5 female, mean age 65.2) with large tegmen defect or with tegmen defect and CSF leakage were enrolled in this study. These patients underwent tympanomastoidectomy with reconstruction of the tegmen defects by transmastoid approach.

The kinds of diseases were cholesteatoma in 3 cases, cholesterol granuloma in 2 cases and MEC after previous middle ear surgery in 2 cases.

We analyzed the size of the defect, the materials for reconstruction and the complications; MEC, CSF leakage, the recurrence of the diseases.

Results: The size of defects were about 8 mm in 1 cases, more than 10 mm in 3 cases and more than 20 mm in 3 cases. The tegmen defects were reconstructed by cortical bony plate with or without bone putty in all cases. In 2 cases, a part of dura was resected because lesion adhered to dura severely, then CSF leak occurred. We reconstructed also the dural defects by temporal fascia. In 2 cases with MEC, the lesion were resected by cauterization before the reconstruction of tegmen defect. We confirmed that bony tissue of tegmen was regenerated in all cases by postoperative CT scan. In 4 cases, they was confirmed during 2nd stage surgery. Although the recurrence of cholesteatoma was found distant from tegmen in one case, no patient have developed MEC, CSF leakage and other serous complication.

Conclusion: Tegmen defect can be reconstructed by transmastoid approach. Reconstruction of tegmen defect by cortical bone will be helpful to prevent MEC and CSF leakage.

doi:10.1017/S0022215116004254

Free Papers (F833)

ID: 833.5

Recent Strategies in the Management of Traumatic Facial Nerve Paralysis

Presenting Author: **Naohito Hato**

Naohito Hato
Ehime University

Learning Objectives: In total, 66 patients with facial nerve paralysis after temporal bone trauma were studied retrospectively. The rate of good recovery in patients undergoing

decompression surgery within 2 weeks after trauma reached 92.9%, resulting in a significantly better outcome than later decompression surgery. The ideal time for decompression surgery for the traumatic facial nerve paralysis was the first 2 weeks in patients with severe, immediate-onset paralysis. Recently, we modified the later decompression surgery using bFGF in a gelatin hydrogel to promote the regeneration of denervated nerves. Our experimental study suggested that bFGF-impregnated biodegradable hydrogel facilitates regeneration of the facial nerve in guinea pigs due to the sustained release of bFGF. Clinically, this therapeutic regimen may be useful for facial nerve decompression surgery, which is indicated for severe facial nerve paralysis. The efficacy of the novel decompression surgery will be presented.

doi:10.1017/S0022215116004266

Free Papers (F833)

ID: 833.6

Surgical management of Petrous Bone Cholesteatoma and facial nerve function restoration

Presenting Author: **Wei ju Han**

Wei ju Han, Ruoya Wang, Weidong Sen
Chinese PLA general hospital

Learning Objectives:

Objective: To analyze the clinical manifestations, classification, surgical approaches of Petrous Bone cholesteatoma(PBC) and restoration of facial nerve function.

Methods: From 2000 to 2014, 91 cases of petrous bone cholesteatoma underwent operations in the Chinese PLA general hospital. Clinical, audiological, and radiological findings, surgical approach with respect to the classification and facial nerve function were analyzed retrospectively.

Results: The most common symptoms were hearing loss and FN paralysis. All patients had petrous bone erosion with high resolution temporal bone CT scan. Out of the 91 PBC cases, 45 (45/91, 49.45%) were supralabyrinthine, 7(7/91, 7.69%) were infralabyrinthine, 12(12/91, 13.19%) were infralabyrinthine-apical, and 27(27/91, 29.67%) were massive with respect to Sanna's classification. All patients were radically removed the lesion. And 5 patients underwent transmastoid approach, 41 patients underwent middle fossa approach, 34 patients were performed by translabyrinthine approach, 10 patients were performed by combined transmastoid and middle fossa approach, one patient was performed by combined translabyrinthine and sphenoid sinus approach. The most common affected section of facial nerve is labyrinth segment. Facial nerve decompression, primary end-to-end anastomosis, great auricular nerve graft and nerve substitution of facial-hypoglossal anastomosis were applied to restore the facial nerve function.

Conclusions: The most common symptoms of Petrous bone cholesteatoma were hearing loss and FN paralysis. The high resolution temporal bone CT scan has important value in

finding PBC. The classification of PBC is fundamental to choose the appropriate surgical approach, and middle fossa approach is most common approach. Radical removal lesions should be prioritized over hearing preservation. Restoration of facial nerve (FN) function is achievable by reanimation procedures.

doi:10.1017/S0022215116004278

Free Papers (F833)

ID: 833.7

Primary tumors of the facial nerve misdiagnosed many years prior: What is the appropriate treatment?

Presenting Author: **Hj Yi**

Hj Yi
*Beijing Tsinghua Changgung Hospital,
Medical center, Tsinghua University*

Learning Objectives: This paper was to determine the characteristics of facial nerve primary tumors misdiagnosed as tumor-free conditions many years prior, and to identify appropriate treatments. The cases of five Chinese patients with misdiagnosed primary tumors of the facial nerve were reviewed; in each case, the condition had been misdiagnosed more than 8 years prior. All patients presented with progressive or complete facial paralysis and hearing loss, with or without vertigo. We reviewed pre- and post-operative images (including CT scans of the temporal bone) and MRI data. After review, all tumors were completely resected using the translabyrinthine or transmastoid approach and were confirmed to be primary tumors of the facial nerve. All tumors were totally resected. Facial-hypoglossal nerve anastomosis failed in one patient whom we sought to manage in two stages, because fibrosis developed at the end of the facial nerve. One patient accepted two-stage facial-hypoglossal nerve anastomosis and patient status improved to House-Brackmann (H-B) grade V from H-B grade VI. The other three patients chose not to undergo reconstruction. All patients recovered well, with no other complications evident after follow-up periods of 0.5–3 years. Unusual primary tumors of the facial nerve should be considered in patients with progressive facial paralysis, especially if this is accompanied by hearing loss or vertigo. Misdiagnosis creates operative difficulties, diminishes the chance of facial nerve reconstruction, and increases the likelihood of poor reconstructive outcomes.

doi:10.1017/S002221511600428X

Bone conduction hearing devices in single sided deafness (R834)

ID: 834.1

Baha Attract System: 6-month results of a multicentre, open, prospective clinical investigation

Presenting Author: **Myrthe Hol**

Peter Monksfield², Piotr Skarzynski⁶, Kevin Green³, Christina Runge⁴, Stina Wigren⁷, Johan Ivarsson Blechert⁷, Mark Flynn⁷, Arjan Bosman¹, Emmanuel Mylanus¹

¹Department of Otorhinolaryngology, Radboud university medical centre, Nijmegen, The Netherlands, ²Department of Otorhinolaryngology, Queen Elizabeth Hospital, Birmingham, United Kingdom, ³Department of Otorhinolaryngology, Queen Elizabeth Hospital, Birmingham, United Kingdom, ⁴Department of Otorhinolaryngology, Medical College of Wisconsin, Milwaukee Wisconsin, United States of America, ⁵Department of Otorhinolaryngology, World Hearing Center, Institute of Physiology and Pathology of Hearing, Nadarzyn, Poland, ⁶Cochlear Bone Anchored Solutions, Mölnlycke, Sweden

Learning Objectives:

Objectives: Present the 6 months results of a multicentre, prospective investigation on the Cochlear™ Baha® Attract™ System.

Design: Fifty-four adult patients with hearing impairment, were included and underwent surgery in the current prospective cohort study. Follow-up visits were scheduled at 10 days, 4, 6 and 12 weeks, and 6 months. Main outcome measures are hearing performance (free-field audiometry, speech in quiet, adaptive speech in noise) with the Baha Attract System compared to the unaided situation and compared to a pre-operative test situation using the sound processor on a softband, safety of the Baha Attract System, hearing related quality of life, surgical information, sound processor magnet strength and magnetic retention force over time, and information on postoperative pain, discomfort, numbness and soft tissue status.

Results: The 6 months results of the multicentre will be presented for the main outcome measures.

Conclusions: The objective is to present data regarding the usability and clinical performance of the Baha Attract System in subjects with hearing impairment that are candidates for Baha surgery.

doi:10.1017/S0022215116004291

Bone conduction hearing devices in single sided deafness (R834)

ID: 834.2

Transcutaneous BAHA Attract Implants – Interim results at two years

Presenting Author: **Jaydip Ray**

Jaydip Ray¹, Panagiotis Dimitriadis², Ahmed Allam², Perdy Edwards²

¹Sheffield Teaching Hospitals NHSFT, ²Sheffield Teaching Hospitals

Learning Objectives: Transcutaneous bone conduction implants produce less soft tissue complications. Interim results show high patient satisfaction. Percutaneous devices can be converted to transcutaneous devices.

Introduction: Many soft tissue problems in bone anchored hearing solutions are related to their percutaneous nature. Tissue preservation and non skin penetration techniques help address these issues.

Methods: Prospective longitudinal study of 80 consecutive BAHA Attract patients (Sept 2013 and Feb 2016.) Data included indications, audiology, incision, surgery, skin thickness, fixture and postoperative follow up (including audiological, soft tissue, magnet types and usage).

Results: Total 80 patients implanted. Age range 4 – 86yrs. Male : Female ratio 47:33. Fifty six were adults and 24 paediatric. Indications were Conductive deafness (56%), Mixed hearing loss (16%) and Single Sided Sensorineural loss (28%). 22% were conversions from percutaneous devices. 10% cases were performed under local anaesthesia only. The incision in all cases was inferiorly facing “C”. Average surgical time 40 min. All had 4 mm fixtures. Average skin thickness at midpoint was 6.2 mm for adults and 4 mm for children. Minimal post operative nursing care was required as the wound healed neatly by 1 week without hair loss and minimal surrounding numbness. No wound complications reported. Four (5%) reported pain after a month but settled conservatively. Two (2.6%) reported surrounding oedema after prolonged continuous use. One reported skin tenderness. Majority loaded with processors at 6 weeks. Commonest magnet strength 4 (range 2 to 5). 89% reported good to excellent device retention. Majority were fitted with the BAHA 4 or BAHA 5 processors. Few had BP110. All patients reported good to very good sound quality with average use of 6hrs /day.

Conclusion: The interim experience with the transcutaneous BAHA Attract system is positive with negligible post operative care requirement.

doi:10.1017/S0022215116004308

Bone conduction hearing devices in single sided deafness (R834)

ID: 834.3

Which device - when and why? The controversial role of bone conduction hearing devices in the rehabilitation of unilateral sensorineural hearing loss

Presenting Author: **David Morris**

David Morris¹, Myrthe Hol², Jaydip Ray³, Joe Toner⁴, Bill Hodgetts⁵

¹Dalhousie University, ²ENT Surgeon - Otolaryngology, Hearing & Implants. Radboud University Medical Centre Myrthe.Hol@radboudumc.nl, ³ENT Consultant. Sheffield Teaching Hospitals & Sheffield Children's Hospital, England, UK., ⁴ENT Consultant. Queens University, Belfast, Northern Ireland, UK., ⁵Program Director, Bone Conduction Amplification Institute for Reconstructive Sciences in Medicine (iRSM) Edmonton, Alberta, Canada

Learning Objectives: Participants will feel able to describe the issues faced by those with unilateral sensorineural hearing loss / single sided deafness (SSD). Participants will appreciate the limitations to rehabilitation of SSD with bone conduction hearing devices. Participants will become familiar with a range of bone conduction hearing devices, described by surgeons who are experienced in their placement. Participants will understand the role of case selection and will appreciate the place for preoperative testing. Participants will appreciate that the personal choice of device selected to address SSD relies on many intertwining factors relating to the surgeon, audiologist and recipient and must also include financial and logistical considerations. Participants will realize the complexities and challenges faced when we attempt to make comparisons between the audiometric performance of such devices.

This lively, one hour round table will bring together colleagues from five experienced auditory implant programmes to share their experience with a range of bone conduction hearing devices now used to rehabilitate patients with unilateral sensorineural hearing loss often referred to simply as single sided deafness or SSD.

The panelists have been selected for their experience with particular devices or for their expertise in audiometric assessment. After a brief introduction, invited panelists will offer their views on a number of controversial topics. It will be interesting to see how much consensus and common ground exists between the different programmes and devices in this regard.

Specific attention will focus on a number of key areas that will guide our discussions:

Selection criteria - is there an age limit to consider at presentation, and if so, how relevant is the state of contralateral cochlea?

Pre-operative trials - short and in-office or prolonged, pre-directed home trial? Is there a place for headband testing with some other surrogate device for transcutaneous implant candidates?

Ease of surgical placement - have the panel experience any notable or avoidable complications?

Device tolerance - are the devices practical to wear day to day?

Postoperative limitations - how relevant are imaging restrictions and removability?

Money - are there any major cost differences between the devices and the resources needed to implant them?

Post-operative performance - how do we begin to determine patient benefit let alone compare the performance of different devices?

Best of breed - one vote - why?

Where will we be in 10 years?

Myrthe Hol will share her Nijmegen, NL, experience on BAHA and Ponto devices, Joe Toner from Belfast, Northern Ireland, will share his extensive experience with Bonebridge, Jaydip Ray from Sheffield, UK, will cover BAHA Attract and Sophono, and Bill Hodgetts from Edmonton, Canada will address the perils of trying to compare device performance.

doi:10.1017/S002221511600431X

Modern training of otologic surgery (N835)

ID: 835.1

Training for otologic surgery: From simulators to OR

Presenting Author: **Daniele Bernardeschi**

Daniele Bernardeschi

Pitié-Salpêtrière Hospital

Learning Objectives:

The aim of this presentation is to describe the different steps of training in otologic surgery: first of all, the surgical simulators are used at the very beginning of the training to evaluate the anatomical knowledge of the resident. Therefore, simulators can provide comparison from different trainers and evaluation of the skill progress.

The next step is the drilling of an artificial temporal bone: this can improve the representation of the 3rd dimension when approaching the temporal bone anatomy: the artificial temporal bone has the advantages of being infectious disease free and low cost compared to cadaveric temporal bone, and the disadvantages are the poor haptic feedback and the lack of surgical scenarios.

After that, the training on cadaveric temporal bones allows the acquisition of a realistic haptic feedback and tool-organs interaction as well as the best anatomical representations of the temporal bone. Surgical procedures can also be simulated on cadaveric temporal bone.

Then the training in the OR is performed with two tools that help the resident in the localization of the facial nerve (the facial nerve stimulating burr) while drilling, and in the recognition of anatomical variations (the computer-assisted surgical navigation) in case of difficult surgeries, always under the supervision of the senior surgeon.

doi:10.1017/S0022215116004321

Modern training of otologic surgery (N835)**ID: 835.2****Development and validation of a temporal bone prototype**Presenting Author: **David Bakhos**David Bakhos
*Tours Hospital**Learning Objectives:*

Background: Inexperienced otologists require training on the temporal bone drilling process, prior to any surgical activity. The shortage of cadaveric temporal bones exerts pressure to create realistic physical prototypes. We described the development and validation of an artificial temporal bone (TB) model devoted to surgical training and education.

Material and Methods: A helical computed tomographic (CT) scan was used to acquire high-resolution data of cadaveric TB. Digital imaging and communications in medicine data were converted into .stl files after data processing. Cadaveric TBs were prototyped using stereolithography. Validation of the prototype needed several steps.

First, we validated the TB prototype using on CT scan and visualization of anatomic landmarks during TB drilling of the cadaveric TBs and prototyped bones. The second step was the validation of the prototype with otologist experts. Twenty-five prototypes were sent to 25 otologists, accompanied by a 20-item questionnaire in order to have their satisfaction rate and feeling about the prototype. At last, we investigated with a scale the use of temporal bone prototype for drilling performance during residency.

Results: Concerning the validation of the prototype using CT scan and drilling, measurements of volume and distance showed no significant difference between prototypes and cadaver TBs. Concerning the otologist experts, satisfaction rate was 92 per cent. The overall prototype score was 48.87 out of 60. Limitations of the model included an excessively vivid facial nerve colour and difficulty in identifying the posterior semicircular canal. At last, the use of an artificial TB showed a significant improvement about drilling performance in residency.

Conclusion: The prototype appears to provide an attractive solution to the shortage of cadaveric TBs and interest in the model for drilling technique training for inexperienced otologists and show an improvement in term of performance.

doi:10.1017/S0022215116004333

Modern training of otologic surgery (N835)**ID: 835.3****Dissection as a teaching tool in otologic surgery**Presenting Author: **Valérie Franco-Vidal**Valérie Franco-Vidal, Damien Bonnard, Vincent Darrouzet
*Bordeaux University Hospital**Learning Objectives:*

Ear surgical techniques require progressive training. Cadaveric temporal bone drilling practice constitutes an essential stage in training for the surgical approach to these complex anatomic structures. The resident in training must master the use of the surgical microscope, the burr, and fine drilling instruments used in otological dissection. This kind of practice is also necessary to learn anatomy of the temporal bone in surgical position which is different from the imaging and the classical anatomical representation. Since a few years, due to economical reasons, the operating duration has to be more and more limited, and time spent for teaching in the operating room is dramatically reduced. Cadaveric temporal bone dissection is a good alternative teaching method. Finally, learning from its mistakes is necessary in surgical practice and it is of course safer on cadaveric specimen than on living beings. The pedagogic interest of this kind of teaching has been largely demonstrated, and is an additional tool, with virtual surgery and simulators increasing surgical practice acquisitions safely.

doi:10.1017/S0022215116004345

Modern training of otologic surgery (N835)**ID: 835.4****Interest and validity of 3D simulator in otologic surgical training program**Presenting Author: **Cécile Parietti-Winkler**Cécile Parietti-Winkler
*University Hospital of Nancy**Learning Objectives:*

Middle ear surgery requires thorough knowledge of middle-ear anatomy and great surgical precision. However, training tools remain limited: absence of animal model and lack of access to cadaveric temporal bone hampers the

implementation of standardized program of training. It seems crucial to develop alternative methods for surgical training, such as virtual reality (VR) and simulator. The aim of our study was to assess face, content, construct validity of the Voxel-Man[®] TempoSurg VR simulator.

Were included in the study 74 ENT surgeons, splitted in 2 groups according to their level of expertise: the expert group ($n = 16$) and the novice group ($n = 58$). The 2 groups benefited from a simple drilling task to familiarize them with the simulator and then performed four temporal bone dissection tasks. The performance of both groups were assessed by a global score and compared to assess the construct validity of the simulator. Finally, face and content validity were assessed using a five-point Likert-type scale. Experienced surgeons performed better ($p < .01$) and faster ($p < .001$) than novices. However, no differences in the bone volume removed and the number of injury to structures were found between the two groups. All experienced surgeons, except one would recommend the Voxel-Man simulator for anatomy learning (mean score 4.7). Most of them (87.5%) also thought that this simulator could be integrated in surgical training (mean score 4.1).

The Voxel-Man TempoSurg Virtual Reality Simulator constitutes an interesting complementary tool to traditional teaching methods for training in otologic surgery. Although some features require improvements, it allows trainees to acquire a good three-dimensional visualization of ear structures and to learn complex surgical skills. By its ability to distinguish different level of expertise, this simulator could be used as a certification tool, constituting a prior condition for performing real-life surgery.

doi:10.1017/S0022215116004357

Tympanoplasty (R836)

ID: 836.1

Canal wall up surgery for cholesteatoma patients. When and how to perform ossicular reconstruction

Presenting Author: **Jean-Yves Sichel**

Jean-Yves Sichel
Shaare Zedek Medical Center

Learning Objectives: TBC

The main goal of cholesteatoma surgery is complete removal of the disease. The secondary goal is to preserve or restore hearing, mostly by ossicular reconstruction. There is no consensus on the best technique and timing (immediate or sequential) for the reconstruction.

The presentation will focus on the factors which influence the decision making: age, extent and location of the cholesteatoma (and need for a second look); status of the ossicular chain and especially the presence or absence of the superstructures of the stapes; inflammatory status of the middle ear during surgery (dry or an active purulent ear); the status of the contralateral ear and others.

According to the literature and the experience of our department we will propose recommendations which may aid in the decision for immediate or staged reconstruction and discuss the different possible technics.

doi:10.1017/S0022215116004369

Tympanoplasty (R836)

ID: 836.2

The natural history of Tympanic membrane perforations in a large cohort of children and the implications of when to operate

Presenting Author: **Philip Robinson**

Philip Robinson¹, Matthew Rollin²
¹University Hospitals Bristol NHS Foundation Trust, ²Imperial Healthcare NHS Trust

Learning Objectives: 2703 tympanic membrane perforations were studied in 1761 children. Data was obtained from a 20 year database containing over 147500 consultations of children seen by the Bristol Paediatric Audiology service. All children who underwent surgical repair of the perforation were excluded from the study. 45% of perforations were related to prior ventilation tube placement. 38% of perforations closed spontaneously within 12 months, 57% by 18 months and 66% by 2 years. 90% of all closures happen within 2.5 years. There is a significant age effect with perforations more likely to close spontaneously in younger children. 90% closure at 2.5 years in children diagnosed <7 years old vs. 75% in children diagnosed aged 7–12 years old. When faced with the clinical question of what period of watchful waiting would be appropriate in monitoring a perforated tympanic membrane, before intervention may reasonably be recommended; there seems to be little advantage in waiting longer than 2.5 years.

2703 tympanic membrane perforations were studied in 1761 children. Data were obtained from a 20 year database containing over 147500 consultations of children seen by the Bristol Paediatric Audiology service. All children who underwent surgical repair were excluded from the study.

45% of perforations were related to previous ventilation tube placement.

38% of perforations closed spontaneously within 12 months, 57% by 18 months and 66% by 2 years. 90% of all closures that will happen occur within 2.5 years.

There is a significant age effect with perforations more likely to close spontaneously in younger children. 90% of perforations closed at 2.5 years in children.

When faced with the clinical question of what period of watchful waiting would be appropriate in monitoring a tympanic membrane perforation before surgical intervention may be reasonably recommended; there seems to be little advantage in waiting longer than 2.5 years.

doi:10.1017/S0022215116004370

Tympanoplasty (R836)

ID: 836.3

Modified overlay tympanoplasty & autologous Bone-Cartilage Composite Graft Ossiculoplasty

Presenting Author: **Shi Nae Park**

Shi Nae Park

Seoul St. Mary's Hospital The Catholic
University of Korea, College of Medicine

Learning Objectives:

Overlay tympanoplasty is one of the well-known techniques of middle ear surgery applied for all types of perforated tympanic membrane. However, classic overlay tympanoplasty has several disadvantages of technical difficulty, lateralization, and anterior wall blunting and long healing time. Modified overlay tympanoplasty was developed to overcome these disadvantages and has been performed for more than 15 years at our university. Overall success rate of this technique was 98%. Precise technique and surgical tips of modified overlay tympanoplasty to achieve a promising surgical result as well as early hearing restoration will be introduced.

Another novel surgical technique of ossiculoplasty, named autologous bone-cartilage composite graft (BCCG) ossiculoplasty will be mentioned. Analytic data of ossiculoplasty of BCCG showed satisfactory hearing outcome and the lowest complication rate among different materials of ossiculoplasty including Polycel[®] and titanium. Especially extrusion rate of BCCG ossiculoplasty appeared 0%. Therefore, we propose our BCCG ossiculoplasty be considered as a useful alternative method especially in patients with Eustachian tube dysfunction. Designing procedure and its application to different cases will be demonstrated.

doi:10.1017/S0022215116004382

Surgery on windows of inner ear (V837)

ID: 837.1

Cholesteatoma surgery with labyrinthine fistula

Presenting Author: **Tommaso Sorrentino**
Tommaso Sorrentino¹, Nader Nassif², Francesco Mancini²,
Luca Redaelli DeZinis²

¹Spedali Civili Brescia, ²ENT Department
Spedali Civili Brescia

Learning Objectives: To give suggestions on the treatment of labyrinthine fistula in cholesteatoma surgery and the risk of hearing loss.

Introduction: Labyrinthine fistula is one of the most common complications of chronic otitis media with cholesteatoma. The aim of this study is to identify factors that may foresee evolution of hearing in case of cholesteatoma surgery with labyrinthine fistula.

Methods: We did a retrospective study on patients undergone tympanoplasty for cholesteatoma with labyrinth fistula. For each case were noted localization/s and the features of the fistula, treatment of the cholesteatoma and the fistula, and air and bone conduction thresholds before and after surgery.

Results: 75 ears has been evaluated. Only for 26.7% of the patients complained about hearing loss at diagnosis, while

all but 3 patients presented hearing loss at audiometric testing. The fistula interested the lateral semicircular canal in 81.3%, while interest multiple canals in 18.7% of the cases. The fistula was membranous in 22.7 % cases, while bony in 77.3 % of cases. The size of the fistula was inferior to 2 mm in 60% of the patients, and superior to 2 mm in 40%. Only 21.3% patients underwent canal wall up , while 78.7% underwent canal wall down tympanoplasty. In 33.3% of the cases the matrix of the cholesteatoma was left in place on the fistula. In the other cases it was removed and the fistula was covered. In 17.3% of cases we don't have details. The mean preoperative bone conduction thresholds was 30.8 dB. The mean postoperative bone conduction thresholds was 35.3 dB. Hearing loss was more significant at 1 and 2 Khz. The risk of hearing loss was statistically correlated to the presence of multiple, membranous fistulae and if the size of the fistula was superior to 2 mm.

Conclusions: In case of labyrinthine fistula the risk of hearing loss is not correlated to the surgical procedure, but mainly on the feature of the fistula. Probably in case of large, multiple fistulae the membranous labyrinth may be damaged not only by surgery but also by inflammatory and infective process.

doi:10.1017/S0022215116004394

Surgery on windows of inner ear (V837)

ID: 837.2

Removal of cholesteatoma matrix from inner ear fistula

Presenting Author: **Harukazu Hiraumi**

Harukazu Hiraumi, Hiroaki Sato
Iwate Medical University

Learning Objectives:

The inner ear fistula is a frequently encountered complication of a cholesteatoma. During the removal of cholesteatoma matrix covering the inner ear fistula, meticulous care should be taken not to insult the inner ear. To minimize the inner ear damage, we preserve the periosteum around the inner ear fistula during the removal of cholesteatoma matrix. With this technique, the damage to the endosteum is minimized. This is very important, especially in case with cochlear fistula. In this video workshop, we present our technique in the removal of cholesteatoma matrix from inner ear fistula.

doi:10.1017/S0022215116004400

Surgery on windows of inner ear (V837)

ID: 837.3

Hearing preservation techniques in semicircular canal surgery

Presenting Author: **Vincent Van Rompaey**

Vincent Van Rompaey, Paul Van de Heyning
Antwerp University Hospital

Learning Objectives: To highlight potential approaches to open the semicircular canals while preserving hearing.

Introduction: In case of incapacitating symptoms, surgical treatment can be offered to patients with confirmed superior semicircular canal dehiscence syndrome. Plugging and capping of the superior semicircular canal are most effective in terms of symptom relief. Both the middle fossa and the transmastoid approach have been reported to reach the superior semicircular canal. However, the middle fossa approach has potential complications including epidural hematoma, seizures, cerebrospinal fluid leakage, facial palsy, etc. Moreover, plugging through the middle fossa approach has been reported to produce up to 25% of sensorineural hearing loss.

Aim: Our aim was to gain insight in the effect of opening and plugging the semicircular canal on postoperative hearing thresholds when using the presented surgical technique.

Methods: We performed a retrospective review on hearing outcomes of 16 cases that underwent transmastoid semicircular canal plugging by two surgeons in a tertiary referral center between October 2008 and January 2016. All patients received systemic corticosteroids during and after surgery. The relevant refinements in surgical technique will be presented. We evaluated air conduction (AC) pure-tone averages (PTA) of 0.5 kHz, 1 kHz and 2kHz and bone conduction (BC) PTA of 1, 2 and 4 kHz before and after surgery.

Results: In our case series of 16 patients that underwent transmastoid plugging, none of the patients experienced postoperative sensorineural hearing loss. None of the patients experienced epidural hematoma, seizures, cerebrospinal fluid leakage or facial palsy. Mean BC PTA was 16 dB preoperatively and 18 dB postoperatively. No BC PTA over 15 dB was observed in the individual patients. Mean AC PTA was 28 dB preoperatively and 24 dB postoperatively. All of the patients had resolution of their autophony or hyperacusis of bone-conducted sounds.

We can confirm the high rate of symptom relief reported in earlier studies on superior semicircular canal plugging, which presents a reliable treatment option to the patient that suffers from incapacitating autophony and hyperacusis of bodily sounds.

Conclusion: The presented technique for opening (and plugging) of the semicircular canal through a transmastoid approach proves to be safe and effective in preserving hearing. We can confirm the high rate of symptom relief reported in earlier studies. No sensorineural hearing loss was observed in our series.

doi:10.1017/S0022215116004412

Facial Palsy in CSOM (R841)

ID: 841.1

Facial Nerve Monitoring in Cholesteatoma Surgery - Past and Present Trends

Presenting Author: **David Kaylie**

David Kaylie
Duke University Medical Center

Learning Objectives: At the completion of this talk the attendee will understand the history of facial nerve monitoring, proper use of the facial nerve monitor and requirements for resident training.

Facial nerve integrity monitoring (NIM) using subcutaneous EMG needles has been established as standard of care for neurotologic and skull base surgery for decades. Several studies have shown that facial NIM is cost effective and best practice for otologic surgery. Despite this level of evidence, there are still several points about routine use of facial NIM that remain controversial.

There is no standard to say in which otologic cases it should be used. Controversy exists over who should be doing the monitoring – otologists, neurologists, audiologists or neurophysiologists. This leads to questions about which specialty has the appropriate training to make them most qualified to do facial NIM. The American Clinical Neurophysiology Society has published guidelines on proper training and method for facial NIM. The American Board of Otolaryngology has mandated training in facial NIM as a core requirement for otolaryngology residency, although there is no core curriculum to teach facial NIM in a uniform manner. Yet another controversy exists over billing for facial NIM. Although CPT codes exist for facial nerve monitoring, these codes cannot be billed concurrently with surgery codes.

The American Academy of Otolaryngology has set up a task force to look at these controversies and come up with an educational plan to ensure that all otolaryngology residents are trained appropriately. The task force will also survey residency directors to assess how facial NIM is being taught.

doi:10.1017/S0022215116004424

Facial Palsy in CSOM (R841)

ID: 841.2

Facial Palsy in Cholesteatoma

Presenting Author: **Richard Irving**

Richard Irving
Queen Elizabeth Hospital

Learning Objectives:

Facial palsy is a presenting feature of approximately 1% of middle ear cholesteatomas but can be present in up to 50% of cases where the disease involves the petrous apex. The risks of apical disease are thus much higher than for disease confined to the middle ear. Despite greater awareness the diagnosis is often delayed and although prompt treatment usually results in a good outcome the prognosis in established facial paralysis can be difficult to predict.

Middle ear cholesteatomas typically cause paralysis by involvement of the horizontal segment of the nerve whereas the labyrinthine segment is the site most frequently involved in apical disease.

All cases presenting to the author have undergone surgical treatment and patients with middle ear disease and treated surgically within 2 months of presentation all showed some recovery in facial nerve function. In those with apical disease the palsy was often present for many years and facial nerve function did not improve but nor did it deteriorate post-operatively in these more long-standing cases.

Facial nerve palsy associated with cholesteatoma should be treated surgically as early as possible but recovery can still be anticipated, even if treatment is delayed for up to 2 months.

doi:10.1017/S0022215116004448

Free Papers (F842)

ID: 842.2

Initial clinical experience with the Nucleus CI532 Cochlear Implant Electrode

Presenting Author: **Robert Briggs**

Robert Briggs¹, Jason Gavrilis², Catherine Morgan², Frank Risi², Antje Aschendorff³, Chris James², Robert Cowan⁴

¹University of Melbourne, ²Cochlear Ltd,

³Universitätsklinikum Freiburg, Germany, ⁴The Hearing Co-operative Research Centre, Melbourne

Learning Objectives:

Objective: To evaluate the efficacy of the Slim Modiolar (CI532) array in delivering consistent scala tympani and perimodiolar placement of the electrode contacts in cochlear implant recipients.

Methods: The Nucleus CI532 device incorporates a new pre-curved, perimodiolar electrode array (EA32) with 22 contacts and a cross-sectional area of approximately 40% of that of the Contour Advance "CA" array with the same electrode length. The EA32 does not have a lumen and stylet like the current CA; instead it has a thin electrode which is introduced into the cochlea through a 0.7 mm diameter straightening sheath.

As part of a multicentre international clinical trial, 10 patients have received the CI532 implant at the Melbourne Cochlear Implant Clinic. Outcome measures have included intra-operative fluoroscopy and Neural Response Telemetry, Post operative Cone Beam CT and speech perception testing.

Results: Electrode placement was successful in all 10 recipients with confirmed Scala Tympani position and low wrapping factor indicating good perimodiolar proximity. Hearing performance at 6 months appears promising.

Conclusion: Initial clinical experience with the CI532 electrode has demonstrated successful placement in 10 patients without complication and excellent perimodiolar position.

doi:10.1017/S002221511600445X

Free Papers (F842)

ID: 842.3

Otitis Media in children with cochlear implants - a long term prospective study

Presenting Author: **Noam Yehudai**

Noam Yehudai, Michal Luntz

Bnai Zion Medical Center, Technion – The Bruce Rappaport Faculty of Medicine, Haifa, Israel

Learning objectives: to determine the incidence of chronic otitis media in pediatric implantees and to define influencing factors.

Introduction: COM is considered a late sequela of both recurrent AOM and also of ventilating tubes. In children with a cochlear implant, the risks of middle ear infection and its potential spread along the electrode array into the cochlea and central nervous system are relatively high, mandating an aggressive management including insertion of ventilating tubes. Although the rate of AOM episodes diminishes after cochlear implantation, it remains high in otitis media (OM) prone children, thus might lead to repeated ventilating tube (VT) insertions. Information regarding the incidence of COM in children after cochlear implantation is scarce. The aim of the study is to determine the incidence of COM in pediatric implantees and to define influencing factors.

Methods: A retrospective study including 200 pediatric implantees. Mean age at CI was 32.58 ± 17.83 months and mean post-operative follow-up was 72.41 ± 35.27 months. Management was based on a structured AOM control protocol.

Results: 126 children (63%) were classified as OM prone and 74 (27%) as non-OM prone. 38 children (19%) underwent ≥ 2 VT insertions. Chronic OM developed in 15 children (7.5%). Seven children had a tympanic membrane perforation, 7 had adhesive middle ear disease and one more had cholesteatoma. Myringosclerosis appeared in 22 children (11%).

Discussion: Children after cochlear implantation continue to suffer from sequela of recurrent episodes of AOM. Significantly more myringosclerosis is found in OM-prone children who underwent repeated VT insertions. These children are also at increased risk for development of COM. OM-prone implantees should be followed carefully and continuously for early diagnosis and surgical intervention in cases of COM.

doi:10.1017/S0022215116004461

Free Papers (F842)

ID: 842.4

Predictive factor for residual hearing preservation after conventional cochlear implantation

Presenting Author: **Masahiro Takahashi**

Masahiro Takahashi, Yasuhiro Arai, Naoko Sakuma, Kenichiro Yabuki, Daisuke Sano, Nobuhiko Oridate
Yokohama City University School of Medicine

Learning Objectives:

Introduction: The concept of cochlear implantation (CI) with hearing preservation by atraumatic soft surgery is well established. The preservation of residual hearing after conventional CI is also frequently observed. The purpose of this study was to investigate predictive factor for residual hearing preservation after atraumatic CI.

Patients: Twenty-six patients (13 adults and 13 children) included in this study were received CI with atraumatic technique using standard-length flexible electrode implant through the round window approach.

Main outcome measure: Residual hearing was defined by unaided preoperative pure-tone threshold by air conduction at the mean of frequencies 125, 250 and 500 Hz. Complete hearing preservation was defined as postoperative thresholds within 10 dB of pre-implant values, hearing loss was defined greater than 10 dB of pre-implant values. Preoperative magnetic resonance imaging (MRI) was undergone in all patients, to measure cochlear fluid using software package included in the electric medical chart system.

Result: Complete hearing preservation was achieved in 17 of 26 (65%) patients. Complete hearing preservation were observed in seven of 13(54%) adults and ten of 13 (77%) children. In the patients less than the age of 6, residual hearing preservation was significantly achieved compared to other patients ($p < 0.05$). The cochlear volumes were ranged between 60 and 108 mm³ in 26 patients. The mean cochlear volume was 81.7 mm³ in the group of the complete hearing preservation, 69.0 mm³ in the group of hearing loss, respectively. Cochlear volume was significantly larger in those with the complete hearing preservation than those with the hearing loss.

Conclusion: Residual hearing preservation after conventional CI was observed in patients with younger age at implantation and larger cochlear volume in the present study. Cochlear volume could be a useful tool in predictively for residual hearing preservation after conventional CI.

doi:10.1017/S0022215116004473

Free Papers (F842)

ID: 842.5

Cone beam (CBCT) imaging in cochlear implantation practice

Presenting Author: **Emma Stapleton**

Emma Stapleton¹, E Mary Shanks², Agnes Allen², Peter Wardrop²

¹Scottish Cochlear Implant Centre,

²Crosshouse Hospital, Kilmarnock

Learning Objectives: 1) An introduction to CBCT imaging 2) A review of the relevant literature 3) A proposal of two models of cone beam imaging in cochlear implantation practice 4) To demonstrate these models using high quality images and explanations.

Introduction: Traditional methods of imaging in cochlear implantation practice include pre-operative MRI and high-resolution CT, to examine detailed anatomical structures and to define bony detail respectively, with post-operative modified Stenver's radiography to confirm electrode placement.

CBCT offers several potential advantages, including reduced radiation dose and minimal metal artefact compared to standard CT scanning. Additionally, there is evidence that electrode position may influence auditory outcome, hence the superior anatomical detail in CBCT offers a distinct advantage over plain radiography.

Methods: A review of the literature, and a summary of the potential uses of CBCT in cochlear implantation practice, as well as our department's current practice and experience, are presented.

Results: A number of studies have assessed the potential of cone beam imaging in determining cochlear implant electrode position in human cadaveric temporal bones.

CBCT offers distinct advantage over standard CT in the form of reduced radiation, reduced metal artefact and superior bony anatomical definition. However it is not suitable for use in young children or babies due to the need to sit upright and still.

Conclusions: Two models of CBCT usage in cochlear implantation practice are explained; both are currently being trialled by cochlear implantation units in the UK:

CBCT of the temporal bone both pre- and post-operatively in cochlear implant recipients offers high quality imaging for the assessment of both bony anatomy and electrode placement. MRI scanning is still required pre-operatively in many cases. Young children cannot be reliably imaged using CBCT due to movement artefact.

An alternative use of CBCT is in the pre- and post-operative assessment of selected cochlear implantation patients, including those with complicated pathology or anatomy, in whom a detailed analysis of anatomy and electrode position is advantageous in terms of their management and prognosis.

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Free Papers (F842)

ID: 842.6

Computer assisted 3D planning for surgical placement of the Bonebridge bone conduction hearing implant, simultaneous implantation of epithesis anchors and audiological outcome in adults and children

Presenting Author: **Ingmar Seiwerth**

Ingmar Seiwerth¹, Florian Radetzki², Torsten Rahne³, Stefan Plontke³

¹Martin Luther University Halle-Wittenberg, Germany, ²University of Halle, Dept. of Orthopedics, Martin Luther University Halle-Wittenberg, Germany, ³University of Halle, Dept. of Otorhinolaryngology, Head and Neck Surgery, Halle, Germany

Learning Objectives:

Introduction: The study aimed on evaluating the benefit of a preoperative three-dimensional (3D) planning tool for surgically placement of the bone conduction floating mass transducer (BC-FMT) of the Bonebridge (BB) bone conduction hearing implant. As the BB should be implanted in the mastoid without compromising the dura or the sigmoid sinus, placement may be challenging especially in children with small mastoids, in malformations and after multiple ear surgery.

Method: Since 2012, the Bonebridge was implanted in 22 Patients, including 7 children <16 y old (mean = 34.2 y ± 23.4 SD; min 5, max 76 y). Audiological testing was performed preoperatively, and 1 month and 3 months post-operatively. A preoperative planning tool was developed based on high resolution CT-scans of the temporal bone: AMIRA-software based 3D models of the Bonebridge implant and of the skull were freely adjusted and fused, allowing to detect the optimal implant position (“virtual surgery”). Transfer to the intraoperative situation was performed based on anatomical landmarks.

Results: The BB could be accurately placed in the selected locations. Simultaneous planning and implantation of the BB and bone anchors for ear prosthesis was performed in 2 cases. In some cases, preoperative planning revealed insufficient bone thickness of the mastoid, preventing BB-implantation. Audiological data showed a significant benefit 3 months after implantation in speech recognition, hearing in noise, in directional hearing and sound localization.

Conclusions: Audiological results were comparable to those reported in other studies about bone anchored hearing systems. Preoperative 3D planning is recommended especially in primarily small, poorly pneumatized mastoids, hypoplastic mastoids in malformations, reduced bone volume after canal wall down mastoidectomy, small mastoids in children, and for planning of simultaneous implantation of bone anchors for ear prostheses.

doi:10.1017/S0022215116004497

Cholesteatoma and the mastoid (N843)

ID: 843.1

Secondary obliteration of discharging mastoid cavities

Presenting Author: **Lars Vendelbo Johansen**

Lars Vendelbo Johansen
Aarhus University Hospital

Learning Objectives: I will demonstrate how I now manage old discharging radical cavities. Over the years I have been

using several techniques and with varying success. Now I most frequently use BonAlive as obliteration material, some times in combination with the temporal periosteal flap (described by M Yung and P Smith). I will present videos and pictures from the operations and updated figures of my material.

I will demonstrate how I now manage old discharging radical cavities. Over the years I have been using several techniques and with varying success. Now I most frequently use BonAlive as obliteration material, some times in combination with the temporal periosteal flap (described by M Yung and P Smith).

I will present videos and pictures from the operations and updated figures of my material.

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Cholesteatoma and the mastoid (N843)

ID: 843.2

Incidence of mastoidectomy among cholesteatoma patients in Denmark

Presenting Author: **Bjarki Djurhuus**
Bjarki Djurhuus¹, Christine Pedersen², Line Grosfeld², Christian Faber³

¹Zealand University Hospital, ²University of Southern Denmark, ³Department of ENT Head & Neck Surgery, Odense University Hospital

Objective:

- 1) To describe the incidence rate of first-time surgically treated middle ear cholesteatoma (STMEC1) in Denmark 1977–2015 and to estimate the proportion undergoing mastoidectomy.
- 2) To describe the recurrence rate after STMEC1 on Funen 1982–2015 taking surgical approach into consideration.

Methods: Cases of STMEC1 were identified by the use of the Danish National Hospital Register which also provided data on mastoidectomy. A change in incidence rate over time was examined using Poisson regression analysis.

For STMEC1s on Funen, the medical records were reviewed. The rate of recurrence was analyzed by the Kaplan Meier method and Cox regression analysis.

Results: A total of 16,475 STMEC1s were identified. Of these 4,416 (27%) were children (<16 years of age) and 12,059 (73%) were adults.

The incidence rate of STEM1 in adults was stable at 6–7 per 100,000 person years for the last couple of decades.

In children the incidence rate fell from 15 per 100,000 person years in 2002 to 7 per 100,000 person years in 2015.

The proportion undergoing mastoidectomy was stable (53% in children and 58% in adults).

The medical records from 1,003 patients with cholesteatoma (1,056 ears) were reviewed. The overall proportion of ears with recurrence was 38% in children and 14% in adults 5 years after primary surgery. Individuals without the need of mastoidectomy were at lowest risk of recurrence while individuals undergoing canal wall up (CWU) without

obliteration had the highest risk of recurrence (58% in children and 20% in adults after 5 years). In children, CWU without obliteration was associated with a hazard ratio for recurrence of 1.9 (95% 1.2–3.0) when compared with CWU with obliteration.

Conclusion: The incidence rate of STMEC1 in children halved from 2002 to 2015. Compared with adults, children were at an increased risk of recurrence. In children treated with CWU, obliteration was associated with a significantly lower risk of recurrence compared with no obliteration.

doi:10.1017/S0022215116004515

Cholesteatoma and the mastoid (N843)

ID: 843.3

Rationale for obliteration of the mastoid cavity

Presenting Author: **Michael Gaihede**

Michael Gaihede
Aalborg University Hospital

Learning Objectives: Basic knowledge about the anatomy and function of the mastoid provides a rationale for obliteration of the cavity in cholesteatoma surgery.

“Danish Otolology Society symposium”

Mastoidectomy is often included in cholesteatoma surgery in order to eradicate the disease. In such cases the subsequent reconstruction of the middle ear may include obliteration of the mastoid. This has become increasingly popular, because studies have demonstrated less recurrent cholesteatomas. While this may speak for itself, the basic reasons for obliteration have not been documented.

The rationale for mastoid obliteration should be based on its function in normal and diseased ears, but our understanding of the mastoid function is rather limited despite its unique structure compared with the tympanum. Thus, the mastoid has been regarded to have only a passive role, where it may enhance the area for gas exchange as well as be a pressure buffer by virtue of its volume.

Recent clinical physiological experiments have demonstrated how pressure regulation of the middle ear cleft consists of both stepwise pressure changes by Eustachian tube openings as well as gradual pressure changes explained by changes in the thickness or congestion of the mastoid mucosa. More studies have confirmed this idea, which may point to a role of the mastoid in the overall pressure regulation.

The histological structure of the mastoid mucosa favors such a function by a loose connective tissue and abundant blood vessels. However, the mucosa does not display cilia and goblet cells as found in the tympanum, which makes it more susceptible to inflammatory changes. Chronic or recurrent infections may easily cause a relative fibrosis, which inevitably limits its capability for thickness changes based on its congestion, whereas its capability for gas absorption may remain unaffected.

In this scenario, the mastoid mucosa may have lost its functional properties because of chronic or recurrent inflammations, and obliteration can eliminate the contribution of a diseased mucosa, which may contribute only to

gas absorption and development of middle ear underpressure.

doi:10.1017/S0022215116004527

Cholesteatoma and the mastoid (N843)

ID: 843.4

Primary obliteration of the mastoid cavity in cholesteatoma surgery

Presenting Author: **Peter Schousboe**

Peter Schousboe
*Consultant, Ph. D., MHM. Vejle Hospital and
Institute of Regional Health Research,
University of Southern Denmark*

Learning Objectives: Handling of Canal wall up and Canal wall down mastoidal cavities in cholesteatoma surgery.

Danish Otolology Society symposium

Mastoidectomy is often necessary in cholesteatoma surgery. If the posterior ear canal wall can be preserved, the mastoidal cavity remains in contact with the middle ear air space, even though it is often filled with scar tissue. The pressure-regulating role of the mastoid mucosa is presumably destroyed or severely diminished due to removal of the trabecular structure. Should the canal wall-up cavity be obliterated in order to prevent recurrence of a cholesteatoma? Or should it be left open allowing subsequent re-aeration? The latter includes a risk of renewed negative pressure in the middle ear and mastoid and the development of recurrent cholesteatoma.

If the posterior ear canal wall has to be removed producing a modified radical cavity, the ear canal is substantially enlarged. This implies regular cleaning (often by an ENT specialist), and moist and infections in the cavity can be troublesome. Should the cavity be obliterated in order to restore the ear canal to its normal size? Or should it be left open for optimal disease control? We have developed a strategy with partial obliteration and enlargement of the ear canal opening. Bone dust, cartilage, fascia and on rare occasions artificial material can be used for obliteration. We find that a partial obliteration diminishes the need for postoperative ear care.

doi:10.1017/S0022215116004539

Endoscopic Ear Surgery 2 (R844)

ID: 844.1

Beyond the middle ear

Presenting Author: **Presutti Livio**

Presutti Livio
University Hospital of Modena

The lateral skull base constitutes an anatomic boundary between the fields of neurosurgery and otolaryngology.

Surgery in this region has always been a challenge for both disciplines owing to the presence of important anatomical structures such as the internal carotid artery, the otic capsule, and the facial nerve.

Several approaches have been developed to reach pathology located in the lateral skull base and in the fundus of the internal auditory canal (IAC) and petrous apex.

Despite the benign nature and limited dimensions of the lesions located in this anatomical region, extensive surgical approaches are often required to reach and remove the disease.

At present the main application of endoscopic surgery relies on the middle ear cholesteatoma surgical treatment, but in the natural evolution of the technique there are the steps forward of lateral skull base surgery and petrous bone pathology.

During the experience of recent years, we progressively noticed that the internal ear and the whole temporal bone could be accessed in an endoscopic assisted fashion or even by exclusive endoscopic approaches. Despite the benign nature and limited dimensions of lesions located in this anatomical region, extirpative surgical approaches are often required to reach and remove the disease. The problem would only be to codify as much as possible the landmarks and the procedures, and to integrate them to classic microscopic approaches.

Three main corridors to the lateral skull base were identified: the transcanal supragenulate corridor, the transcanal transpromontorial corridor, and the transcanal infracochlear corridor.

doi:10.1017/S0022215116004540

Endoscopic Ear Surgery 2 (R844)

ID: 844.2

Integrating endoscopy into everyday otology practice

Presenting Author: **José Carlos Casqueiro**

José Carlos Casqueiro

Hospital Universitario Severo Ochoa / Grupo Otológico Madrid

Endoscopes are not new for otologist but it took a long way to use them first for documentation and then in modern endoscopic ear surgery (EES).

We will discuss our experience with the use of endoscopes after five years adopting this approach and we will explain how the endoscopy has modified our management in some cases. The benefits and disadvantages will also be discussed.

We will show our learning curve in EES, our difficulties in adopting the use of endoscopes and our thoughts about how endoscopes can improve our everyday practice.

doi:10.1017/S0022215116004552

Endoscopic Ear Surgery 2 (R844)

ID: 844.3

Endoscopic Assisted ear surgery: Cholesteatoma and beyond

Presenting Author: **Mohamed Badr-El-Dine**

Mohamed Badr-El-Dine

Faculty of Medicine, University of Alexandria, EGYPT

Learning Objectives:

Objective: The purpose of this presentation is to emphasize the importance of incorporating the endoscope together with the microscope during cholesteatoma surgery. Because poor access to the hidden recesses of the middle ear was the major reason for residual disease, therefore, angled endoscopes were considered a major adjunct in dealing with such blind spots.

Methods: Endoscope-assisted surgery (EES) helped the surgeon to overcome the limitation of the straight vision offered by the microscope. On the other hand, EES has its own peculiarities as the surgeon works practically with one hand, and in many instances uses angled-vision endoscopes. New instrumentations specifically adapted for EES are now available. Also, new technologies have stimulated the creation of powered endoscopic equipment. Both have pushed the surgeon to widen the indications of EES beyond cholesteatoma.

Results: Our results confirmed that better control over the pathology, especially in hidden recesses, is possible with the help of endoscope. Advancements in EES improved maneuverability and offered better visualization over the pathology; therefore pushing the limits of endoscope and widening its indications.

The author highlights the importance of endoscope-assisted surgery during cholesteatoma surgery and presents different recent indications of endoscope in the field of otology and skull base surgery. EES is increasingly used for removal of various middle ear tumors, middle ear exploration for CHL, otosclerosis surgery and cochlear implant surgery. Also, CPA surgery during micro-vascular decompression and acoustic neuroma complete removal from the fundus of IAC.

Conclusion: Combining the attributes of endoscope together with the microscope is the most efficacious approach and will continue widening the indications of endoscope in the future. EES is technically feasible for the majority of surgeons and should be included in all training programs and courses.

doi:10.1017/S0022215116004564

Endoscopic Ear Surgery 2 (R844)

ID: 844.4

Pros and Cons of Otoendoscopy: 22 years Experience

Presenting Author: **Muaaz Tarabichi**

Muaaz Tarabichi

American Hospital Dubai

Learning Objectives: 1-Understand advantages of endoscopic otologic surgery for eliminating residual disease. 2-Understand advantages of endoscopic otologic surgery for re-establishing ventilation. 3-Understand limitation of endoscopic otologic surgery.

Introduction: Although it has been 15 years since the introduction of operative endoscopy to ear surgery in the form of exploration of old mastoid cavities¹, there is presently tremendous variations in thoughts and practice across the globe on the role of the endoscope in cholesteatoma surgery.

Literature Review: There are increased numbers of citations on this subject especially in the last 5 years. These reports have focused on four patterns of application of operative endoscopy in ear surgery, the first and the oldest report revolve around exploration of old mastoid cavities using the endoscope with endoscopic removal of recurrent disease.¹ The second is examination of the mastoid cavity through a stab postauricular incision.² The third is the use of transcanal endoscopic evaluation and removal of disease from the sinus tympani during traditional combined tympanomastoidectomy.³⁻⁴ The fourth is the use of transcanal endoscopic approach as the primary access to the cholesteatoma within the middle ear and the use of traditional postauricular mastoidectomy only to address the disease within the mastoid cavity proper.⁵

Best Practice Summary:

- 1- There is little evidence in the literature, beyond the cohorts reported by the initial authors 16 years ago, to support the use of the endoscope in exploring old cavities or through a stab wound in the postauricular area.
- 2- Transcanal Endoscopic Access to disease within the sinus tympani in combination with traditional combined tympanomastoidectomy should be incorporated into the routine management of cholesteatoma.
- 3- Exclusive transcanal endoscopic approach to the middle ear as the primary surgical method of removal of cholesteatoma has been reported increasingly in the literature, but more data is needed to compare outcome to traditional accepted surgical treatment of cholesteatoma.

doi:10.1017/S0022215116004576

Updates in the surgical managements for cholesteatoma (N845)

ID: 845.1

Revision surgery after canal wall down tympanomastoidectomy

Presenting Author: **YOUNG HO Kim**

Young Ho Kim¹, Minhyung Lee², Seung Hoon Han², Min Hyun Park², Seung-Ha Oh³, Jun Ho Lee³

¹Seoul National University Boramae Medical Center, ²Seoul National University Boramae Medical Center, ³Seoul National University College of Medicine

Learning Objectives: The aim of this study is to investigate causes and treatment results of revision surgery cases performed after CWD tympanomastoidectomy.

Canal wall down (CWD) tympanomastoidectomy may be an appropriate choice for the successful removal of cholesteatoma in the middle ear, attic, and mastoid cavity. However, it sometimes needs some revision surgeries. The aim of this study is to investigate causes and treatment results of revision surgery cases performed after CWD tympanomastoidectomy. From Jan 2010 to Dec 2015, among 276 patients who underwent CWD tympanomastoidectomy, cases requiring revision surgery were enrolled in this study. Six cases of staged operations and 18 patients who were not followed up more than 6 months were excluded in this analysis. Using medical records, demographics of subjects, causes of revision surgery, operation name, and postoperative results were investigated retrospectively. Patients were divided into 2 groups according to whether they had got an intact canal wall mastoidectomy as the initial surgery. Among 252 patients, 18 (7.1%) needed revision surgeries due to postoperative problems excluding staged operations and minor procedures. Male to female ratio was 6:12 and left to right ratio 10:8. Residual cholesteatoma was found in 3 cases (1.2%) and they were removed in sinus tympani (2 cases) and malleus handle (1 case) successfully. There was no more cholesteatoma recurrence after revision surgery. Tympanoplasty or myringoplasty was performed in 15 cases (6.0%) and the perforation of tympanic membrane was healed in all cases. Revision ossiculoplasty due to prosthesis extrusion was done in 1 case (0.4%). Final postoperative outcomes showed no statistical significance between two groups ($p > 0.05$). Revision surgeries after CWD tympanomastoidectomy showed a low incidence and good postoperative outcomes. However, regular and careful examinations after initial surgery should be emphasized to avoid revision surgery.

doi:10.1017/S0022215116004588

Updates in the surgical managements for cholesteatoma (N845)

ID: 845.2

Subtotal petrosectomy: Long term surgical results in managing chronic ear disease

Presenting Author: **Shi Nae Park**

Shi Nae Park

Seoul St. Mary's Hospital The Catholic University of Korea, College of Medicine

Learning Objectives:

Objectives: To investigate the long term surgical results of subtotal petrosectomy, a retrospective study of the patients with chronic otitis media who underwent subtotal petrosectomy with or without cochlear implantation was performed.

Subjects & Methods: Twenty nine patients (14 men and 15 women, mean age 61.5 years, SD 8.7 year) who received subtotal petrosectomy by one surgeon between April 2004 and December 2015 were included in this study. Ten patients underwent simultaneous or sequential cochlear implantation for the hearing rehabilitation depending on the active

inflammatory condition of their middle ear. In all cases, after complete eradication of the pathology, mastoid cavity was obliterated with abdominal fat followed by double layered external auditory canal obliteration with special cosmetic concern. Surgical outcomes of this procedure were analyzed.

Results: Middle ear inflammation and cholesteatoma were completely managed with this surgical technique. None of the patients showed the inflammatory symptoms of otorrhea or other early inflammatory complication after the surgery. Cochlear implant was successfully placed and active electrodes were fully inserted in all of the 10 patients. Only one patient showed the delayed extrusion of the ball electrode to the obliterated ear canal which was successfully managed by replacement of extruded ball electrode with conchal cartilage reinforcement under local anesthesia. Postoperative quality of life during the medical interview revealed the highly satisfied status of subtotal petrosectomy from both disease eradication and cosmetic viewpoints.

Conclusion: Subtotal petrosectomy seems to be very safe, effective and even cosmetically acceptable procedure for the deafened patients with chronic otitis media whether accompanying cochlear implantation is planned or not.

doi:10.1017/S002221511600459X

Updates in the surgical managements for cholesteatoma (N845)

ID: 845.3

Atticosinoplasty for early cholesteatoma management

Presenting Author: **Yun-Hoon Choung**
Yun-Hoon Choung, Oak-Sung Choo, Sang Young Hong
Ajou University School of Medicine

Learning Objectives:

Objective: These days surgery rates for early cholesteatoma and residual or recurrent cholesteatoma are increasing. For this matter, Prof. Keehyun Park suggested a surgical technique called 'atticosinoplasty' to mediate early cholesteatoma. Thus, we analyzed the adequacy and applicability of atticosinoplasty as a treatment for early cholesteatoma comparing with other surgical techniques.

Materials & Methods: One hundred seventy two patients who underwent atticosinoplasty (n = 72) or canal wall up mastoidectomy (n = 73) in Ajou University Hospital (Suwon, Korea) between 2002 and 2014 were enrolled in this study. Patients with less than 12 months of follow up period were excluded from this study. During the follow up, post-operative physical examination and audiometry were performed including temporal bone CT in necessary cases. Based on these data, recurrence and re-operation rate, pre- and post-operative hearing levels, and hearing gain were compared between both groups.

Results: The atticosinoplasty technique includes the removal of cholesteatoma through atticotomy or posterior sinusectomy, removal of incus and malleus, transmeatal endoscopic exploration, ossicle reconstruction and wall reconstruction

with cartilage. There was no significant difference of hearing gain (PTA) between the atticosinoplasty group (44/72 patients) and the CWUM group (47/73 patients). Decrease of air-bone gap was detected in 61% (44/72) patients in the atticosinoplasty group and in 64% (47/73) in the CWUM group ($p > 0.05$). Revision mastoidectomy was performed in 3 (4.2%) in the atticosinoplasty group and in 4 (5.4%) in the CWUM group. However, revision ossiculoplasty was done less in the atticosinoplasty group (7, 9.7%) rather than the CWUM group (18, 24.6%) ($p < 0.05$).

Conclusion: Atticosinoplasty can be considered as an effective surgical technique for the treatment of early cholesteatoma, resulting in low recurrence rate and improved hearing.

doi:10.1017/S0022215116004606

Updates in the surgical managements for cholesteatoma (N845)

ID: 845.4

Endoscopic management of cholesteatoma

Presenting Author: **IL-WOO Lee**

IL-WOO Lee
Pusan National University Yangsan Hospital

Learning Objectives: Endoscope is widely accepted instrument for minimally invasive surgical approach for many clinical field. The main benefits of endoscopic management for cholesteatoma surgery are preserving the normal anatomical structure with complete removal of disease in the complicated middle ear structure. There are two aspects of endoscopic cholesteatoma surgery: totally transcanal endoscopic surgery vs. endoscope as an adjuvant instrument. Though totally transcanal endoscopic ear surgery (TEES) can provide wide surgical view without destruction of normal anatomical structures, it has disadvantage of one hand surgery with two instrument in relatively narrow ear canal. Surgical time for the TEES is longer than in microscopic surgery, especially for the beginners. We use the endoscope for every cholesteatoma surgery as an adjuvant instrument for microscopic surgery. With combined approach from both transcanal and transmastoid approach, we use the endoscope of 45 and 70 degree for inspection of blind spot in the middle ear cavity, and remove the remnant or residual cholesteatoma with intact canal wall. The chances of canal wall down approach were reduced dramatically with this methods. This technique is very useful especially for adhesive middle ear disease, attic cholesteatoma and congenital cholesteatoma. We will present the cases of adhesive middle ear disease, attic and congenital cholesteatoma with this endoscope as an adjuvant for microscopic surgery.

Endoscope is widely accepted instrument for minimally invasive surgical approach for many clinical field. The main benefits of endoscopic management for cholesteatoma surgery are preserving the normal anatomical structure with complete removal of disease in the complicated middle ear structure. There are two aspects of endoscopic cholesteatoma surgery: totally transcanal endoscopic surgery vs. endoscope

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We will present the cases of adhesive middle ear disease, attic and congenital choesteatoma with this endoscope as an adjuvant for microscopic surgery.

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Updates in the surgical managements for cholesteatoma (N845)

ID: 845.5

Tailored management and long-term outcome of congenital cholesteatoma

Presenting Author: **Seung Ha Oh**

Seung Ha Oh

Seoul National University Hospital

Learning Objectives: As the endoscopic exam of tympanic membrane in young children become more popular, detection rate of early stage of congenital cholesteatoma has been increased significantly. Once identified, every cholesteatoma should be treated surgically with a primary goal of total eradication to obtain a safe and dry ear. The congenital cholesteatoma at anterior superior quadrant can be removed relatively easier than the posterior located one. Posterior mesotympanic choelsteatoma spreads posterior-superiorly, medial to incus body. It invades into the facial recess and sinus tympani and is prone to involve stapes and its joint. Epitympanum and mastoid invasion should be accessed by temporal bone CT and diffusion MRI image technique. These preoperative diagnostic evaluation can prevent the unnecessary mastoidectomy. Nowadays, it has been more popular to use endoscope during ear surgery. By using endoscopic assistance, transcanal approach could be enough to manage the most of congenital cholesteatoma which does not extend to the mastoid. In addition to that, the use of endoscope is justified for direct visualization of the deep sinus tympani. A long term follow up is necessary in order to detect the residual or recurrent cholesteatoma. Unwanted retraction or adhesion of tympanum are not infrequent especially in the posterior mesotympanic cholesteatoma cases. Our experience and management algorithm will be discussed.

As the endoscopic exam of tympanic membrane in young children become more popular, detection rate of early stage of congenital cholesteatoma has been increased significantly.

Once identified, every cholesteatoma should be treated surgically with a primary goal of total eradication to obtain a safe and dry ear. The congenital cholesteatoma at anterior superior quadrant can be removed relatively easier than the posterior located one.

Posterior mesotympanic choelsteatoma spreads posterior-superiorly, medial to incus body. It invades into the facial recess and sinus tympani and is prone to involve stapes and its joint. Epitympanum and mastoid invasion should be accessed by temporal bone CT and diffusion MRI image technique. These preoperative diagnostic evaluation can prevent the unnecessary mastoidectomy.

Nowadays, it has been more popular to use endoscope during ear surgery. By using endoscopic assistance, transcanal approach could be enough to manage the most of congenital cholesteatoma which does not extend to the mastoid. In addition to that, the use of endoscope is justified for direct visualization of the deep sinus tympani.

A long term follow up is necessary in order to detect the residual or recurrent cholesteatoma. Unwanted retraction or adhesion of tympanum are not infrequent especially in the posterior mesotympanic cholesteatoma cases. Our experience and management algorithm will be discussed.

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Outcome measure in Cholesteatoma Surgery (R846)

ID: 846.1

Systematic Review Questionnaires in Otology

Presenting Author: **Paul Merkus**

Paul Merkus, Koen Viergever, Els Bruinewoud, Lisette Van Leeuwen, Sophia Kramer, Hans Ket

VU University Medical Center Amsterdam

Learning Objectives:

- To help the ENT surgeon identifying the most suitable questionnaire for their practice.
- To give a brief overview of all available otologic questionnaires.

Introduction: A Patient Reported Outcome Measure (PROM), like a questionnaire, is a valuable tool in assessing quality of health care from a patient perspective. Questionnaires are widely used by otologists. However, the large number of available questionnaires makes it almost impossible for the ENT surgeon to choose which one to use.

Methods: A systematic literature search has been conducted using the Embase and Pubmed medical databases. Questionnaires addressing any otologic complaint (tinnitus, hearing, earache, otorrhea, itch, dizziness, pressure sensation, and taste) were evaluated for eligibility by two independent researchers. Inclusion criteria were: human adult population, closed end questionnaire, English language and availability of the original article describing the development of the instrument. Methodological quality was

assessed by using the COSMIN-criteria: a checklist providing a standard for design requirements and preferred statistical analyses.

Results: A large number of questionnaires was found. The following outcome variables will be presented in our overview: the number of items, response scales, subscales, cut-off/end points, reliability and validity. If possible, the questionnaires will be ranked according to usefulness and actual use in literature.

Conclusion: A large number of otologic questionnaires is available in literature. The presented overview will highlight the best available questionnaires in the follow-up of otologic patients.

doi:10.1017/S0022215116004631

Outcome measure in Cholesteatoma Surgery (R846)

ID: 846.2

The COMQ-12 and the COMBI questionnaires for the assessment of cholesteatoma surgery outcome

Presenting Author: **John Phillips**
John Phillips

Norfolk & Norwich University Hospitals NHS
Foundation Trust

Learning Objectives: 1. To appreciate the significance of attaining HRQoL data from patients to assess outcome. 2. To understand the development and application of the COMQ-12. 3. To understand the development and application of the COMBI. 4. To appreciate how the use of the COMQ-12 and COMBI represent an opportunity to compare HRQoL worldwide.

Health related quality of life (HRQoL) measurements reflect the overall burden of disease from the perspective of the patient rather than the clinician. This makes the acquisition of this kind of data particularly pertinent in otology, where single clinical, radiological, and audiological findings may inter-relate poorly, and therefore poorly predict HRQoL. The use of HRQoL measures has been shown to aid both the patient's prioritisation of their symptoms and the management of their individual expectations.

The COMQ-12 and COMBI have been developed to assess the patient-reported health-related quality of life (HRQoL) due to chronic otitis media. Both of these questionnaires have been developed to be completed by the patient before physician assessment. Both questionnaires are composed of 12 items that cover a broad range of experiences pertinent to patients with chronic otitis media. The COMQ-12 and COMBI have been developed from the same core item pool, and are complimentary tools that have been shown to provide an accurate assessment of disease severity.

This presentation will take the opportunity to detail the process of questionnaire development and psychometric analysis. Details regarding the translation of these questionnaires into foreign languages and their relevance for assessing outcome in clinical practice will also be provided.

doi:10.1017/S0022215116004643

Outcome measure in Cholesteatoma Surgery (R846)

ID: 846.3

Temporary removal of the posterior bony canal wall in cholesteatoma surgery

Presenting Author: **Vincent Van Rompaey**

Vincent Van Rompaey, Karen Van der Gucht,
Olivier Vanderveken, Paul Van de Heyning, Jos Claes
Antwerp University Hospital

Learning Objectives: To describe an alternative technique to enable cholesteatoma removal. To report on the outcome in patients that underwent this type of surgery.

We describe the surgical technique of temporary removal of the posterior auditory canal wall with reconstruction and report the outcome of using this technique as a treatment method for cholesteatoma in a case series. In 32 cases of cholesteatoma surgery a technique of temporary removal of the posterior bony wall was applied. During primary surgery the posterior auditory canal wall was removed using an oscillating saw. For the purpose of reconstruction, the canal wall was repositioned and fixed using two titanium microplates (n = 26). In case the canal wall could not be reconstructed with osteosynthesis, either glass-ionomeric cement (BioCem) was used for fixation (n = 4) or fibrin glue (Tissucol) (n = 2) to support the posterior wall. The outcome includes the healing process in the first post-operative month, the absence of residual or recurrent disease and the successful reconstruction of the posterior auditory canal wall as evaluated during second-look surgery. When microplates were used, we saw healing problems of the canal skin in about 4 % of patients. Recurrent cholesteatoma was found in 4 cases (14 %), residual cholesteatoma in 8 ears (25 %). In the osteosynthesis group, successful reconstruction was achieved in 25 patients (96 %). In 3 out of 4 patients of the glass-ionomeric cement group (75 %) excessive granulation tissue developed with extensive bony lysis. Temporary removal of the posterior auditory canal wall offers potential for the control of cholesteatoma. Our first results suggest that osteosynthesis allows for a good anatomical and functional reconstruction.

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Bonebridge and Soundbridge – practical approaches (V847)

ID: 847.1

Bonebridge: Surgical Planning, Outcomes, and Innovations

Presenting Author: **Peter Grasso**

Peter Grasso
MED-EL

Learning Objectives: The objective of this presentation is to review the key features of the radiological and surgical planning software for the Bonebridge.

Percutaneous implantable Bone Conduction Hearing Aids have been used for decades to treat certain types of hearing losses. These devices can offer improved sound quality, by stimulating the bone directly. However this class of device has a major drawback: a chronic open wound, as vibratory energy is delivered to the skull through an osseointegrated screw directly attached to an external audio processor. To overcome issues related to wound management and infections, two new classes of bone conduction hearing aids have been recently developed: passive, and active, transcutaneous implants. The passive devices transfer mechanical energy through intact skin to the bone. The BONEBRIDGE system represents the first active bone conduction device that addresses the wound issues of percutaneous devices. The system is implanted in the Temporal Bone or in the retrosigmoidal area.

In order to evaluate the surgical risk of exposure /compression of important structures such as the dura and the sigmoid sinus, the BONEBRIDGE can be “virtually implanted” prior to the actual surgery using dedicated software called BB Fast View. The BB Fast View software utilises conventional CT scans (DICOM) and can assist radiological and surgical planning. Important information about the placement of the BONEBRIDGE can be forwarded to the radiologist and surgeon for evaluation. The software has been proven to be a useful tool as a preliminary assessment of the feasibility of BONEBRIDGE implantation.

doi:10.1017/S0022215116006435

ID: 847.2

Coupling of Active Middle Ear Implants to the Ossicles and the Cochlea

Presenting Author: **Joachim Mueller**

Joachim Mueller¹, John Martin Hempel²

¹Section Otolaryngology and Cochlear Implants, ²Dept of Otorhinolaryngology, Munich University

Learning Objectives: In general, the audiological results achieved after tympanoplasty showed postoperatively for 80 % of the patients an improved or equal hearing compared to preoperatively. Thus 20% of the patients are not satisfied with their hearing. Active middle ear implants offer new possibilities for the improvement of hearing. In principle, active middle ear implants can directly drive any vibratory structure of the middle ear. The lecture uses video sequences to describe and discusses the coupling techniques of active devices to the ossicular chain (Incus, Stapes), to partial or total prosthesis, directly to the round or oval window. For some attachments, special elements had been developed. Also accompanying procedures, such as tympanic membrane reconstruction with cartilage are discussed. In cases of a atelectatic middle ear the alternative application of the device directly to the round oval or round window is advantageous. Active middle ear implants enrich the field of reconstructive middle ear surgery and enable a detailed discussion on different ways of reconstruction.

Since the basic principles of tympanoplasty had been developed in the early 50ties, many otologists made additional contributions to our current knowledge of tympanoplasty procedures.

In general, the audiological results achieved after tympanoplasty showed postoperatively for 80 % of the patients

an improved or equal hearing compared to preoperatively. Thus 20% of the patients are not satisfied with their hearing.

Active middle ear implants offer new possibilities for the improvement of hearing.

In principle, active middle ear implants can directly drive any vibratory structure of the middle ear. The lecture describes and discusses, based on short videosequences, the coupling techniques to the ossicular chain (Incus, Stapes), to a partial or total prosthesis, or directly to the cochlea, via the round or oval window. For some couplings methods, special elements had been developed.

Also accompanying procedures, such as tympanic membrane reconstruction with cartilage are discussed.

In cases of a atelectatic middle ear some of the above mentioned alternative applications of the active device directly to the round oval or round window is advantageous.

Active middle ear implants enrich the field of reconstructive middle ear surgery and enable a detailed discussion on different ways of reconstruction.

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ID: IP137

Quality of information available via the internet for patients with otological conditions

Presenting Author: **Alistair Mitchell-Innes**

Alistair Mitchell-Innes¹, Alistair Mitchell-Innes², Julian Danino³, Jameel Muzaffar⁴, James Howard², Chris Coulson²

¹University Hospital Birmingham Foundation NHS Trust, ²University Hospital Birmingham,

³New Cross Hospital, Wolverhampton,

⁴Worcester Royal Hospital

Learning Objectives:

Objective: Evaluate the type, content and quality of information available via the internet for patients with common otological conditions.

Methods: The Google search engine was used to generate responses for the following search terms: glue ear, otitis media, otosclerosis, Meniere’s disease, cholesteatoma and ear perforation. The first 10 websites for each search term were selected for analysis. Websites were evaluated with the validated DISCERN instrument, the LIDA tool, the Flesch Readability Formula, the SMOG (Simple Measure Of Gobbledygook) readability score and against the JAMA criteria. Comparisons were made with a similar study assessing quality of information in non-otological conditions.

Results: Mean SMOG score was 12.19 years of education (range 6.2–22.8). The HON symbol appeared on 15 of 49 websites (30.61%). Pearson’s r was used to identify interactions between variables and demonstrated a significant correlation between LIDA score and Google ranking ($R^2 = -0.1195$, $p = 0.002$); between university/hospital affiliation and JAMA score ($R^2 = -1.7889$, $p = 0.0182$) and commercial affiliation and JAMA score ($R^2 = 1.0561$;

$p = 0.01$). Multivariate linear regression analysis showed LIDA to be the strongest predictor of Google ranking (Page rank decreasing by 0.10572 per LIDA score; $p = 0.01$).

Conclusion: As websites with better Google ranking were only weakly associated with higher quality rankings patients would benefit from being directed to reliable websites by clinicians. There is currently a gap in the available resources repository of otological information aimed at patients.

doi:10.1017/S0022215116004667

Stem cell and their potential for hearing preservation (K853)

ID: 853.1

Stem cells and their potential for the restoration of hearing

Presenting Author: **Marcelo Rivolta**

Marcelo Rivolta

University of Sheffield

Learning Objectives: To present the current advances produced in our laboratory of the application of human pluripotent stem cells in the treatment of hearing loss.

The manipulation of human embryonic stem cells has opened new horizons for regenerative medicine, especially for incurable conditions like deafness. Hopes have been fuelled further by the potential to generate patient-specific, induced-pluripotent stem cells (iPSCs).

Pluripotent stem cells need to be driven into the desired cell lineages. In our laboratory, we initially tackled this problem by isolating stem cells from the human fetal cochlea, and used them to unravel the basic signals involved in producing sensory cells. We then developed a method to generate otic cells from human embryonic stem cells (hESCs) using molecules that induce the formation of the ear *in vivo*. In this way we generated otic progenitors that can produce sensory hair cell-like cells and auditory neurons. When hESC-derived otic progenitors were transplanted into an animal model of auditory neuropathy, they survived, engrafted and differentiated into neurons. Moreover, they connected with the hair cells and the brain and, more remarkably, they elicited a functional recovery represented by improved ABR thresholds. We are now exploring if hESC-derived auditory neurons could interact with experimental cochlear implants. We have also developed iPSC lines using different techniques and we are adapting the methods developed for hESC for their use with iPSCs.

The field is still at an early stage, but the progress already achieved is substantial. Although the use of stem cells for hearing loss is likely to be initially limited to some conditions, this will probably change with the development of more efficient ways of producing sensory cells and with the improvement of delivery and grafting techniques. In

summary, the presentation will revise the recent advances produced by our laboratory and the impact that this new technology could have in the future ways we treat this condition.

doi:10.1017/S0022215116004679

Cholesteatoma imaging: current value and possibilities (K855)

ID: 855.1

Cholesteatoma: Pre- & Postoperative imaging

Presenting Author: **Jan Casselman**

Jan Casselman¹, Bert De Foer², Jean-Philippe Vercruyse², Thomas Somers², Erwin Offeciers²

¹AZ Sint Jan Brugge-Oostende AV, ²AZ Sint Augustinus Wilrijk

Learning Objectives: - Know the value of CT (CBCT) and non-EPI DWI in the diagnosis of cholesteatoma - Be familiar with the cholesteatoma mimickers and know how to avoid false positive and negative results - Be aware of the strength of MR in the post-operative follow-up.

For many years CT was the only available technique. Its accuracy was however low as it failed to visualise new and residual lesions in partially or completely non-aerated middle ears and post-operative cavities.

Characterization of lesions in the middle ear with MR became possible in well-, partially- and non-aerated middle ears. Cholesteatomas do not enhance, scar tissue and/or granulation tissue in postoperative cavities sometimes enhances only after 30 to 40 minutes. Therefore scar tissue can only be distinguished on contrast-enhanced T1W images made 45 minutes after contrast injection. However this technique is time consuming and requires gadolinium injection and false positive and negative results were reported.

Cholesteatomas have a very characteristic high signal intensity on non-EPI DWI images. High resolution non-EPI DWI is able to detect lesions down to 2 mm. False negatives are rare and are due to movement or metal artefacts, auto-evacuation etc.

Studies showed that non-EPI DWI is the only sequence needed, making cholesteatoma screening very short (< 8 min.) and obviating the need for contrast materials.

After CWU surgery, the bony walls of the EAC are still intact and therefore post-operative clinical inspection is limited. Hence the need for imaging to detect residual cholesteatoma.

The value of this technique is even more crucial in patients who were treated with a "bone obliteration technique" or "mastoid/middle ear/external auditory canal exclusion technique". Post-operative inspection or second look surgery is not a real option in these patients. The accuracy of pre- and post-op non-EPI DWI is high is therefore replacing CT and second look surgery throughout the world. Finally today excellent software is available which allows matching of non-EPI DWI and Cone Beam CT images. These images provide the surgeon with all necessary information in one

3D image series. All the above will be discussed and illustrated during this presentation.

doi:10.1017/S0022215116004680

Management of difficult cases (R861)

ID: 861.1

Single stage and staged cochlear implant for chronic suppurative otitis media suffers

Presenting Author: **Furong Ma**

Furong Ma¹, Tao Pan²

¹Peking University Third Hospital, ²Dept. of Otolaryngology Peking University Third Hospital Beijing P. R. China 100191

Objective: To explore and summarize the operation method and operation stage for cochlear implant with chronic suppurative otitis media, to provide the reference for cochlear implant with chronic suppurative otitis media.

Methods: the clinical data of 6 cases of cochlear implant with chronic suppurative otitis media in our hospital was analyzed retrospectively. The operation stage, surgical skill, possible risk and prognosis was analyzed and summarized.

Results: 3 of 6 cases received single stage subtotal petrosectomy and cochlear implant. 3 of 6 cases received subtotal petrosectomy, they received staged cochlear implant 4 to 6 months later. No complications occurred, all of the cochlear implantee had good open set speech perception.

Conclusions: staged operation was the first choice for cochlear implant with chronic suppurative otitis media. Single stage operation took potential risks, it should be done cautiously. The key points for the operation was the clearance of the pathological tissue totally, this required experience hands and operation approach option.

doi:10.1017/S0022215116004692

Management of difficult cases (R861)

ID: 861.2

Subtotal petrosectomy for large cholesteatoma and follow up using MR imaging

Presenting Author: **Thomas Somers**

Thomas Somers, S Delrue, A Zarowski, J van Dinther, F. E. Offeciers

European Institute for ORL

Introduction and aim: Subtotal petrosectomy involves the complete exenteration of the tympanomastoid air cells with

blind sac closure of the external auditory canal and fat or muscle obliteration of the remaining cavity. The aim of this study is to review the different indications, hearing rehabilitation and long-term outcome results. Special emphasis is put on the use of diffusion-weighted MRI (DW-MRI) to follow up those ears after absence of possible micro-otoscopic control due to blind sac closure.

Material and methods: Retrospective analysis of all patient who underwent subtotal petrosectomy between 1995 and 2015 in a tertiary referral otological centre.

Results: Subtotal petrosectomy was performed in 102 consecutive cases. The indications were chronic middle ear disease with (n = 39) or without (n = 38) cholesteatoma, cochlear implantation in the unstable ear (n = 19), neoplasms of the petrous bone (n = 4) and cerebrospinal fluid leakage (n = 2). Residual cholesteatoma was found in 7 cases, 5 were originally cholesteatoma cases with wide extension and facial nerve involvement.

Conclusions: Subtotal petrosectomy is a reliable technique which can be used for different indications. With the introduction of DW-MRI surgical outcome can more accurately be assessed and screened for residual pathology. The latter can need revision surgery if one consider it potentially harmful for the patient. In elderly patients or in cases with an intermediate signal on DWI images a wait and scan attitude has been adopted in selected cases. Hearing rehabilitation strategy depends on the remaining inner ear function of both ears and the patient's demand as also on the risk for residual cholesteatomatous pathology. Staging after MRI-control can be a safer approach.

doi:10.1017/S0022215116004709

Management of difficult cases (R861)

ID: 861.3

Management of CSF leaks and encephaloceles

Presenting Author: **Joe Kutz**

Joe Kutz

University of Texas Southwestern Medical Center

Learning Objectives: 1. Describe the typical clinical presentation of CSF leaks and encephaloceles 2. Understand the advantages and disadvantages of imaging modalities to diagnosis and locate CSF leaks and encephaloceles 3. Compare surgical approaches and techniques to repair CSF leaks and encephaloceles.

Spontaneous cerebrospinal fluid (CSF) leaks and encephaloceles are uncommon but important conditions to recognize because of the risk for meningitis. Typical symptoms include a chronic effusion, tympanostomy tube otorrhea, or recurrent meningitis. Once a CSF leak is suspected, diagnosis may be challenging and is aided by laboratory testing of the fluid and imaging. Surgical approaches depend on multiple

factors including age, location of the defect, and surgeon's preference. In this case-based presentation, the challenges of diagnosing and managing CSF leaks and encephaloceles will be discussed. Advantages and disadvantages of imaging modalities will be compared. Finally, surgical approaches including middle fossa craniotomy, transmastoid, and combination approaches will be examined.

doi:10.1017/S0022215116004710

Management of difficult cases (R861)

ID: 861.4

The surgical management of temporal bone cholesteatoma involving into jugular foramen

Presenting Author: **Chunfu Dai**

Chunfu Dai
Fudan University

Learning Objectives: To share surgical experiences on management of temporal bone cholesteatoma involving into jugular foramen.

Cholesteatoma involving into jugular foramen are rare. Clinical findings such as symptoms, signs, and preoperative hearing are frequently nonspecific in cases of temporal bone cholesteatoma, the surgical removal of cholesteatoma in this region is great challenge for the skull base surgeons. Eighteen cases with temporal bone cholesteatoma involving into jugular foramen were operated, the surgical approaches, intraoperative findings, surgical outcomes were retrospectively reviewed in the present study.

Eight cases are female, 10 cases are male, 8 cases in the left side, 10 in the right. The age ranges from 26-68 years old. The symptoms included hearing loss (17/18), otorrhea (8/18), pulsatile tinnitus (7/18), headache (2/18). Ten patients complained of facial paralysis, no patients suffered from the dysfunction of lower cranial nerves. All patients were undergone infratemporal fossa approach with facial fallopian canal bridge technique, Jugular foramen was erossion in all 18 cases, horizontal segment of ICA was encroached in 6 cases, sigmoid sinus and posterior fossa were compressed in 17 case. The clivus was destructed in 2 cases.

Facial nerve intact was remained in 6 patients, cable graft was conducted in 2 patients, facial hypoglossal nerve anastomosis was performed in two patients. Intraoperatively CSF leakage was incurred in 9 patients, sigmoid sinus or jugular bulb erupted in 3 cases, and sigmoid sinus occlusion with jugular vein ligation was undertaken. Eustachian tube was packed with temporal muscle and bone wax, the surgical cavity was packed with abdominal fat, blind sac closure was conducted in all patients. No major complications was observed.

Infratemporal fossa approach with facial nerve canal bridge technique is good option for patients with cholesteatoma involving into jugular foramen, which is sufficient to remove the lesion and control the vessels, as well to preserve facial nerve function.

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Free Papers (F862)

ID: 862.1

Smoking does not influence the take rate of transcanal endoscopic tympanoplasty

Presenting Author: **Wu-Po Chao**

Wu-Po Chao, Chin-Kuo Chen, Chang-Yu Tsai
Chang Gang Memorial Hospital

Learning Objectives: To evaluate the anatomical and audiological outcomes of transcanal endoscopic tympanoplasty with patient who has smoking habit, and to those who do not.

Smoking does not influence the take rate of transcanal endoscopic tympanoplasty.

Objective: This study is aimed to evaluate the anatomical and audiological outcomes of transcanal endoscopic tympanoplasty with patient who has smoking habit, and to those who do not.

Material and method: We had retrospectively reviewed the patients who had tympanic membrane perforation and underwent transcanal endoscopic tympanoplasty in Chang-Gung Memorial Hospital. After the surgery, the follow-up reperforation rate and audiological test will be used to evaluate the take rate of the surgery between smoking and non-smoking group. All calculation were performed with a commercial statistical software package (SPSS 12.0 for windows).

Results: The result showed the take rate of transcanal endoscopic tympanoplasty between smoking and non-smoking group was 89% and 86% respectively.

Conclusion: It seems that smoking maybe an important factor to the patient with otitis media. However, it may not influence the outcome of take rate post-operatively. We will present our data and discuss on the conference.

doi:10.1017/S0022215116004734

Free Papers (F862)

ID: 862.2

Preliminary outcomes of endoscopic middle ear surgery, our UK experience

Presenting Author: **Constantina Yiannakis**

Constantina Yiannakis, Rhona Sproat, Arunachalam Iyer
NHS Lanarkshire

Learning Objectives:

- Review the indications for endoscopic middle ear surgery.
- Compare the short-term outcomes of endoscopic with conventional middle ear surgery.
- Discuss the application of endoscopic techniques within the UK patient population.

Introduction: Totally Endoscopic Ear Surgery (TEES) and Endoscopic Assisted Microsurgery (EAMS) is still a new concept. Endoscopic techniques for the treatment of pathological conditions of the middle ear have been gradually introduced since 1990. However, relatively few centres in the UK are performing them. Advantages over standard techniques include better visualisation of difficult to reach areas, such as the sinus tympani, and limited external incisions^(1,2).

Here we report our short-term outcomes for endoscopic middle ear surgery.

Methods: We performed a prospective review of the first 97 consecutive patients undergoing TEES or EAMS in Monklands District General Hospital undertaken by one operator. Outcomes assessed were: tympanic membrane healing, audiological data and complications.

Results: 23 patients underwent EAMS while 74 had TEES. Operations performed included: cholesteatoma surgery, stapedectomy and myringoplasty. We had no reported cases of dead ear or permanent facial nerve palsy. Average air-bone gap following stapedectomy was 6.49 dB. The tympanic membrane healing rate was 87%.

Conclusion: Our results confirm that endoscopic middle ear surgery is safe with short-term outcomes that are comparable with conventional surgery. We feel that it offers an exciting way of improving the management of middle ear pathology through improved access and visualisation. This in turn has implications for teaching and training.

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Free Papers (F862)**ID: 862.3****Endoscopic Stapes Surgery: Our Experience**Presenting Author: **Rhona Sproat**

Rhona Sproat, Constantina Yiannakis, Arunachalam Iyer
NHS Lanarkshire

Learning Objectives: To report our experience with the use of endoscopes in stapes surgery in terms of complication rates and hearing outcomes.

Introduction: Endoscopic ear surgery is a rapidly developing area in otology. The endoscope can provide a unique view of middle ear anatomy and is being utilised to facilitate ever more surgical procedures. We aim to report our experience with use of the endoscope in stapedectomy.

Methods: Data was collected prospectively for all stapedotomy operations carried out in NHS Lanarkshire by a single surgeon from August 2009 to December 2015, using the Common Otology Audit, a UK wide data collection tool. Outcome measures were pure tone audiometry pre- and post-operatively at 0 and 3 months; and complication rates at 3 month follow up.

Results: 83 operations were carried out for otosclerosis with stapes fixation during this time period. 78 of these were primary operations, and 5 were revision procedures. 27 of these were carried out endoscopically or endoscopic-assisted, and 56 were performed using an operating microscope. Average total pre-operative air-bone gap was 29 dBHL; 28 dBHL for endoscopic operations; and 29 dBHL for open operations. 70 patients were followed up in clinic at 3 months. Two were lost to follow-up from the endoscopic group and 11 from the open group. Average post-operative air-bone gap was 7.9 dBHL in the open group and 7.6 dBHL in the endoscopic group. 84% of patients achieved reduction in air-bone gap to less than 10dBHL in the open group and 88% in the endoscopic group. 100% of both groups achieved less than 20 dBHL. No patients had a facial nerve palsy, vertigo or complained of taste dysfunction. One patient complained of tinnitus at 3 months from the endoscopic ear surgery group.

Conclusions: Our results demonstrate that the endoscopic approach to ear surgery has comparable outcomes to microscopic approaches, both in respect to our own unit, and to published literature, in terms of hearing gain and complication rates. Our experience suggests that endoscopic approach to ear surgery is safe and effective.

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Free Papers (F862)**ID: 862.4****Surgery for cholesteatoma of the facial recess and sinus tympani: retrotympanotomy from anterior, mobilizing and using chorda tympani for guidance - Farrior's principle rediscovered and modified**Presenting Author: **James Look**

James Look
University of Stellenbosch

Learning Objectives: To describe an operation to access the retrotympanum using the operating microscope and removing bone over the facial recess and sinus tympani safely by mobilizing and utilizing the chorda tympani as an indicator of the position of the facial nerve.

Introduction: The retrotympa-num (facial recess and sinus tympani) is involved in a high percentage (48%) of cases of cholesteatoma. This subsite of the mesotympanum presents particular challenges in terms of access for removal of disease. Approaches suggested have included posterior tympanotomy (Janssen) and endoscopic transcanal (Tarabichi).

Method: The operation is described in detail using photography, diagrams and video material. The surgical principles are to use:

- visualization of the facial nerve at the 2nd genu.
- skeletonization and mobilization of chorda in its course through the bone down towards its branching off facial nerve above the stylomastoid foramen.
- the principle that chorda is always superficial and anterior to facial nerve.
- that if bone is removal only superficial and anterior to chorda, the facial nerve cannot be injured.

We report the use of this technique in a series of 247 cholesteatomas involving the facial recess and sinus tympani. A literature search shows that Farris (1968) described some aspects of this approach.

Results: This surgical approach provides adequate access to this difficult anatomic area for cholesteatoma visualization and removal – far better than posterior tympanotomy. It provides binocular vision and the possibility of using both hands, unlike the endoscopic approach. In our series, adequate access was provided in 99% of cases – in only 2 cases was there any doubt about complete removal of the invasive sac. In no case was there injury to the facial nerve.

Conclusion: Retrotympa-notomy from anterior, mobilizing and using chorda tympani for guidance, is a safe and reliable way of removing cholesteatoma from the facial recess and sinus tympani.

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Free Papers (F862)

ID: 862.5

Can we reduce rates of residual cholesteatoma by improving the clarity of the operative field? A multivariate analysis

Presenting Author: **Gavin le Nobel**

Gavin le Nobel¹, Sharon Cushing², Blake Papsin², Adrian James²

¹University of Toronto, ²Hospital for Sick Children

Learning Objectives: 1) to demonstrate the influence of impaired surgical field clarity due to intraoperative bleeding on development of residual cholesteatoma. 2) To emphasize the importance of implementing methods to minimize surgical site bleeding, such as hypotensive general anesthesia.

Introduction: Sites within the middle ear and mastoid with limited visualization are more frequently implicated in residual cholesteatoma. We hypothesize that other factors

leading to compromised surgical field visualisation may similarly affect rates of residual cholesteatoma. The objective of this study was to evaluate whether impairment of surgical site visualisation from intra-operative bleeding contributes to the risk of residual cholesteatoma.

Methods: Data were collected prospectively on a consecutive series of children having intact canal wall surgery for cholesteatoma at an academic pediatric hospital. Clarity of surgical field was assessed intra-operatively on a six-point rating scale and categorized as minimally compromised (grades 0-I) or significantly compromised (grades II-V). Presence of residual cholesteatoma was assessed at follow up clinical encounters, second stage procedures, and with MRI.

Results: Surgery was completed on 224 ears, during which 82 (37%) had minimal visual field compromise from bleeding. Residual cholesteatoma was identified in 38 (17%) of ears, with only 8 (9.8%) in cases with minimal bleeding at first surgery, and 30 (21%) in cases with significant bleeding. Predictors of residual disease on univariate regression analysis included severity of bleeding ($p = 0.029$), extent of cholesteatoma ($p < 0.001$), years of surgeon's experience ($p = 0.0045$). Age and type of cholesteatoma were not found to be significant. Multivariate regression analysis demonstrated that the most robust predictor was extent of cholesteatoma ($p < 0.001$).

Conclusions: Impairment of surgical field visualization from intraoperative bleeding is one factor that contributes to the presence of residual cholesteatoma. These findings support the use of techniques, such as hypotensive general anesthesia, that minimize surgical site bleeding and improve surgical field visualization.

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Free Papers (F862)

ID: 862.6

Over a hundred endoscopic ear surgery cases; surgical outcomes of a starting practice

Presenting Author: **Maarten de Wolf**

Maarten de Wolf¹, Chris Coulson²

¹Academic Medical Center, Amsterdam, The Netherlands, ²Department of Otorhinolaryngology, Queen Elizabeth Hospital, Birmingham, United Kingdom

Learning Objectives:

- Basic principles of endoscopic ear surgery.
- Surgical results from a starting endoscopic ear surgery practice including cholesteatoma and tympanoplasty.

Introduction: Endoscopic ear surgery offers an unparalleled view of the middle ear thanks to the wide-angle field of view and is increasingly gaining popularity amongst ENT-surgeons worldwide. However, the transition from operating with the microscope to the endoscope is challenging,

primarily due to operating one-handed, but also adjusting to the different view achieved with the endoscope.

Methods: This study shows a preliminary retrospective overview of a consecutive series of all endoscopic ear surgery cases performed by one ENT-surgeon since starting his EES practice two years ago.

Results: Hundred and five consecutive patients were included in the study group, including 46 cholesteatoma cases, 52 type 1 tympanoplasties and 7 PORP ossiculoplasties. No major adverse events or incidences were noted. In 3 cases the endoscopic approach had to be converted to a microscopic post auricular approach for complete removal of cholesteatoma. Overall, 9 out of the 105 surgeries (8.6%) resulted in a post-operative residual perforation. In one case recurrence of cholesteatoma was noted 21 months post operatively. Overall average follow-up time was 6.4 months (range 1–20 months).

Conclusions: Results demonstrate that a surgeon can pick up the necessary skills relatively quickly and achieve acceptable success rates while delivering the reduced morbidity associated with EES.

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Retraction Pocket (N863)

ID: 863.1

The role of endoscopy in retraction pockets

Presenting Author: **Presutti Livio**

Presutti Livio

University Hospital of Modena

Background: It is well known that Eustachian Tube (ET) plays a crucial role in maintaining middle ear aeration and atmospheric pressure. Usually inflammatory middle ear chronic disease is related to ET dysfunction due to poor tympanic ventilation. Although middle ear aeration is certainly related to ET function, other anatomic factors play an important role in ventilation of these spaces. Actually epitympanum aeration is strictly dependent to the ventilation pathways; if the tensor fold and the lateral incudo-malleal fold are complete the only ventilation pathway to the epitympanum is through the tympanic isthmus. In such cases when an isthmus blockage occurs the ventilation of epitympanum may be impaired and the only gas exchange would come from the mucosa of mastoid cells. This scenario describes a selective epitympanic disventilative syndrome, possibly not related to ET impairment.

With introduction of the endoscope in middle ear surgery, anatomy of middle ear spaces has become wider and clearer due to a better magnification and to the possibility to look “behind the corner” and to better understand the ventilation pathways, particularly in patients with retraction pockets.

Materials and methods: From December 2008 to December 2015, 470 tympanoplasty were performed with exclusive endoscopic approach; All patients candidate to ear surgery underwent to high resolution CT-scan, audiometric

and impedenzometric evaluations. Inclusion criteria in our study were patients affected by not-self cleansing attic retraction pocket. Subjects affected by a disease of the epitympanic compartments (not self cleansing retraction pockets of the attic; epitympanic cholesteatoma) and with type A tympanogram were included in present study.

Exclusion criteria: subjects affected by a disease involving the protympanic, the mesotympanic and the retrotympanic region, or patients who previously underwent middle ear surgery.

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Retraction Pocket (N863)

ID: 863.2

Paediatric retraction pocket: prevention and treatment

Presenting Author: **Nicola Quaranta**

Nicola Quaranta

University of Bari

Learning Objectives: To discuss the classification, prevention and treatment of pediatric retraction pockets.

Tympanic membrane retraction pocket (RP) is defined as an inward displacement of the TM from its normal position. It is characterized by partial collapse of the meso or epitympanic spaces, which correspond clinically to a retraction of a portion of the TM in its pars tensa (PT) or pars flaccida (PF). Even if several classifications have been proposed, there is not a consensus in the treatment of this condition. The available classification systems will be reviewed as well as the medical and surgical treatment proposed.

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Retraction Pocket (N863)

ID: 863.3

Retraction Pockets: Overview and Randomized Study

Presenting Author: **Maurizio Barbara**

Maurizio Barbara¹, Edoardo Covelli², Luigi Volpini²

¹Sapienza University Rome, ²Sapienza University NESMOS Department Rome Italy

Background: The attitude of treatment of retraction pockets (RP) depends on several factors that include age of the patient, stage of the disease and patient’s compliance. Silent forms usually do not need any surgery, although the presence of predisposing factors (craniofacial malformations, for example) and/or the young age could indicate a preventive surgical procedure. For the advanced stages, where periodical accumulation of debris occurs, surgery would seem to be mandatory.

Material and Methods: A randomized, longitudinal study took into consideration the Stage II RP that were either treated by a surgical procedure or simply observed for a period of two years. Surgery consisted in an endaural approach epitympanectomy with scutum reconstruction (tragal cartilage).

Results: All the operated cases showed a permanent healing condition with stable hearing function. Nearly half of the “observation group” showed instead deepening of the pocket that in one case even ended up with perforation. In none of the study patients a real cholesteatoma was observed.

Conclusions: A preventive surgery is to be preferred in all Stage II RP. In fact, even if in some of the patients it could remain stable over the time taken into consideration (2 years), the possibility of occurrence of a more severe stage, ending up potentially to cholesteatoma, would represent a reasonable choice in order to avoid in the future more complex surgical procedures and all related possible complications.

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Labyrinthine problem in chronic ear diseases (R864)

ID: 864.1

Cholesteatoma with canal fistula and the third mobile window

Presenting Author: **Tadashi Kitahara**

Tadashi Kitahara
Nara Medical University

Learning Objectives: The better bone conduction threshold at low-tone frequencies immediately after tympanoplasty with mastoidectomy and no preoperative fistula symptoms might imply the third mobile window theory. The worse bone conduction threshold in high-tone frequencies with spontaneous nystagmus after surgery might indicate inner ear damage.

Objective: To understand the third mobile window effect of chronic otitis media with cholesteatoma with inner ear fistula on the bone conduction threshold, we examined changes in the bone conduction audiogram after tympanoplasty with mastoidectomy for chronic otitis media with cholesteatoma with canal fistula.

Study Design: Retrospective case review.

Patients: According to the intraoperative classification of Dornhoffer and Milewski, we focused especially on type IIa (anatomical bony fistula with no perilymph leak). We checked the bone conduction threshold at least three times: just before, just after, and 6 months after surgery in 20 ears with type IIa lateral semicircular canal fistula.

Results: Compared with the preoperative bone conduction threshold, six cases were better, 12 cases were unchanged, and two cases were worse within the first postoperative week. Finally, one case was better, 15 cases were unchanged, and four cases were worse at the sixth postoperative month.

Patients with a better bone conduction threshold in the low-tone frequencies immediately after surgery had a tendency to show no preoperative fistula symptoms. Postoperative spontaneous nystagmus had a tendency to be observed in patients with a worse bone conduction threshold in the high-tone frequencies.

Conclusion: The better bone conduction threshold at low-tone frequencies immediately after tympanoplasty with mastoidectomy and no preoperative fistula symptoms might imply the third mobile window theory. The worse bone conduction threshold in high-tone frequencies with spontaneous nystagmus after surgery might indicate inner ear damage.

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Labyrinthine problem in chronic ear diseases (R864)

ID: 864.2

The surgical management of labyrinthine fistula in chronic ears

Presenting Author: **Neil Donnelly**

Neil Donnelly, Patrick Axon, James Tysome,
Anand Kasbekar
Cambridge University Hospitals

Learning Objectives: This presentation will explore the identification, surgical management and outcome of labyrinthine fistula in the presence of chronic ear disease. The format will use real patient scenarios and intra-operative video to illustrate the learning points.

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Labyrinthine problem in chronic ear diseases (R864)

ID: 864.3

Staging method for cholesteatoma-induced semicircular canal fistula using CTP (Cochlin tomo-protein), as a diagnostic marker

Presenting Author: **Tetsuo Ikezono**
Tetsuo Ikezono¹, Han Matsuda², Tomohiro Matsumura³,
Yasuhiro Kase⁴

¹Saitama Medical University Faculty Of
Medicine, The PLF Study Group, Japan,
²Department of Otorhinolaryngology, Saitama
Medical University Faculty Of Medicine, The
PLF Study Group, Japan, ³Department of

Boichemistry & Molecular Biology, Nippon Medical School, ⁴Department of Otorhinolaryngology, Saitama Medical University Faculty Of Medicine

Learning Objectives: In order to better understand the inner ear damage in chronic inflammatory ears, the diagnosis and treatment of cholesteatoma induced fistulae is very important. Here in this talk, new staging method of fistulae using a biomarker is introduced and discussed with the previous methods.

Introduction: Previously proposed staging methods of labyrinthine fistulae include; A) the depth or severity of labyrinthine structure involvement (Dornhoffer et al. Palva et al.) B) Diameter of the fistula (Gacek). In this presentation I will introduce a novel method of staging using a biochemical marker.

Methods: CTP (Cochlin tomo-protein, an isoform of Cochlin), perilymph specific protein, is a novel and unique biomarker. We reported a biochemical test for perilymph leakage detecting CTP in middle ear lavage (MEL, lavaging the middle ear cavity using 0.3 ml saline). Recently we could establish a highly reliable ELISA-kit to detect CTP. The Japanese PLF diagnosis criterion is now based on the visual identification of the fistula (not a leakage) and/or detecting CTP. With a help of private clinical test enterprise (SRL inc.) in Japan, CTP test is widely available nationwide, in 170 hospitals.

If there is 2ul of leaked perilymph in the MEL, the test is positive. The diagnostic performance of the test has a high reliability, and the AUC in ROC analysis was greater than 0.90.

Results: We have tested fistulae and suspected fistulae induced by cholesteatoma. If the diameter of the fistula is more than 2 mm, there is more chance to detect CTP.

Conclusions: CTP test is a objective biochemical test to detect PL leakage. The visual judgment of "the depth or severity" of the fistula propped previously is a subjective judgment. The detection of CTP correlated better with the diameter of the fistulae.

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Labyrinthine problem in chronic ear diseases (R864)

ID: 864.4

Panel Discussion: Labyrinthine Problems in Chronic Ear Disease

Presenting Author: **Joel Goebel**

Joel Goebel

Washington University School of Medicine

Learning Objectives: 1. Understand the causes of vestibular dysfunction in chronic ear disease. 2. Appreciate the available vestibular function tests to assess function in the setting of middle ear/mastoid disease. 3. Recognize the

causes, symptoms and treatment for labyrinthine fistulae and third window phenomena.

Patients with chronic ear disease and cholesteatoma frequently present with symptoms of dizziness and vertigo that may represent labyrinthine dysfunction in the involved ear or dizziness from unrelated causes. The challenge for the otologist is to recognize specific signs of vestibular involvement on the physical exam and order appropriate vestibular function testing. This panel will explore various examination and laboratory signs of labyrinthine involvement in patients presenting with dizziness. Of particular interest on examination are the presence of the Halmagyi head impulse sign, presence of nystagmus with pressure or air caloric stimulation, and the postural responses on foam posturography. In the laboratory, responses to rotation, centrifugation, evoked responses to sound stimulation and computerized dynamic posturography are of particular utility to diagnose and treat labyrinthine dysfunction in patients with active chronic ear disease.

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Various aspects of cholesteatoma surgery (N865)

ID: 865.1

Long-term Results of Troublesome CWD Cavity Reconstruction by Mastoid and Epitympanic Bony Obliteration (CWR-BOT) in Adults

Presenting Author: **Jean-Philippe Vercruyse**

Jean-Philippe Vercruyse¹, Joost van Dinther², Bert De Foer³, Jan Casselman³, Thomas Somers², Andrzej Zarowski², Cor Cremers⁴, Erwin Offeciers²

¹European Institute of ORL, ²European institute of ORL, Antwerp, ³Department of radiology, Sint-Augustine Hospital, Antwerp, ⁴Department of Otorhinolaryngology – Head and Neck Surgery, Radboud University Medical Centre, Radboud University Nijmegen, Nijmegen

Learning Objectives: To present the long-term surgical outcome of the bony mastoid and epitympanic obliteration technique with canal wall reconstruction (CWR-BOT) in adults with an unstable cavity after prior canal wall-down surgery (CWD) for extensive cholesteatoma Study Design: Retrospective study Interventions: Therapeutic Setting: Tertiary referral center Patients: Fifty consecutive adult patients undergoing a CWR-BOT between 1998 and 2009. Main Outcome Measure(s): (A) Recurrence and residual rates of cholesteatoma, (B) postoperative hygienic status of the ear, including postoperative aspect of the tympanic membrane (TM) and external ear canal integrity (EAC), (C) functional outcome and (D) long-term safety issues. Results: (A) The percentage of ears remaining safe without recurrent or residual disease after CWR-BOT was 96% after a mean follow-up time of 101,8 months. Recurrent cholesteatoma occurred in 2% (n = 1) and a residual cholesteatoma was detected in 2% (n = 1) of the cases. (B) A safe dry, and trouble-free graft and self-cleaning EAC was achieved in 94%. (C)

The postoperative hearing results showed a gain of 1,7 dB on pure-tone average air-conduction (PTA-AC). (D) Non-echo planar diffusion weighted imaging (non-EP DW MRI) documented the residual (n = 1) and recurrent cholesteatoma (n = 1). The 1 and 5 year Imaging follow-up revealed no other recurrent or residual disease. Conclusions: The CWR-BOT is a safe and very effective option for treatment of problematic unstable canal wall-down mastoid cavities, resulting in dry trouble-free ears.

Objective: To present the long-term surgical outcome of the bony mastoid and epitympanic obliteration technique with canal wall reconstruction (CWR-BOT) in adults with an unstable cavity after previous canal wall-down surgery for extensive cholesteatoma.

Study Design: Retrospective study.

Interventions: Therapeutic.

Setting: Tertiary referral center.

Patients: Fifty consecutive adult patients undergoing a CWR-BOT between 1998 and 2009.

Main Outcome Measure(s): (A) Recurrence and residual rates of cholesteatoma, (B) postoperative hygienic status of the ear, including postoperative aspect of the tympanic membrane and external ear canal integrity (EAC), (C) functional outcome, and (D) long-term safety issues.

Results: (A) The percentage of ears remaining safe without recurrent or residual disease after CWR-BOT was 96% after a mean follow-up time of 101.8 months. Recurrent cholesteatoma occurred in 2% (n = 1) and a residual cholesteatoma was detected in 2% (n = 1) of the patients. (B) A safe dry, and trouble-free graft and selfcleaning EAC was achieved in 94%. (C) The postoperative hearing results showed a gain of 1.7 dB on pure-tone average air-conduction. (D) Nonecho planar diffusion-weighted imaging (non-EP DW magnetic resonance imaging) documented the residual (n 1/4 1) and recurrent cholesteatoma (n = 1). The 1 and 5-year imaging follow-up revealed no other recurrent or residual disease. Conclusion: The CWR-BOT is a safe and very effective option for treatment of problematic unstable canal wall- down mastoid cavities, resulting in dry trouble-free ears.

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Various aspects of cholesteatoma surgery (N865)

ID: 865.2

**For the Dutch-Flemish Otology Society:
Patient Satisfaction in Cholesteatoma
Surgery: study set-up and preliminary
results**

Presenting Author: **Joost van Dinther**

Joost van Dinther¹, Stefan Delrue², Valerie Droessaert², Sophie Camp², Robby Vanspauwen², Youri Maryn², Andrzej Zarowski², Thomas Somers², Erwin Offeciers²

¹European Institute for ORL-HNS, Sint Augustinus Hospital Antwerp Belgium,

²European Institute for ORL-HNS - Sint Augustinus Hospital Antwerp Belgium

Learning Objectives: 1. To test the validity and test-retest reliability of the Dutch translation of the Chronic Otitis Media Questionnaire 12 (COMQ-12). 2. To evaluate the quality of life in cholesteatoma patients after treatment with the bony obliteration technique.

Objective: To test the validity and test-retest reliability of the Dutch translation of the Chronic Otitis Media Questionnaire 12. To evaluate the QOL in cholesteatoma patients after treatment with the bony obliteration technique (BOT).

Materials and Methods: 35 individuals with no history of COM received the questionnaire as well as a group of 35 patients with complaints of COM. The healthy participants had to complete the questionnaire twice (control group 1 and control group 2) to estimate the test-retest reliability, and their scores were compared with those of the patients (group 3) to test the validity. The Dutch GBI and COMQ-12 questionnaires were used in a group of cholesteatoma patients after treatment with the BOT.

Results: The overall COMQ-12 score in control group 1 ranged from 0 to 11, in control group 2 from 0 to 6, and in group 3 from 7 to 46. The mean score in group 1 was 1.43, 1.34 in group 2 and 27.80 in group 3. A comparison of the COMQ-12 scores of the two control groups and the patient group showed a significantly higher COMQ-12 score in patients with COM. The diagnostic accuracy was investigated, and a COMQ-12 cut-off score of 8 was found to have a near-perfect sensitivity and specificity in distinguishing between the presence and absence of COM. The single-measures ICCAA was 0.859 (with a 95% confidence interval from 0.738 to 0.926). This clearly exceeded the ICC threshold for acceptable reliability (ICC \geq 0.75) and therefore confirmed that there was reasonable test-retest reliability when applying the questionnaire to control subjects. The preliminary results of the GBI and COMQ-12 questionnaires in a group of cholesteatoma patients after treatment with the bony obliteration technique will be discussed.

Conclusion: The Dutch version of the COMQ-12 has good validity, diagnostic accuracy, and test-retest reliability. The preliminary QOL results after the BOT in cholesteatoma patients will be discussed.

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Various aspects of cholesteatoma surgery (N865)

ID: 865.3

**Pediatric cholesteatoma behaviour and the
role of bony obliteration in its treatment**

Presenting Author: **Marc van der Schroeff**

Marc van der Schroeff

Sophia Children's Hospital, Erasmus MC

Learning Objectives: Characteristics of pediatric cholesteatoma. Our experience in using a bony obliteration tympanoplasty technique is discussed.

Mastoid obliteration in cholesteatoma surgery symposium, Dutch-Belgian Otology Group.

Pediatric cholesteatoma is a different identity to its adult counterpart. It is more frequently infectious, aggressive, more proliferative and associated with less favorable prognosis. An overview on characteristics and epidemiology of pediatric cholesteatoma is given. Preliminary results on >100 children operated in the Sophia Children's hospital from January 2014 using predominantly a canal wall up approach with bony obliteration of the mastoid and epitympanic space are shown.

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Various aspects of cholesteatoma surgery (N865)

ID: 865.4

Setup of a national multi center RCT to evaluate the cost effectiveness of follow-up with diffusion-weighted MRI versus 2nd look surgery after primary cholesteatoma treatment

Presenting Author: **Robert Jan Pauw**

Robert Jan Pauw¹, Paul Merkus²

¹Erasmus MC, ²VU University Medical Center Amsterdam

Learning Objectives: To inform on the setup of a national multi center RCT in The Netherlands that aims to evaluate the cost effectiveness of follow-up with diffusion-weighted MRI versus 2nd look surgery after primary cholesteatoma treatment.

In The Netherlands we have set up a prospective multicenter randomized controlled trial to evaluate the cost effectiveness of follow-up with diffusion-weighted MRI versus 2nd look surgery after primary cholesteatoma treatment. The planned start of the trial is in the 2nd half of 2016. The aims and objectives of the trial as well as the methodology will be discussed.

Research questions:

1. Are the hearing levels after three years of follow-up with annual diffusion-weighted MRI comparable to those after follow-up with second look surgery?
2. Is a diffusion-weighted MRI follow-up strategy cost-effective compared to second look surgery?
3. Are other outcome measures (residual and recurrent cholesteatoma, quality of life and adverse events) comparable between both follow-up strategies?

Hypothesis: Diffusion-weighted MRI is a cost-effective follow-up strategy after primary cholesteatoma surgery compared to the usual care, 2nd look surgery with equal quality of

care in terms of hearing, cholesteatoma detection rate, complications and quality of life.

Patients and methods: An economic evaluation alongside a prospective multicenter randomized controlled trial with an intention-to-treat analysis plus additional observational study will be performed. 132 patients of 16 years and older after primary cholesteatoma surgery treatment with normal to mild conductive hearing loss will be included and randomized in either.

'Annual diffusion-weighted MRI during 3 consecutive years, starting 1 year after primary surgery' or 'Second look surgery 1 year after primary surgery and follow-up during 3 consecutive years'.

Outcome measures

1. The degree of hearing loss after 3 three years of follow-up.
2. The costs of three years follow-up.
3. The number of 2nd look surgeries without cholesteatoma present (unnecessary surgical procedures) and the number of residual and recurrent cholesteatoma, health related quality of life and number of complications.

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Free Papers (F866)

ID: 866.1

Ouabain-Induced Cochlear Nerve Degeneration: Synaptic Loss and Plasticity in a Mouse Model of Auditory Neuropathy

Presenting Author: **Yasheng Yuan**

Yasheng Yuan¹, Fanglu Chi²

¹EYE & ENT Hospital of Fudan University, ²Fudan University

Learning Objectives: hair cells, ribbon synapse, neurodegeneration.

Ouabain application to the round window can selectively destroy type-I spiral ganglion cells, producing an animal model of auditory neuropathy. To assess the long-term effects of this deafferentation on synaptic organization in the organ of Corti and cochlear nucleus, and to ask whether surviving cochlear neurons show any post-injury plasticity in the adult, we quantified the peripheral and central synapses of type-I neurons at posttreatment times ranging from 1 to 3 months. Measures of normal DPOAEs and greatly reduced auditory brainstem responses (ABRs) confirmed the neuropathy phenotype. Counts of presynaptic ribbons and postsynaptic glutamate receptor patches in the inner hair cell area decreased with post-exposure time, as did counts of cochlear nerve terminals in the cochlear nucleus. Although these counts provided no evidence of new synapse formation via branching from surviving neurons, the regular appearance of ectopic neurons in the inner hair cell area suggested that neurite extension is not uncommon. Correlations between pathophysiology and histopathology showed that ABR thresholds are very insensitive to even massive neural degeneration, whereas the amplitude of ABR wave 1 is a better metric of synaptic degeneration.

doi:10.1017/S0022215116004904

Free Papers (F866)**ID: 866.2****Inflammatory, invasive and neoplastic features of primary and secondary cholesteatomas: immunohistochemical and histological findings**Presenting Author: **Nadir Yildirim**Nadir Yildirim¹, Aysenur Deger², Onur Erdogan³, Sinan Aksoy³¹Dumlupinar Universitesi Medical Faculty,²DPU Medical Faculty Department ofPathology, ³DPU Medical Faculty Department of ORL-HNS

Learning Objectives: Objective: Etio-pathogenesis of middle ear cholesteatoma has not been wholly understood. Acquired cholesteatomas are classified into epitympanic/primary (PAK) and mesotympanic/secondary (SAK) subtypes. Herewith, we aimed to investigate the expression of multiple inflammatory, invasive and neoplastic markers in cholesteatomas using immunohistochemistry (IHC) and hematoxyline-eosin (H&E) staining with special reference to the PAK and SAK.

Objective: Etio-pathogenesis of middle ear cholesteatoma has not been wholly understood. Acquired cholesteatomas are classified into epitympanic/primary (PAK) and mesotympanic/secondary (SAK) subtypes. Herewith, we aimed to investigate the expression of multiple inflammatory, invasive and neoplastic markers in cholesteatomas using immunohistochemistry (IHC) and hematoxyline-eosin (H&E) staining with special reference to the PAK and SAK.

Material-Method: We statistically compared 74 (33 primary, 41 secondary) cholesteatoma matrices and normal (control) skin samples harvested from operated cholesteatoma patients for 10 different markers within, and between the subgroups using IHC and H&E staining. Evaluating pathologist was blinded.

Results: Statistically, staining scores for IHC markers of Ki67, collagen type-4, Proliferating cell nuclear antigen (PCNA), keratinocyte growth factor (KGF), fibronectin (FN), interleukin1 α (IL-1 α), tumor necrosis factor- α (TNF- α); and staining with H&E for vascularization and lymphocyte numbers were significantly higher in cholesteatomas than control materials of both subgroups except for collagen type-7. However, no difference in significances was found between the subgroups.

Conclusion: These results indicate that acquired cholesteatoma is pathologically the same invasive, inflammatory and hyperproliferative disease at different locations, irrespective of their different etio-pathology. Non-expression of collagen type-7 in cholesteatoma might be related to its interfacing location in uninvolved part of the basal membrane.

doi:10.1017/S0022215116004928

Free Papers (F866)**ID: 866.4****Regional differences of mouse utricle hair cells proliferation and differentiation and establishment of the planar cell polarity**Presenting Author: **Dongdong Ren**

Dongdong Ren, Xiaoyu Yang, Rui Ma, Xinwei Wang, Xiaoqing Qian, Juanmei Yang, Fanglu Chi

Eye & Ent Hospital of Fudan University

Learning Objectives: Cochlear sensory epithelial cells stop proliferation from the apical turn, while the earliest differentiated cochlear hair cell originates from the basal turn. Up to now, very few studies have been done to characterize the vestibular hair cells proliferation and differentiation. Planar cell polarity (PCP) is a special cell arrangement regularity. Vestibular organ has special cell polarity, with hair cell arrangement closely correlated with the function of vestibule. Whether the PCP establishment has the relationship with vestibular HC differentiation is still unknown. In this study, By collecting the embryonic utricles at the different stages, first we observed the 3D-schematic view of PCP in E18.5 mouse vestibular system, which showed the different PCP in five sensory organs. We choose utricle as an example, we found that the number of Edu/Myosin7a double positive cells peaks at E11.5 in medial extrastriola(MES) and striola zone of utricle. In the lateral extrastriola(LES), the number peaks at E13.5. Besides, at E12.5, P27 and Math1 positive cells were mainly observed in striola. At E13.5, P27 and Math1 positive cells occur in striola and MES. Edu positive cells decrease first in striola and then in MES. Interestingly, the PCP of hair cells stereocilia bundles also established first in the striola and MES region at E13.5. After overexpression of Emx2 in the E13.5 utricle epithelia, PCP of cultured utricle epithelia was disturbed, the orientation of HCs along the supposed LPR(line of polarity reversal) was not opposite, especially the orientation of the hair bundle arranged as a circular. Here we discovered the regional difference in the timing of terminal mitosis of hair cell precursors could account for the difference in their planar cell polarity. PCP of utricle epithelia regional establishment is consistent with HC proliferation and differentiation. Emx2 plays the role of the regional polarity formation in the developing utricle epithelia.

doi:10.1017/S002221511600493X

Free Papers (F866)**ID: 866.5****Comparative Genomic Hybridization Analysis of Patients with Severe Cisplatin Ototoxicity**Presenting Author: **Yüksel Olgun**

Yüksel Olgun¹, Ayşe Banu Demir², Zekiye Altun²,
Günay Kırkım³, Enis Alpin Güneri³, Safiye Aktaş²

¹Dokuz Eylül University School of Medicine,
²Dokuz Eylül University Institute of Oncology
Department of Basic Oncology, ³Dokuz Eylül
University School of Medicine Department of
Otorhinolaryngology

Learning Objectives:

Introduction: Cisplatin (CDDP) is a widely used chemotherapeutic drug with important side-effects, such as ototoxicity. CDDP ototoxicity affects individuals variably, which is mostly due to individual genetic factors. Aim of this study is to analyse the genetic background of the patients in which severe ototoxicity occurred.

Methods: 72 children who received CDDP chemotherapy between January 2013 and March 2015 were included in the study. Audiological evaluations were performed before and minimum three months after the therapy. Ototoxicity was evaluated using Muenster, Brock classifications. During routine controls, 5cc of peripheral blood samples were taken into EDTA-coated tubes. Peripheral blood mononuclear cell and subsequent DNA isolations were performed. In order to analyze the genetic background of patients, we performed comparative genomic hybridization (CGH) arrays for 5 patients with the most severe ototoxicity (Grade 3 and 4), among the studied 72 patients. Results were evaluated statistically by using "Agilent CytoGenomics Software".

Results: CGH analysis showed some common genetic differences among evaluated patients. Chr8.p23.1 (Defensin-family genes) deletion was seen in 3 patients. Chr11.q13.2 (NDUFV1) gain was observed among 4 patients. Chr14.q32.33 (ADAM6) amplification, Chr2.p21 (SIX3) amplification and Chr11.p15.5 (H19) gain were common in all patients. Chr20.q13.32 (GNAS) gain was also seen in 3 patients and this chromosomal region was deleted in one patient. Further assessments may be important to understand the roles of these genes in CDDP induced ototoxicity.

Conclusion: In order to minimize the risk for CDDP ototoxicity, identification of genetic differences is of great importance. Further studies on new candidate genes such as Defensin-family genes, ADAM6, SIX3, GNAS, NDUFV1, and H19 should be performed to better understand their effect on CDDP ototoxicity.

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Free Papers (F866)

ID: 866.6

Network analysis of Innate Immune Interaction in Cholesteatoma

Presenting Author: **Anke Leichte**

Anke Leichte¹, Karl-Ludwig Bruchhage², Holger Sudhoff³,
Barbara Wollenberg²

¹University of Lübeck, Lübeck, Germany,
²Department of Otorhinolaryngology, Head
and Neck Surgery, University of Lübeck,
Lübeck, Germany, ³Department of
Otorhinolaryngology, Head and Neck Surgery
Klinikum Bielefeld Bielefeld, Germany

Learning Objectives: Innate Immunity, Cholesteatoma, Network Analysis, Regulatory Network.

Introduction: The etiopathogenesis of Cholesteatoma is controversial, but it is associated with recurrent, persistent ear infections and bacteria. Thereby the interaction between pathogen susceptibility and innate immunity is relevant. Toll-like (TLRs) and Nod-like receptors (Nods) are known to be important participants in the innate immune response to pathogens at other sites, via elaboration of inflammatory cytokines. We explored the network of Innate Immune Receptor-signalling and cytokine production in cholesteatoma.

Methods: Cholesteatoma and control tissue of the external auditory canal skin (EAS) from patients undergoing surgery were evaluated for innate immune pattern and molecules. Cholesteatoma thickness and cellular infiltration were evaluated histologically. mRNA expression of receptors and downstream molecules were evaluated by microarray, real-time PCR, while protein levels were determined by Immunohistochemistry and bioinformatical network analysis.

Results: A subset of receptors involved and downstream molecules in Innate Immunity such as TLRs, Nods and TNF are expressed in cholesteatoma. NOD2 mRNA and protein, but not TLRs or Nod-receptors were significantly induced compared to control samples of the external auditory canal skin (EAS). Moreover, regulation of genes in an interaction network of the RIPK2 was detected. In addition to NOD2, NLRC4, PYCARD, the downstream molecules IRAK1 and anti-apoptotic regulator CFLAR, showed significant upregulation, whereas SMAD3, a pro-apoptotic inducer, was significantly downregulated.

Conclusions: The network interaction of innate immune regulation is important in the etiopathogenesis and growth of cholesteatoma.

doi:10.1017/S0022215116004953

Endoscopic Ear Surgery: Concept and Technique 2 (V867)

ID: 867.1

Teaching Videos of Endoscopic Middle Ear Anatomy: A Free Educational Resource

Presenting Author: **Alexander Saxby**

Alexander Saxby, Jonathan Kong, Nirmal Patel,
Nicholas Jufas

Sydney Endoscopic Ear Surgery Research Group

Learning Objectives: Teaching the complex anatomy of the middle ear has always been a challenge. Textbook drawings and diagrams often fail to show the intricate 3D relationships of the various structures.

The Sydney Endoscopic Ear Surgery (SEES) Research Group has produced a series of videos looking specifically at the anatomy of this region, as visualized with new endoscopic techniques. The endoscope enables an incredible view of areas, such as the retrotympaanum, previously hidden by microscopic techniques.

Each video looks at a specific area of the middle ear and describes its anatomical relationships and clinical correlation. The videos will be available as a free online resource to anyone wishing to use them.

This presentation will demonstrate key parts of the video series and discuss in a broader context how the endoscope has improved trainee education of ear anatomy.

doi:10.1017/S0022215116004965

Endoscopic Ear Surgery: Concept and Technique 2 (V867)

ID: 867.2

Transcanal Endoscopic Ear Surgery for Lateralized Tympanic Membrane and Medial Meatal Fibrosis

Presenting Author: **Tsukasa Ito**

Tsukasa Ito, Tomoo Watanabe, Sayuri Nakajima, Toshinori Kubota, Takatoshi Furukawa, Kazunori Futai, Seiji Kakehata

Yamagata University Faculty of Medicine

Learning Objectives: Techniques for surgical treatment of LTM and MMF with TESS.

Introduction: The lateralized tympanic membrane (LTM) and medial meatal fibrosis (MMF) are conditions in which the visible surface of the tympanic membrane (TM) is located lateral to the bony annular ring. While the TM is out of position in each condition, the causes differ for the lateralization and the final position of the TM layers. Specifically the LTM loses contact with the ossicular chains while MMF is characterized by acquired atresia with fibrous tissue in the medial part of external auditory canal. Treatment of LTM and MMF presents challenges, in part due to difficulties in visualizing the affected site. Our unit has worked on developing a treatment protocol which incorporates and extends current treatment approaches as well as incorporates the use of the endoscope to achieve a less invasive approach with improved visualization of the affected site.

Methods: Transcanal endoscopic ear surgery (TEES) was used to treat both LTM and MMF using a rigid endoscope with an outer diameter of 2.7 mm coupled to a full HD system. A cross-shaped incision is made across the TM surface and four skin flaps are elevated to exposure the pathology. LTM is treated by removing the mucosa from the ear

canal wall and grafting the TM perforation with fascia to the anterior part of tympanic annulus using the underlay technique. MMF is treated by removing the fibrous tissue from the bony ear canal and the TM lamina propria. The lamina propria and denuded bone is covered with split-skin grafts. Both conditions require canalplasty using a curved bur for complicated bony canal stenosis.

Results: Endoscopes allow for greater overall visualization which is a significant advantage in the surgical treatment of LTM and MMF particularly around the tympanic annulus.

Conclusions: Surgical treatment for LTM and MMF via TEES is an effective and less invasive procedure.

doi:10.1017/S0022215116004977

ID: IP001

The Diagnosis and Treatment of Middle Ear Cholesteatoma with Tuberculous Otitis Media Co-infection: A Series of 11 cases

Presenting Author: **Franco Louie Abes**

Franco Louie Abes¹, Generoso Abes², Teresa Luisa Gloria-Cruz³, Cecilia Montalban⁴

¹*Manila Doctors Hospital; University of Santo Tomas Faculty of Medicine and Surgery; Asian Hospital and Medical Center; University of the Philippines National Institutes of Health Philippine National Ear Institute,* ²*Manila Doctors Hospital; University of the Philippines Philippine General Hospital - Department of Otorhinolaryngology; University of the Philippines National Institutes of Health Philippine National Ear Institute,* ³*University of the Philippines Philippine General Hospital Department of Otorhinolaryngology;* ⁴*Manila Doctors Hospital*

Introduction: Tuberculosis is thought to be an endemic disease in the Philippines wherein there have been a number of documented tuberculous otitis media (TOM) cases. The suspicion of TOM co-infection among patients with cholesteatoma of the middle ear (CME) has led to this investigation.

Objectives: 1.) To describe the clinical features and the treatment outcomes of patients with CME and co-existent TOM. 2.) To compare the features of TOM with CME to that of TOM without cholesteatoma.

Study Design: Retrospective review of cases.

Setting: Tertiary private hospital.

Patients: 11 out of 73 patients were diagnosed with TOM and co-existent CME from January 2009-September 2014.

Interventions: Pure tone audiometry, CT-scan, PPD skin test, chest x-ray, PCR and histopathologic examinations were used as diagnostic procedures. The patients underwent single-stage tympanoplasty with mastoidectomy and anti-tuberculosis pharmacotherapy.

Main Outcome Measures: Otoloscopic, audiometric and clinical evaluations were done upon follow-up.

Results: The primary clinical feature among our cases was the presence of cholesteatoma and chronic otorrhea. No residuals or recurrences were noted upon follow-up of the patients. The mean air-bone gap improvement after surgery and pharmacotherapy was 10.5 dB. The detection of tuberculosis infection was detected via PCR in all of the 11 patients with TOM and CME. CT-scan findings showed that the majority of TOM with CME patients exhibited various characteristics that are not present in TOM alone. Most of the TOM with CME patients exhibited positive PPD test results while exhibiting negative chest x-ray results.

Conclusions: The clinical and radiologic features of our TOM with CME patients were notably different from the more frequently reported TOM cases without CME. Modest short-term treatment outcomes can be achieved when antituberculosis medical therapy is adequately given after cholesteatoma surgery among TOM with CME patients.

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ID: IP002

The Effects of electromagnetic field exposure at 900 mHz frequency emitted from mobile phones on cochlear cells

Presenting Author: **Yüksel Olgun**

Safiye Aktaş¹, Zekiye Altun¹, Ayça Pamukoğlu¹, Banu Demir¹, Serkan Saygan², Burak Çiçeksoy³, Pınar Erçetin¹, Efe Serinan¹, Yüksel Olgun⁴, Nur Olgun⁵

¹Dokuz Eylül University Institute of Oncology Department of Basic Oncology, ²Derinuzay Science and Technology Labs R&D Assc, ³University of Economics Department of Electric and Electronical Engineering, ⁴Dokuz Eylül University School of Medicine Department of Otorhinolaryngology, ⁵Dokuz Eylül University, Institute of Oncology

Learning Objectives:

Aim: Technological developments encountered radiofrequency field from mobile phones in our lives. Possible side effects of electromagnetic field (EMF) need to be investigated. The aim of this study is to evaluate cytotoxic,

apoptotic and DNA damage effects of 900 MHz EMF emitted by mobile phones on House Ear Institute- Organ of Corti 1 (HEI-OC1 cell line) cochlear cells.

Methods: Cochlear cells were cultured in 6 well plates at 33°C, 10%CO₂ in humidified conditions. They were exposed to 900 Mhz EMF in conditions of 5 minutes and 15 minutes, directly and 10 cm away from EMF. EMF was applied by a 3 G cell phone and measured by Arduino EMF detector. Cell viability and apoptosis were evaluated after 24 and 48 hours after exposure for each condition and control group by trypan blue and Annexin V methods respectively. DNA damage related gene expressions were evaluated by real time PCR after RNA isolation and cDNA synthesis.

Results: Cell death was more prominent in cells which received 5 minutes of EMF at 48 h. The apoptosis ratio in cells situated 10 cm away from EMF were similar to cells that were directly exposed to 5 minutes of EMF. In gene expression results it was observed that DNA damage related gene expressions were increased in cells after EMF exposure in 48 hours. The expression levels are nearly same in cells that were 10 cm away from EMF. The genes that showed high expression than control are Bax, Gadd45a, Gadd45 g, Mpg, Msh2, Rad51c and Xrcc3, which are related to apoptosis induction and DNA repair.

Conclusion: EMF at high dose for 5 minutes caused cell death via apoptosis in HEI-OC1 cell line in vitro. This result was supported by apoptosis detection and DNA damage related gene expressions. Apoptosis was prominent in 5 minutes and similar for both direct and close distance exposure. Further in vivo and in vitro studies with different doses and distances are needed to evaluate the effects of EMF on cochlea.

doi:10.1017/S0022215116004990

ID: IP003

Friendship of Capsaicin and Cisplatin in HEI-OC1 Cells

Presenting Author: **Yüksel Olgun**

Zekiye Altun¹, Kerem Altun², Yüksel Olgun³, Ayça Pamukoğlu², Nur Olgun²

¹Dokuz Eylül University School of Medicine, ²Dokuz Eylül Institute of Oncology Department of Basic Oncology, ³Dokuz Eylül University School of Medicine Department of Otorhinolaryngology

Learning Objectives:

Introduction: Cisplatin (CDDP) is anticancer agent with serious side effects like ototoxicity. Capsaicin, the active ingredient of chili peppers, has protective effects against CDDP induced renal toxicity. The aim of this study was to evaluate the role of capsaicin on CDDP induced apoptotic cell death and DNA-damage related genes in House Ear Organ Corti (HEI-OC1) cells.

Methods: HEI-OC1 and KELLY neuroblastoma cells were treated with CDDP (100µM), capsaicin(5µM) and capsaicin (5µM)-CDDP (100µM) at 24 h. Cell viability and apoptotic cell death evaluated by WST-1 and annexin-V/PI flow cytometric analysis. DNA-damage related gene expressions were evaluated by Real-time PCR array (Bio-Rad) in cochlear cells.

Results: Capsaicin did not alter cell viability of HEI-OC1 and KELLY. CDDP reduced the viability of HEI-OC1 (46%) and KELLY cells (74%). Combined treatment of capsaicin (5µM)-CDDP (100µM) resulted in a marked decrease in KELLY (16%) cells. Moreover cell viability in HEI-OC1 (80%) cells were increased. Capsaicin alone induced apoptotic cell death of KELLY cells while it did not induce apoptosis in HEI-OC1 cells. CDDP alone and capsaicin-CDDP combinations increased the apoptotic cell death at same ratios in HEI-OC1 cells. In KELLY cells, capsaicin-CDDP combinations induced apoptotic cell death more than CDDP alone. Capsaicin-CDDP induced Fancg, Mif, Mlh3 DNA repair related gene expressions in cochlear cells when compared to CDDP. Bax, Parp2, Pms2, Rad51, Sumo1 and Trp53 (apoptotic and DNA repair) gene expressions were decreased with capsaicin-CDDP combinations while increased in CDDP alone. Expression of Cdc25c was increased with capsaicin-CDDP while decreased with CDDP alone.

Conclusion: This study showed that capsaicin increased CDDP induced neuroblastoma cell death while cochlear cells viability was increased. Capsaicin might be non-tumor interfering protective agent and the effects must be shown by further studies.

doi:10.1017/S0022215116005004

ID: IP004

Surgical approach of mesotympanic congenital cholesteatoma

Presenting Author: **Mercedes Alvarez-Buylla Blanco**

Mercedes Alvarez-Buylla Blanco¹,
Miguel Alvarez-Buylla Camino²

¹Hospital, ²Hospital V. Alvarez-Buylla

Learning Objectives: Congenital cholesteatoma surgical technique preserving intact tympanic structures.

Introduction: Congenital cholesteatoma is often presented as an asymptomatic disease. It is usually discovered during the otoscope examination, seen as a white mass behind a normal intact tympanic membrane. The mean age of presentation is in children between 5 and 10 years old. The early diagnosis and treatment is essential in order to avoid future complications. In children the minimally invasive approach is essential preserving the anatomic ear structures.

Clinical case: We present a minimally invasive approach for congenital mesotympanic cholesteatoma. We perform an endoaural approach, with two incisions, upper and lower one, and a conchomeatal flap is made. This allows a direct approach to the middle ear. The posterior and anterior

annulus are detached extending the anterior annulus 90 degrees anterior to the short process of the malleus, maintaining the stability of the tympanic membrane in the umbo. The ossicular chain remains intact. The cholesteatoma is removed and it is checked by endoscopic vision the full excision of the matrix.

Conclusions: We present a minimally invasive endoaural approach to reach full control and elimination of a disease that left to its natural evolution can develop intracranial and extracranial complications.

doi:10.1017/S0022215116005016

ID: IP005

Tacking troublesome tinnitus in Lothian children

Presenting Author: **Ida Amir**

Ida Amir¹, Mary-Louise Montague², Dawn Lamerton²
¹NHS Tayside, ²NHS Lothian

Learning Objectives: We aim to evaluate the incidence, associated factors, management and outcome of paediatric tinnitus in our cohort of patients.

Introduction: Around a third of children experience tinnitus at some point in childhood. Troublesome tinnitus can affect 5% of children.

Methods: A retrospective cohort study of children referred to a paediatric tinnitus clinic over a 5 year period (March 2010-June 2015).

Results: 30 children were referred for assessment to the paediatric tinnitus clinic. The median age of affected children was 10 years (range 5–16). 83% were boys. 83% had bilateral tinnitus. In 5 children with unilateral tinnitus an MRI scan was normal. Only 17% were found to have abnormal hearing results; 2 with bilateral sensorineural hearing loss (SNHL) and 3 with unilateral conductive hearing loss (CHL). In those with unilateral CHL, 2 had chronic suppurative otitis media (CSOM) and 1 was found to have congenital cholesteatoma. There was no correlation between the type/laterality of hearing loss and the laterality of the tinnitus. 57% had no associated past medical history. History of autistic spectrum disorder (ASD) and anxiety disorder contributed to 30% of cases. Two thirds of children underwent behavioural therapy and were provided with a masker. The remaining children had a combination of behavioural therapy and a sound-ball (Puretone relaxation therapy ball). All patients had a minimum of 6 months follow-up (range 6 months-4 years). 43% were discharged after 1 year of follow-up, with equal numbers of those receiving a masker and a sound-ball (6 and 7 respectively). A further 37% required more than 2 years of regular review. No re-referrals were received during the study period.

Conclusions: Paediatric tinnitus is more common in boys. History of ASD and anxiety disorder are important factors to consider. Behavioural therapy with a sound masker or a

sound-ball appear to be equally effective strategies for managing tinnitus in this cohort of Lothian children.

doi:10.1017/S0022215116005028

ID: IP006

Cholesteatoma complicated by parapharyngeal abscess occurred after temporal bone fracture

Presenting Author: **Irina Arechvo**

Irina Arechvo¹, Andrius Talijunas², Svajunas Balsaris¹

¹Republican Vilnius University Hospital,

²Vilnius University Hospital Zalgirio Clinic

Learning Objectives:

Introduction: Parapharyngeal abscess as a cervical complication of the cholesteatoma is an extremely rare disease. In the modern antibiotic era only a few cases of this life-threatening complication have been reported in the literature. The different routes of extension, e.g. peritubal, through the eroded mastoid tip or due to the involvement of the apex of the petrous temporal bone, have been previously described. However, the appropriate time and surgical strategies for management of the complication and principal disease are still controversial.

Methods: This is a retrospective descriptive case report based on clinical chart data and analysis of computed tomography scans.

Results: A 65-year-old man with a long history of recurrent right purulent otorrhea presented to our tertiary care facility with right temporal bone fracture. Later, he started to complain of hoarseness, snoring and dysphagia and was diagnosed with right parapharyngeal abscess on a contrast enhanced computed tomography scan. The patient underwent abscess drainage through transcervical route with simultaneous emergency radical mastoidectomy. Despite development of septic shock with acute renal failure in the postoperative period the patient recovered.

Conclusions: Temporal bone fracture in patients with pre-existing chronic otitis media with cholesteatoma can cause infection extension to the deep neck spaces through the fracture bone defects. Early consultation of an otologist is indicated in such cases. Analysis of the computed tomography scans with thorough evaluation of the fracture line extension should be performed to prevent the complications.

Learning Objectives: Due to the rarity the cervical complications of the cholesteatoma are requiring a high index of suspicion among otologists. To increase awareness of this condition, we report this unique case.

doi:10.1017/S002221511600503X

ID: IP007

Treatment strategy according to staging of congenital cholesteatoma in pediatric patients

Presenting Author: **MOO JIN Baek**

Moo Jin Baek¹, Dong Geun Lee², Eui Kyeong Bang³

¹Haeundae Paik Hospital, Inje University,

Busan, Korea, ²Haeundae paik Hospital,

Busan, Korea, ³Busan vetrans Hospital, Busan,

Korea

Learning Objectives:

Background: The main goal of congenital cholesteatoma treatment is total eradication of the disease in order to prevent recurrence and preserve normal structure and function. This is usually achieved by a surgical method depending on the nature and extent of the disease. The authors aims to find out the proper surgical method for each stage by comparing possible surgical methods and their following prognoses depending on the stage.

Method: We retrospectively reviewed 55 patients from 2010 to 2015 who were diagnosed congenital cholesteatoma. The surgical treatment was performed by several different approaches determined by the location and extent of the disease and degree of adhesion to the surrounding structure. After 6 months of follow up, Recurrence was evaluated. Data was analyzed according to the patients age, stage by Potts's classification, relationship between age and location of the lesion and also relationship between surgical methods and results.

Results: Age distribution was from 1 year to 14 years and among these patients, 25(45%) were under 2 years of age. 26 Patients(47%) were classified as Stage I with the highest number. Patients diagnosed at an elder age showed a tendency of lesions being located more posteriorly and being found at more various locations such as the mastoid or attic. The result of surgical procedure was stage I with no recurrence, stage II with 1 case of recurrence, stage III with no recurrence, stage IV with 2 cases of recurrence. Recurrence was found in 3 cases among the total 55 cases.

Conclusion: Early diagnosed diseases with lower stage were treated with surgical approaches capable of removing the lesion and at the same time preserving normal function. And also in these cases rates of recurrence and complication revealed to be low. Therefore early diagnosis with minimal conservative surgery is the most important principle to achieve the main goal of congenital cholesteatoma treatment.

doi:10.1017/S0022215116005041

ID: IP008**The symptoms and prognosis of traumatic pneumolabyrinth by air location**Presenting Author: **MOO JIN Baek**Moo Jin Baek¹, Dong Hyun Lee², Eui Kyeong Bang³¹Haeundae Paik Hospital, Inje University, Busan, Korea, ²Haeundae paik Hospital, Busan, Korea, ³Busan vetrans Hospital, Busan, Korea*Learning Objectives:*

Objective: The Pneumolabyrinth is a rare condition in which air is present in the inner ear due to abnormal pathways between the middle ear and inner ear. This condition can be caused by congenital reasons, middle ear surgery, head trauma. The cases of traumatic pneumolabyrinth is increasing due to the high resolution CT. But Symptoms and prognosis of traumatic pneumolabyrinth is not clarified yet and needs further investigation.

Methods: We reviewed 149 cases of head trauma Patients who underwent temporal bone CT between Jan 1st 2012 to Jan 1st 2014. Review of records was done according to the factors: temporal bone fracture, otic capsule involvement, location of air bubble, symptom improvement.

Results: Ten patients showed pneumolabyrinth with symptoms of dizziness and hearing loss. Dizziness which is related to air bubble in the vestibule showed symptom improvement in all 10 cases. While hearing loss followed by air bubble in the cochlea(5 cases) did not show symptom improvement. No correlation was found between Symptom improvement and otic capsule involvement.

Conclusion: In cases of traumatic pneumolabyrinth there are a few factors that can be considered to predict the prognosis. Location of the air bubble appears to be the key factor to predicting the prognosis.

doi:10.1017/S0022215116005053

ID: IP009**Sem Study on Cholesteatoma-affected Ossicles**Presenting Author: **Maurizio Barbara**Maurizio Barbara¹, Selenia Miglietta², Michela Relucenti³, Ezio Battaglione⁴, Giuseppe Familiari⁵, Edoardo Covelli⁶¹Sapienza University Rome, ²Department of Anatomy, Histology, Forensic Medicine and Orthopaedics, Sapienza University, Rome, Italy, ³Department of Anatomy, Histology, Forensic Medicine and Orthopaedic, Sapienza University, Rome, Italy, ⁴Department of Anatomy, Histology, Forensic Medicine and Orthopaedic, Sapienza University, Rome, Italy,⁵Department of Anatomy, Histology, Forensic Medicine and Orthopedics, Sapienza University, Rome, Italy, ⁶ENT Unit, NESMOS, Sapienza University, Rome, Italy

Learning Objectives: To shed some light on the erosive processes that affect the incus in respect to the cholesteatoma localization.

Background: The degree of invasiveness of a cholesteatoma is usually based on some clinical features, such as its extension, relapsing tendency and erosive capacity. For this latter, the ossicular chain, and mostly incus, is usually involved, leading the surgeon to its accurate cleansing or removal.

Material and Methods: For this study, incus specimens were collected during tympanomastoid surgery from adult patients with cholesteatomatous otitis media. The samples were processed for scanning electron microscopy and the investigation aimed to consider at first the whole bone, then to give a detailed mapping of the eroded parts of the incus adjacent to the cholesteatoma tissue. The different degrees of erosion (in terms of presence/absence of erosion, lacunae and their diameter and depth) and the presence/absence of biofilm were considered. Erosion degree was recorded with 0 if absent, and with 1–2–3 if mild, moderate or severe, respectively. Five consecutive fields at 100X magnification, aligned in 3 rows, the first one proximal and the last one distal to the surgical erosive point were analyzed. A total of 60 fields for each row were observed.

Results: Erosion lacunae were clustered on the surface of the eroded areas, their diameter being $75 \pm 15\mu\text{m}$. Although a proximal to distal gradient exists, looking to the distribution of the eroded areas, grade 3 erosion was not only limited to the area proximal to the ossicle erosive edge (first row) but also in row 2 and sometimes scattered up to row 3. Grade 3 erosion was observed around nutrient foramina of the bone (65%).

Discussion: Our observations confirm the hypothesis that the erosion degree is higher near the resection edge, but also prove that erosion areas of degree 3 can also be observed in regions far from the erosive point.

doi:10.1017/S0022215116005065

ID: IP010**Protocols for Application of Non-EPI DW MRI in Cholesteatoma**Presenting Author: **Maurizio Barbara**Maurizio Barbara¹, Alessandro Bozzao², Edoardo Covelli³, Andrea Romano⁴, Luigi Volpini³, Veronica Confaloni⁴¹Sapienza University Rome, ²Neuroradiology, Sapienza University, Rome, Italy, ³ENT Unit, NESMOS Department, Sapienza University, Rome, Italy, ⁴Neuroradiology, Sant'Andrea Hospital, Rome, Italy

Learning Objectives: Shed some light on role of MRI for cholesteatoma.

Background: Although the diagnosis of cholesteatoma is in nearly all cases achieved by a meticulous otomicroscopical or endoscopic examination, imaging is usually required for a better definition of the extension of the pathology as well as to evidentiate eventual bony erosions. Non-ECHO-planar diffusion weighted magnetic resonance (non-EPI DW MRI) has been recently acquired as an important diagnostic tool in case of cholesteatoma, with high rates of sensitivity and specificity. At the ENT Unit of Sant'Andrea Hospital in Rome, Italy, this technique is regularly applied since five years especially for following-up after surgery. In this study, specific protocols are presented to be applied in different clinical situations.

Material and Methods: A consecutive number of subjects affected by cholesteatoma were scheduled for surgery. Both primary and recurrent cases were taken into consideration. Primary cases were subdivided in limited and extended cases, while recurrent cases comprised both routine cases and sequels from subtotal petrosectomy with blind sac closure of the external meatus. In the extended cases and in petrous bone cholesteatoma cases, non-EPI DW MRI was planned soon after surgery (within 1 month) and 3, 6 and 12 months after surgery. In the limited cases, it was only planned 12 months after surgery.

Results and Discussion: Non-EPI DW MRI has proven to be highly sensitive for detecting residual pathology with only rare cases of false positivity. The early application of this technique in selected invasive cases enabled to reassure the surgeon on the performed surgical procedure or give notice of the expected residual tissue left in particular cases where other priorities were taken into consideration (e.g. facial nerve function).

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ID: IP011

Intracranial complications of chronic otitis media

Presenting Author: **Anna Bartochowska**
Anna Bartochowska, Łukasz Borucki, Agata Buczkowska, Witold Szyfter

Poznań University of Medical Sciences

Learning objectives: In the presentation the clinical course and therapeutic results of intracranial complications of otogenic origin will be discussed.

Introduction: Intracranial complications of otogenic origin are rare but still represent a potentially lethal threat.

Methods: The aim of the study was clinical analysis of 48 intracranial complications in 29 patients with chronic otitis media. The incidence of complications, symptoms reported at admission, neurological condition, microbiological material, the choice of the surgical therapeutic method and treatment results were evaluated.

Results: 16/29 patients had a single complication, while 13/29 - multiple complications. Brain abscess was reported in 18/48 cases, meningitis in 14/48, sigmoid sinus thrombosis in 7/48, epidural abscess in 6/48 and subdural empyema in 3/48. Surgical treatment was implemented immediately and simultaneously in the temporal bone focus and the site of complication. There were no deaths.

Conclusions: Brain abscess was the most common complication in the study group. In many patients several intracranial complications occurred at the same time. The authors recommend fast evacuation of the temporal bone purulent focus accompanied by the surgical treatment of intracranial complications with the evacuation of the abscess under the control of neuronavigation.

doi:10.1017/S0022215116005089

ID: IP012

Endoscopic Ear Surgery and its impact on the operating theatre team

Presenting Author: **Paramita Baruah**

Paramita Baruah¹, Duncan Bowyer²

¹West Midlands Deanery, ²Princess Royal Hospital Telford

Learning Objectives:

Introduction: The development of Endoscopic Ear Surgery (EES), from being an adjunct to microscopic dissection to becoming the prime methodology in select cases, has been an exciting recent development. This work assesses the experience of theatre team members with EES versus conventional ear surgery.

Methodology: A questionnaire was designed covering the areas of theatre time management (planning and organisation, leadership and direction, inter-team working), team thinking (shared situational understanding, thinking ahead, decision making) and team safety (safe practice, equipment use, low energy and fatigue), comparing EES to conventional microsurgery of the ear. The scale used was: 1-much worse, 2-somewhat worse, 3-neither better nor worse, 4-somewhat better, 5-much better.

Results: The respondents included 7 theatre nurses, 3 anaesthetists and 3 theatre practitioners. All respondents reported a greater subjective satisfaction with EES mainly with regard to being able to appreciate what was happening during the surgery. The anaesthetists reported that it was easier to anticipate anaesthetic requirements at the close of the procedure in EES and that patients were more comfortable postoperatively. Five out of the seven nurses consistently rated EES as a 4 or 5 compared to conventional ear surgery with regard to theatre team management, team thinking and team safety. EES was initially perceived as challenging by the nurses but with experience they report a greater degree of involvement and satisfaction with the endoscopic procedure. The theatre practitioners rated EES to be better in theatre team management and team thinking but as equivocal with regard to team safety.

Conclusion: Theatre staff report an initial challenging learning curve with EES. With time however the theatre team satisfaction levels are higher due to greater awareness and involvement with the surgical procedure.

Learning points: The theatre team shows high levels of satisfaction with EES.

doi:10.1017/S0022215116005090

ID: IP013

Sonotubometry using perfect sequences: clinical results of the 105 healthy subjects

Presenting Author: **Vilma Beleskiene**

Vilma Beleskiene

Vilnius University Hospital Santariskiu Clinics

Learning Objectives:

Objectives: The aim of this study was to establish the rate variation of sonotubometric measurements using a specific broadband class of signals, the so-called perfect sequences (PSEQ) among healthy adults and to identify an optimal and technically simple test to provoke Eustachian tube (ET) openings.

Methods: Sonotubometry was performed on 105 healthy adult subjects. Three different consecutive maneuvers were performed for ET opening: dry swallowing, water swallowing (a small (2 ml) and a large (5 ml) water bolus). Values of the amplitude and duration of each measured ET opening were calculated.

Results: 6,300 measurements were performed. Sonotubometric ET openings were detected for all subjects but not for each measurement. 6,180/6,300 measurements (98.1%) objective ET openings were registered. Mean ET opening duration time and the mean sound amplitude were similar for all performed test and are 270 (SD ± 96) ms, 13.48 (SD ± 6.57) dB.

Conclusion: sonotubometry based on PSEQ stimuli is a reliable methodology to assess the Eustachian Tube opening function in healthy subjects. Mean ET opening duration time and the mean sound wave amplitude were similar performing all analysed tests, hence might be concluded, that dry (saliva) and water swallowing are a reliable sonotubometric maneuvers and may be used examining ET opening function. Size of a sip during water swallowing does not affect the sonotubometry result. All maneuvers can be equally used as the optimal maneuver, and we think that water swallow is most comfortable for the subject.

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ID: IP014

Devices for restoring hearing in the sequelae of cholesteatoma

Presenting Author: **Millo Achille Beltrame**

Millo Achille Beltrame

Centro Clinico Multispecialistico

Rovereto

Learning Objectives: Possible solution to restore the hearing using bone conduction implants and middle ear implants solutions. The presentation illustrates different situations, in patients where the hearing loss changed post cholesteatoma's surgery.

The hearing loss in patients with history of Cholesteatoma, have multifarious features that depend either by the damaging disease activity or by the result of the surgery. The majority of them suffer from conductive hearing losses because the ossicles have been destroyed by the disease or surgically removed. The hearing has to be restored, reconstructing the ossicular chain (ossiculoplasty) or, in other cases, with hearing implants. Frequently patients with previous cholesteatoma, show a mixed hearing loss, due to the aging or toxicity of the disease. A limited number presents a profound deafness, or anacusis due to a cholesteatoma's invasion into the labyrinth or by iatrogenic damage during the surgery. All these outcomes can be corrected with auditory implants inserted either in the middle ear or in the cochlea. Subjects that have CWU and CWD tympanoplasty done and good bone hearing threshold were treated with BONEBRIDGE device in the retro-sigmoid site, in order to avoid any future contamination in case of a disease recurrence or infections in the middle ear. In mixed hearing losses, a Vibrant Soundbridge system has been preferred to place the FMT over the stapes, if present, or onto the footplate or on the round window. In CWD cases the round window membrane has been always the site of choice. When the cavity is completely clean and dry a VSB could be implanted with the FMT on the RW pays attention of the positioning of the conductor link, far from the diseased area and in a channel covered with bone pâté. Doing a cholesteatoma removal and a middle ear implantation on the same surgical session is not always the best option. There are situations where the procedure requires two steps: cholesteatoma removal first and implantation later. Always an open external ear canal is mandatory in order to check with otoscopy the condition of the middle ear cavity in the next visits. Finally, in patients with profound hearing losses, a cochlear implant was implanted via retro-sub-facial approach.

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ID: IP015

The Chorda Tympani Nerve Degenerates during Chronic Otitis Media. An Electron Microscopy Study

Presenting Author: **Katarina Berling Holm**

Katarina Berling Holm¹, Magnus von Unge², Paula Mannström³, Mats Ulfendahl³, Niklas Danckwardt Lillieström⁴

¹Center for Clinical Research, Landstinget Västmanland, Västerås, Sweden, ²Dept. of Otorhinolaryngology, Akershus University Hospital and University of Oslo, Norway,

³Dept. of Neuroscience, Karolinska Institutet,

Stockholm, Sweden, ⁴ENT department Uppsala Academic Hospital, Uppsala University

Learning Objectives: Patients with chronic inflammatory middle ear diseases can experience taste disturbance before surgery due to the degenerative capacity of the inflammatory process.

Background: The important nerve of taste, the chorda tympani nerve, runs uncovered through the middle ear. This location predisposes it to become affected by bacterial toxins, enzymes and mechanical damage in various forms of middle ear pathology, such as chronic otitis media and cholesteatoma. A difference between inflammatory diseases, such as chronic suppurative otitis media and cholesteatoma, and noninflammatory diseases, such as otosclerosis, regarding taste disturbance preoperatively and symptoms postoperatively have been noticed. The present study aims to investigate ultrastructural changes of chorda tympani in inflammatory middle ear disease as compared with normal.

Methods: Five chorda tympani specimens were collected from healthy middle ears of patients subjected to surgery for acoustic neuroma to be used as normal controls, and five from middle ears with chronic otitis media or cholesteatoma where the nerve could not be saved during the operation. Light microscopy and electron microscopy were used to identify signs of pathological processes.

Results: Ultrastructural changes that implicate inflammatory changes and degeneration were found in all five nerves from ears with chronic otitis media and cholesteatoma. There were signs of proliferation of connective tissue of the endoneurium, disorganization and demyelination of axons, vacuolar degeneration of the axons, myelin sheath disintegration and edema. As a sign of regeneration capacity there was occurrence of sprouting in CTN from ears with inflammatory diseases.

Conclusion: Chorda tympani nerves from ears with chronic inflammatory middle ear disease exhibit structural signs of deterioration that correlates well to taste disturbances.

There were signs of nerve regeneration that could explain the ability of taste recovery.

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ID: IP016

Use of Bioactive glass S53P4 in mastoid and epitympanic obliteration: our experience in 74 cases

Presenting Author: **Daniele Bernardeschi**

Daniele Bernardeschi, Olivier Sterkers
Pitié-Salpêtrière Hospital

Learning Objectives:

Objective: to present our experience with the use of Bioactive glass S53P4 in ear surgery

Material and Methods: Seventy-four cases (72 adult patients, 2 operated bilaterally) operated from May 2013 to December 2015 in a tertiary referral center. All but 10 cases were revision surgeries (mean previous operation = 2). The mean pre-operative hearing threshold was 57 ± 18 and 29 ± 15 dB for air conduction and bone conduction respectively. All patients underwent mastoid and epitympanic obliteration in a single stage CWD (n = 60) or CWU (n = 14) tympanomastoidectomy. Intraoperative bacteriological test was performed for all patients. Anatomical and functional results were evaluated 3 months and 1 year after surgery, and a CT scan \pm MRI was performed 1 year after surgery. Quality of life measured with the GBI and specific questionnaire was performed 1 year after surgery.

Results: Cholesteatoma was found in 48 cases; Bacteriological tests showed some bacteria and/or fungus in 43 cases. At 3 months all but 2 patients had a well-healed EAC and intact tympanic drum. Two cases of uncovered granules in the EAC underwent revision surgery for recovering of the granules with cartilage. At 1 year (n = 41), anatomical results remained stable with no cases of recurrent cholesteatoma. Regarding the hearing, one year after surgery (n = 41) the mean hearing threshold was 46 ± 22 and 27 ± 17 dB for air conduction and bone conduction respectively. CT scan (n = 41) and MRI (n = 17) showed no residual cholesteatoma inside or near the obliteration. GBI and specific questionnaire (n = 41) showed an improvement in the QOL (mean total score = 28).

Conclusion: The bioactive glass S53P4 is a well-tolerated biomaterial for primary or revision chronic otitis surgery, as shown by the absence of revision surgery for removal of the granules even in case of surgery in infected ears. Hearing results depend mainly on the number of previous surgeries, and the patient's quality of life is improved after operation.

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ID: IP017

A systematic review of the epidemiological relationship of mucosal otitis media, tympanic retraction, and cholesteatoma

Presenting Author: **Mahmood Bhutta**
Mahmood Bhutta

Royal National Throat Nose and Ear Hospital

Learning Objectives: To better understand the relationship of squamous forms of otitis media to mucosal disease, based upon a systematic review of longitudinal epidemiological studies. To use these data to create a map of disease relationships.

Introduction: Clinical experience suggests that cholesteatoma often arises in individuals with a history of prior mucosal otitis media, or a history of tympanic retraction. I set out to exploit existing longitudinal studies to ascertain the relation of these disease entities, specifically to assess the relation of mucosal disease to tympanic retraction and cholesteatoma.

Methods: I searched the pubmed database using terms “tympanic retraction” OR “cholesteatoma” AND “epidemiology”. 708 articles were returned. Titles and abstracts were screened for relevance. Only longitudinal prospective or retrospective studies were included. Articles on syndromic or special populations were excluded. 24 articles were included for review, and the full text of these articles was evaluated to identify further references.

Results: Differing populations and definitions make meta-analysis inappropriate. There is no evidence of association of acute otitis media with risk of squamous disease. Presence and duration of chronic otitis media with effusion is associated with risk of subsequent squamous disease. Tympanic membrane retraction shows variable chronology, with many retractions resolving, and development of new retractions rare. Cholesteatoma remains a rare complication, and is predisposed to by TM retraction, but almost certainly also arises de novo, perhaps in those with subclinical disease. There is no evidence that grommet insertion reduces risk. These relationships can be constructed into a map of the inter-relation of disease, akin to the landscape map for mucosal otitis media I have previously constructed (Audiol Neurotol 2014;19:210–223).

Conclusions: Existing epidemiological studies can be used to construct a map of the relation of mucosal to squamous forms of otitis media, and so help to better understand epidemiological correlates, and to hypothesise pathophysiological relations.

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ID: IP018

Distinguishing Between Conductive and Sensorineural Extended High-Frequency Hearing Loss Following Middle Ear Surgery

Presenting Author: **Philip Bird**

Philip Bird¹, Melissa Babbage², Greg O’Beirne³

¹University of Otago, ²University of Canterbury, CHCH, New Zealand, ³University of Canterbury

Learning Objectives: 1. Appreciate the issues regarding bone conduction in high frequencies. 2. Recognise the risk of extended high frequency hearing loss with middle ear surgery and its possible significance.

Introduction: Permanent hearing loss in the extended high-frequency range (8–16 kHz) occurs in up to 50% of patients following otherwise successful middle ear surgery. The mechanisms of this high-frequency loss are poorly understood, but hypotheses include suprphysiological ossicular movement and noise exposure from drilling and suctioning. High-frequency loss could also be conductive and result from physical changes to the conductive mechanism. Previous research has been limited by difficulties measuring high-frequency bone-conduction thresholds, and thus distinguishing between conductive and sensorineural loss. We present a small pilot study demonstrating that high-frequency

hearing loss can be composed of both conductive and sensorineural components.

Methods: A giant magnetostrictive transducer was modified for audiometric use and testing was conducted to establish the reliability and validity of thresholds measured using the device. Air- and bone-conduction audiometric thresholds at 0.5–16 kHz were then measured preoperatively and at 1 week, 1 month, and 3 months postoperatively in four patients; three undergoing stapedectomy and one ossiculoplasty.

Results: Testing in normal hearing listeners showed that the modified transducer could be used to measure high-frequency bone-conduction thresholds with a level of reliability comparable to standard bone-conduction testing. The pilot study identified two clear cases in which an initial transient conductive high-frequency loss was documented concurrently with a persistent high-frequency sensorineural loss.

Conclusions: These results suggest that extended high-frequency hearing thresholds as measured using the modified bone-conduction transducer are a more sensitive measure of operative trauma to the cochlea that may be used to determine the efficacy of interventions to protect the ear from surgical trauma.

doi:10.1017/S0022215116005156

ID: IP019

The use of titanium to repair the external ear canal: sheeting vs. mesh

Presenting Author: **Bruce Black**

Bruce Black

University of Queensland/Lady Cilento Children’s Hospital

Learning Objectives:

Introduction: Titanium sheeting and mesh have been used in this centre from 2008 to repair EAC defects, succeeding previous porous hydroxylapatite techniques. The purpose of this presentation was to evaluate and compare the outcomes from each material.

Materials and Method: Titanium sheeting (0.12 mm, 99% pure, annealed) was used in 111 cases, and fine mesh (Biomet) in 74. Surgical techniques were intact canal wall mastoidectomy in 130 cases, mastoidectomy reconstruction in 55. The titanium was used as a support layer, applied to the medial aspect of the bony ICW wall and overlaid with cartilage. In reconstruction cases the titanium was covered with a middle temporal flap, but with only occasional cartilage supplements.

Ossiculoplasties employed Grace Alto devices, alternatively Gyrus Spanner struts if the malleus-stapes angulation was favourable.

Results: Sheetting results were excellent for both the ICW and reconstruction roles. Mesh was disappointing. Dehiscences of the overlying tissue occurred in 16% of

54 ICW cases, 25% of mastoid reconstructions. This was evidently due to the ittegular mesh surface causing more local reaction, but also occurred in case where wall resorption occurred after ICW. In these cases recurrent disease penetrated the mesh.

Technically, sheeting was simpler to use, as mesh snagged on the local soft tissues. At second stage surgery, sheeting was more easily cleared of fibrsosis during inspection for residual disease.

Conclusions: Titanium sheeting was highly successful in EAC defect repair, and handles better than mesh. Due to accompanying complications, mesh is no longer in use.

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ID: IP020

The Use of Internet Videos in Otolaryngology Training in Domestic and International Cohorts

Presenting Author: **David Black**

David Black¹, Simon Cole², Annette Jardine²

¹Bristol Royal Infirmary, ²Royal United Hospital, Bath

Learning Objectives:

To establish the prevalence of Internet video usage for self-education.

To determine the most used sites.

To ascertain how trainees and trainers assess the quality of individual videos.

Introduction: Internet based videos are increasingly used throughout medical education. We wished to investigate the use of Internet videos for personal education in otological surgical training both in the UK and internationally.

Method: A short questionnaire was constructed to assess the use of Internet videos for education in otological surgery. It was distributed to participants at two temporal bone courses: a regional ENT registrar course held in the UK and an international course held in France.

Results: 21 delegates completed surveys at each course. All responders in the UK were UK based registrars. The international cohort comprised 14 European and 7 non-European delegates. Use of Internet videos for personal education was very high in both groups - 76% and 90% respectively. 42% of the international cohort used videos for pre-course preparation. Delegates reported using their own judgment to access video quality (94% and 73%) whilst 5% in the international group looked for names with an international reputation. The most used site was YouTube.

Conclusion: Internet videos are an effective and often free source of educational material. Use of this resource is increasing globally across all surgical specialties. The

quality of videos available is variable and other than personal assessment there remains no way to determine the standard of videos accessed.

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ID: IP021

Is endoscopic ear surgery an option to manage middle ear cholesteatoma?

Presenting Author: **José Carlos Casqueiro**

José Carlos Casqueiro¹, Miguel Aristegui²

¹Hospital Universitario Severo Ochoa / Grupo Otológico Madrid, ²Hospital Universitario Gregorio Marañón / Grupo Otológico Madrid

Learning Objectives:

Introduction: In the last decades, the use of endoscopes in ear surgery for the removal of cholesteatoma has widespread significantly.

Objective: To describe a case series of transcanal endoscopic ear surgeries for cholesteatoma removal performed by our group. We evaluate the indications and outcomes of the endoscopic management of middle ear cholesteatoma. The characteristics, advantages, and disadvantages of this technique are also discussed.

Methods: A retrospective case series study, based on the review of patients submitted to transcanal endoscopic surgery in the period from January of 2011 to January of 2016.

Results: 23 patients with a minimum of 1-year follow-up (range 1 to 5-year follow-up) underwent endoscopic ear surgery for middle ear cholesteatoma in our group. Several kinds of cholesteatoma were included, most of them secondary acquired because of a chronic tympanic perforation. We also include some cases with primary acquired cholesteatoma with an intact ossicular chain. The outcomes were analyzed and the results were discussed.

Conclusion: We believe that transcanal endoscopic approach is a feasible, safe, and effective procedure in selected cases for limited cholesteatoma.

doi:10.1017/S0022215116005181

ID: IP022

The role of D2 weighted Magnetic Resonance Imaging in the management of cholesteatomas for the North of Scotland

Presenting Author: **Wan Hei Chan**

Wan Hei Chan, Constantinos Mamais, Sangeeta Maini
University of Aberdeen

Learning Objectives: 1) To identify the rate of false positives and false negatives in our patients by correlating the radiological findings of D2-weighted MRI with intra-operative findings in patients with primary and recurrent cholesteatoma. 2) To determine the value of D2-weighted MRI in preventing the need for second-look surgery. 3) To determine whether a specific diameter of lesion observed on MRI can be established in order to predict the clinical significance of recurrent cholesteatomas.

Introduction: There has been increasing evidence that demonstrates the accuracy of non-echo-planar diffusion-weighted magnetic resonance imaging in the identification of cholesteatoma. This retrospective study aims to determine if the sensitivity and specificity of D2-weighted MRI used to evaluate the presence and recurrence of cholesteatoma, in the North of Scotland, is coherent with current published literature.

Method: Retrospective collection of data between January 2012 to December 2015 was conducted on patients that have undergone cholesteatoma surgery using operation codes and the review of theatre diaries. Electronic records of D2-weighted MRI findings and operative notes were reviewed and compared for comprehensive analysis. Results were then quantified in order to identify measurable outcomes (eg specificity, sensitivity).

Results: 41 of 235 patients whom had gone under tympano-mastoid surgery were confirmed to have received D2-weighted MRI. The results of this study are predicted to be concurrent with recent published data with a similar degree of sensitivity and specificity.

Conclusion: The high degree of accuracy in D2-weighted MRI observed will continue to decrease the need for second-look surgery in the North of Scotland. Data accumulated will provide additional evidence in the reliability of D2-weighted MRI to predict the clinical significance of recurrent cholesteatomas.

doi:10.1017/S0022215116005193

ID: IP023

Applied FESS posture in TEES cholesteatoma surgery

Presenting Author: **Huang CHANG-WEI**

Huang Chang-Wei, Lai Jen-Tsung
Kuang-Tien General Hospital

Learning Objectives: As the frequently encountered condition of the cholesteatoma visible but out of reach in TEES with conventional instruments, the curved instruments and angular endoscopes are gradually developed and adopted in clinical practice. The cadaveric practice is essential to get used to operate together with curved instruments and angular endoscopes in narrower EAC of asian people. The frontal sinus FESS-like posture not only place the endoscope at safer place of hypotympanum but also

acquire more operation fields of attic/antrum and prevent doing harm to facial nerve and stapes as the conflict of endoscope and instrument in right ear surgery. With flexible-tip endoscope inspection of attic/antrum and regular post-operative follow up, the minimal invasive TEES, a.k.a Functional EES cholesteatoma surgery could be achieved on the limited cholesteatoma, increasing proportion in the developed country like Taiwan.

As the frequently encountered condition of the cholesteatoma visible but out of reach in TEES with conventional instruments, the curved instruments and angular endoscopes are gradually developed and adopted in clinical practice. The cadaveric practice is essential to get used to operate together with curved instruments and angular endoscopes in narrower EAC of asian people. The frontal sinus FESS-like posture not only place the endoscope at safer place of hypotympanum but also acquire more operation fields of attic/antrum and prevent doing harm to facial nerve and stapes as the conflict of endoscope and instrument in right ear surgery. With flexible-tip endoscope inspection of attic/antrum and regular post-operative follow up, the minimal invasive TEES, a.k.a Functional EES cholesteatoma surgery could be achieved on the limited cholesteatoma, increasing proportion in the developed country like Taiwan.

doi:10.1017/S002221511600520X

ID: IP024

Characteristic of geno-phenotype on GJB2 p.V37I Variant Knock-in Mice

Presenting Author: **Ying Chen**

Ying Chen, Ying Chen, Xueling Wang, Changling Sun, Xin Lin, Lingxiang Hu, Tao Yang, Hao Wu
Ear Institute, Shanghai Jiaotong University School of Medicine, Shanghai, China

Learning Objectives: To explore the phenotype of mice segregating the highly prevalent human GJB2 p.V37I variant and their differently expressed genes.

Materials and Methods: Mice from the same brood separately were divided into p.V37I Knock-in group with poorer hearing (KI, n = 10) and wild-type group (WT, n = 10). ABR was practiced every four weeks from 6-week-old to 50-week-old. Cochlears were dissected separately from 50-week-old mice for confocal immunofluorescence to count the number of hair cell. Another six 5-day-old mice also from same brood of each group were killed for cochlear. The RNA of harvested tissues were extracted and examined for analysis of Illumina MouseWG-6 v2 Expression Beadchip to compare the expression patterns by groups. Q-PCR were prepared for validation for results of the Mice Beadchip.

Results: KI group revealed progressive hearing loss from 30-week-old compared with WT group ($P = 0.002$), especially on frequencies of 4k, 24k and 32kHz. After dyeing by confocal immunofluorescence, it was found that 3 of 100 hair cells of middle and apical turn were missing under each field of microscope in KI group. The beadchip identified 929 up-regulated and 897 down-regulated expressed genes compared KI with WT group. Genes expressed in the

cochlear from the ten most differently bi-regulated candidate genes were chosen for further q-PCR validation. As a result, *Fcer1g*, *Nnmt*, *Lars2* (up-regulated) and *Cuedc1* (down-regulated) genes were proved to be differentially expressed between KI and WT group.

Conclusion: *GJB2* p.V37I KI mice presented progressive late-onset hearing loss with depletion in numbers of hair cell. *Fcer1g*, *Nnmt*, *Lars2* and *Cuedc1* genes were proved to be differentially expressed between KI and WT group.

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ID: IP025

An ear microsurgery trainer for low-resource settings

Presenting Author: **Matthew Clark**

Matthew Clark¹, James Mitchell², James Morris³, Brian Westerberg⁴

¹Gloucestershire Royal Hospitals NHS Trust, ²ENT Dept, Frimley Park Hospital, ³ENT Dept, Gloucestershire Royal Hospitals NHS Trust, ⁴Clinical Professor, Department of Surgery, University of British Columbia

Learning Objectives

Introduction: The World Health Organisation has identified chronic suppurative otitis media as a neglected condition affecting up to 330 million people worldwide, the burden of the disease located in impoverished countries. There are huge socioeconomic implications that support any progress towards the correct management of otorrhoea. The recent Lancet Commission on Global Surgery highlighted the need for NGOs to hardwire training into their programmes and that low cost simulation would be one avenue by which this might be achieved. With this in mind, we aimed to develop an ear surgery simulator appropriate for training in resource poor settings and to demonstrate its effectiveness in facilitating acquisition of headlight and microsurgical skills necessary to perform procedures via the ear canal, safely.

Methods: A low-fidelity ear trainer was designed to emulate the ear canal and middle ear space. Face validity was assessed via questionnaires. Six tasks were developed, from headlight foreign body removal through to microscope-orientated tasks of foreign body removal, ventilation tube insertion, tympanomeatal flap raising, myringoplasty, and middle ear manipulation skills.

Novices (medical students), those with limited otology experience (junior ENT doctors) and experts (consultant otologists) were video-recorded performing each task. Videos were scored by a blinded observer, using a validated measurement tool and specially adapted task-specific checklist, in order to assess construct validity.

Results: Face validity results confirmed that ET was a realistic representation of the ear. Construct validity results showed a statistically significant trend with experts

performing better than those with limited experience performing better than novices.

Conclusion: This study validates ET as a useful training tool to assess headlight and microsurgical skills required to perform otologic procedures. Further testing is now planned in the developing world setting.

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ID: IP026

Bioactive glass for obliteration after subtotal petrosectomy

Presenting Author: **David Colnot**

David Colnot, Pepijn Borggreven, Jasper Quak
Diakonessenhuis Utrecht

Learning Objectives: Bioactive glass granules can be used as an alternative filler material for obliteration after subtotal petrosectomy.

Introduction: Subtotal petrosectomy for chronic suppurative otitis media requires obliteration of the mastoid cavity and middle ear space. Generally, abdominal fat is used for this purpose. A considerable risk of using fat is infection, which might require revision surgery. The use of bioactive glass granules seems an attractive alternative since the granules have antibacterial properties.

Methods: A 59 year old male patient with a history of chronic suppurative otitis media of the right ear, complicated by a sudden profound perceptible hearing loss was already treated with a mastoidectomy 6 years ago and thereafter extensively treated conservatively. Because of recurrent chronic otorrhoea and pain we decided to perform a subtotal petrosectomy with blind sac closure of the external ear canal, closure of the Eustachian tube, and obliteration of the cavity with S53P4 bioactive glass granules (BonAlive Biomaterials Ltd., Turku, Finland). A wound drain was kept in place for 7 days.

Results: No complications occurred peri-operatively and a dry ear was obtained with complete relief of pain. Duration of follow-up is now 6 months and no late adverse events were observed.

Conclusions: S53P4 bioactive glass granules are feasible to use for obliteration after subtotal petrosectomy. Elimination of chronic suppurative otitis media can be achieved with this technique. Bioactive granules might be an alternative for abdominal fat, which has a risk of infection.

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ID: IP027

Long-Term Hearing and Functional Outcomes and Complications after Ossiculoplasty

Presenting Author: **Matthew Cox**

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

Learning Objectives: To review hearing results, long-term outcomes, and complications after ossiculoplasty.

Patients: 464 patients (3-88 years of age) undergoing ossiculoplasty with tympanoplasty or tympanomastoidectomy using cartilage tympanic membrane grafts, retrograde mastoidectomy with canal wall reconstruction or mastoid obliteration techniques between 1998 and 2012. All patients had at least 1 year of clinical follow-up.

Outcome Measures: Early and late audiometric outcomes, rate of successful air-bone gap closure and tympanic graft healing, and incidence of long-term complications.

Results: Hearing results were assessed in all patients with 1 year of longer of audiometric follow-up. There was no significant difference between adults and children for early hearing results (average post-op PTA-ABG [pure tone average air-bone gap] was 18.2 dB vs. 19.6 dB, respectively; $p = 0.306$), late hearing results (average final PTA-ABG was 18.6 dB vs. 19.4 dB, respectively; $p = 0.439$), or rate of air-bone gap closure to less than 20 dB (63.1% vs. 58.0%, $p = 0.282$). Complications were assessed in patients with 5+ years of clinical follow-up. Smoking was not found to have a significant impact on hearing results, but smokers had a significantly increased incidence of complications, as compared to non-smokers (34.7% vs. 14.0%, respectively; $p = 0.0003$). Revision surgeries were required in 10.3% of patients, and half of these revisions occurred more than 5 years after the initial surgery.

Conclusions: In uncomplicated cases, hearing results remain stable in the long term following ossiculoplasty. Failures of ossiculoplasty, complications and recurrence of conductive hearing loss may occur at any time, with half of revisions occurring more than 5 years after the initial surgery.

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ID: IP028

Mastoid Obliteration – A case series review of our practice and a financial case to do more?

Presenting Author: **Paula Coyle**
 Paula Coyle, Clair Saxby, James Quinn
Lister Hospital

Learning Objectives: To collate a review of our experience with mastoid obliteration over the last ten years. Evaluate the cost effectiveness of mastoid obliteration in the chronically discharging ear.

Introduction: The chronically discharging ear after open mastoid surgery for cholesteatoma can be problematic to manage for the Otolaryngologist requiring numerous appointments. In the current climate of cost saving within the NHS,

we must balance clinical evidence and cost. We review our practice of Mastoid obliterations in our district general hospital in the UK over the last ten years to look at both success and cost.

Methods: All the notes of patient who had mastoid obliteration over the last ten years were reviewed. The cases were found by going through the theatres scheduling records. We reviewed the preoperative, intraoperative and postoperative course of each patient. We report on our technique, the success rate of improving symptoms, audiogram changes and complications. We compare the monetary costs of the patient's preoperative versus operative and postoperative costs.

Results: There were 14 patients, six male and eight female with an mean age of 46.7years. They had been listed for mastoid obliteration due to chronically discharging ear. All mastoid cavities were obliterated with bone dust, fat and fascia lata graft. Postoperatively patients reported their symptoms had improved and some also reported quality of life improvement including confidence and embarrassment in social situations. Subjectively some patients even reported their hearing had improved and leaving a small dip in the obliterated cavity of the external auditory canal for a conventional ear-level hearing aid was a bonus for patients. Patients preoperative costs and therefore presumed continued costs, justified the operation and postoperative costs.

Conclusions: We conclude that in the correct patient group mastoid obliterations are beneficial to both the patient and the NHS.

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ID: IP029

Cholesteatoma Decoded – Indian Scenario

Presenting Author: **Jyoti Dabholkar**

Jyoti Dabholkar, Arpit Sharma, Jaini Lodha,
 Abhishek Kumar
King Edward Memorial Hospital

Learning Objectives: 1. Complete eradication of disease by adequate exposure, proper saucerisation of mastoid cavity, adequate lowering of the facial ridge and wide meatoplasty are four main principles for a dry cavity. 2. Obliteration in select cases is required to create an optimum sized cavity. 3. Hearing improvement, though secondary, is vital and should be attempted if eustachian tube function allows.

Introduction: Cholesteatoma continues to pose a significant challenge to otologic surgeons, especially in developing countries. Challenges include: advanced stage with extensive spread, complications at presentation and different degrees of expertise of treating physicians. Being a tertiary care centre, we are faced with above problems and revision surgeries. This study was conducted to understand the behavior of cholesteatoma, intraoperative findings and to assess results in terms of cavity status and hearing outcome.

Materials and methods: This prospective study was conducted at KEM Hospital, India in 216 patients operated

from 2010 to 2013 by a single surgeon with 2.5 years follow-up. Patient demographics, intraoperative disease induced changes and postoperative outcomes were analyzed.

Results: Of the 216 patients, 119 had primary and 73 had secondary cholesteatoma. 24 patients were referred for residual/recurrent disease and 48 presented with one or more complications. Erosion of sinus plate was seen in 9 and dural plate in 16 cases. Sinodural angle was involved in 28, sinus tympani in 40 and facial recess in 45 cases. Facial nerve was dehiscient in 53 cases. All patients underwent canal wall down mastoidectomy as a rule. Mastoid obliteration was done in 40 cases. Hearing mechanism was reconstructed by tympanoplasty – type 3 (116), type 4 (38) and type 2 using autologous incus (32). 26 patients underwent staged procedure and 4 required cul-de-sac closure. Dry cavity was achieved by an average of 1.75 months. Recurrence was seen in 1 patient.

Conclusion: Complete eradication of disease by adequate exposure, proper saucerisation of mastoid cavity, adequate lowering of the facial ridge and wide meatoplasty are four main principles for a dry cavity. Obliteration in select cases is required to create an optimum sized cavity. Hearing improvement, though secondary, is vital and should be attempted if eustachian tube function allows. A good follow-up is always essential.

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ID: IP030

Successful early loading of a BAHA (Bone Anchored Hearing Aid) in a patient with learning difficulties

Presenting Author: **Nicholas Dawe**

Nicholas Dawe¹, Ian Johnson²

¹Freeman Hospital, Newcastle upon Tyne,

²Department of ENT, Freeman Hospital, Newcastle upon Tyne

Learning Objectives: Early loading of the BAHA abutment is feasible, safe and provides evidence for a change of clinical practice to ever shorter loading times.

Introduction: BAHA placement is routinely undertaken as a single stage process. Loading is performed at an interval period – usually six days – to allow for osseointegration. We report the successful early loading of a BAHA, at four hours post-operatively, undertaken as a result of hearing loss on a background of learning difficulties in a paediatric patient with Down's syndrome and autism. Satisfactory short and long-term outcomes are reported.

Methods: Case Report.

Results: A 16-year-old male with Down's syndrome and autism underwent a left BAHA placement. A conventional hearing aid had not been tolerated by the patient. Since the age of 9, a soft-band device had been trialled and had been well tolerated.

The procedure involved single-stage placement of a 4 mm implant with 10 mm abutment, performed via the FAST technique, using a curvilinear incision.

Post-operatively the patient was agitated and it was elected to load the abutment early, at four hours, to overcome difficulties in communication.

The initial intra-operative resonance frequency analysis (RFA) stability measurement was 49 (implant stability quotient (ISQ) 65 units after correction for abutment length). Medium and long-term follow-up at 12 months confirmed maintenance of implant stability by maintained ISQ values. No local complications occurred.

Conclusions: A successful outcome following early loading of the BAHA abutment was achieved, and is considered the earliest recorded BAHA loading described in the literature. The procedure is predicated upon the use of real time RFA measurement.

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ID: IP031

Pediatric cholesteatoma surgery : results of cartilage block ossiculoplasty

Presenting Author: **Francoise Denoyelle**

Francoise Denoyelle¹, Jérôme Nevoux², Pierre Chauvin³, Noël Garabédian⁴

¹Necker Children's Hospital, APHP and Paris Descartes University, Paris France,

²Otolaryngology and Head and Neck Surgery Department, Bicêtre Hospital and Paris XI University, ³Department of Public Health, Saint Antoine Hospital, Paris VI University,

⁴Pediatric Otolaryngology and Head and Neck Surgery Department, Necker Children's Hospital, APHP and Paris Descartes University, Paris France

Learning Objectives: To assess the efficacy and long-term stability of partial ossicular chain reconstruction using autologous cartilage.

Objective: To assess the efficacy of partial ossicular chain reconstruction using autologous cartilage.

Design and setting: Retrospective study, Tertiary academic children's hospital.

Patients: Two hundred forty-eight children (268 ears) underwent partial ossicular chain reconstruction using a shaped block of tragal cartilage interposed between the head of the stapes and an underlay tympanic membrane reconstruction along with tragal cartilage and its perichondrium.

Main Outcome Measures: Anatomical and audiologic results were evaluated according to the American Academy of Otolaryngology–Head and Neck Surgery guidelines. X2 Tests and multivariate analysis were used for statistical evaluation.

Results: Mean age at surgery was 10.9 years. Single stage surgery was performed in 124 ears (46.3%) (62.9% for cholesteatomas and 32.3% for retraction pockets). Second-look patients (53.7%) included 93.8% of staged surgery. Audiometric results were available for 222 ears at 1 year and for 78 ears at 5 years. Closure of the average air-bone gap (ABG) to within 20 dB was achieved in 62.2% of ears at 1 year. The mean (SD) preoperative and 1-year postoperative ABGs were 25 (11.8) dB and 18.9 (10.3) dB, respectively. Anatomical results were satisfactory in 87.3%. No cases of extrusion, resorption, or displacement of the cartilage were encountered. No statistically significant difference was found between audiometric results at 1 and 5 years. Multivariate analysis showed a significant negative correlation between preoperative and postoperative ABGs and between postoperative otitis media with effusion and postoperative ABG ($P_{.05}$).

Conclusions: Cartilage block ossiculoplasty is a reliable technique for partial ossicular replacement. Long-term hearing outcomes remain stable and satisfactory. Preoperative ABG and postoperative otitis media are the predictive factors of the hearing outcome.

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ID: IP032

Congenital Cholesteatoma Associated With Congenital Ossicular Anomalies

Presenting Author: **Qiang Du**

Qiang Du¹, Yasheng Yuan², Fanglu Chi²

¹Eye, Ear, Nose and Throat Hospital, Fudan University, Shanghai, China, ²Department of Otolaryngology and Skull Base Surgery, Eye & ENT hospital of Fudan University

Objective: The purpose of this study is to describe and analyse the clinical features of congenital cholesteatomas associated with congenital ossicular anomalies.

Method: The clinical data of eight non-syndromic patients who were diagnosed congenital cholesteatomas associated with congenital ossicular anomalies were reviewed retrospectively. The clinical data included sex, age, symptoms, signs, audiological results, temporal bone computed tomography scan, intraoperative findings, management, pathological findings and follow-up results.

Results: In three cases, external ear anomalies were accompanied. In one case, an atretic plate replaced a normal tympanic membrane. In seven cases, the cholesteatoma was in the postero-superior tympanum. Only in one case, the cholesteatoma was in the anterior-superior tympanum. The ossicular anomalies were mainly incus and/or stapes anomalies. In seven cases, the ossicular chain was reconstructed after removal of the cholesteatoma. In the other case, reconstruction of the ossicular chain had been given up because of the absence of the oval window. In three cases, the hearing ability had improved. In two cases, hearing ability did not

change. All these five cases had no evidence of recurrent or residual cholesteatoma. The other three cases had been lost contact.

Conclusion: Congenital cholesteatomas associated with congenital ossicular anomalies is rare. The cause seems to be developmental abnormalities of the first and the second branchial arches.

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ID: IP033

Transcanal Endoscopic Approach for Holotympanic Cholesteatoma

Presenting Author: **Manuela Fina**

Manuela Fina

Assistant Professor, University of Minnesota

Learning Objectives: This narrated eight minutes video lecture demonstrates the surgical anatomy and the surgical steps involved in eradication of a holotympanic cholesteatoma through an exclusive transcanal endoscopic approach with preservation of the middle ear space and mastoid antrum and avoidance of a radical mastoidectomy.

Objective: This narrated surgical video illustrates the transcanal endoscopic approach to a holotympanic cholesteatoma with extension in the sinus tympani and Eustachian tube. This video demonstrates the advantages of the endoscopic approach to visualize and gain access to disease in anatomical subsites that traditionally would have required a posterior tympanotomy and a radical mastoidectomy.

Methods: A pre-operative endoscopic exam and a CT scan of the temporal bone were obtained for surgical planning and assessing extension of the cholesteatoma. The surgery was performed under general anesthesia. Rigid 0 and 30 degree endoscopes, 3 mm in diameter and 14 cm in length were used and connected to a three chip video camera and high definition monitor. The surgical procedure was performed working from the images on the monitor.

Results: The holotympanic cholesteatoma was removed utilizing a transcanal endoscopic approach by direct visualization and removal of the disease from the retrotympanum, epitympanum, periantral mastoid cells and protympanum. Reconstruction of the tympanic membrane and attic defect was performed with a composite tragal cartilage graft. The mastoid antrum was not involved and was preserved intact.

Conclusions: Endoscopic ear surgery is a valuable surgical technique and offers wide field visualization of the retrotympanic space, attic, periantral mastoid space and protympanum. In this video a transcanal endoscopic approach is utilized to access and remove cholesteatoma involving the sinus tympani and the Eustachian tube with mastoid preservation and avoidance of a radical mastoid cavity.

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ID: IP034**A new look at middle ear adhesions: transcanal endoscopic approach to aditus block**Presenting Author: **Manuela Fina**

Manuela Fina

Assistant Professor, University of Minnesota

Learning Objectives: To illustrate the anatomy of the middle ear ventilation routes to the attic, to understand the pathophysiology that leads to aditus block syndrome and to show how to functionally restore the blocked pathways of ventilation.

Introduction: This narrated six minutes surgical video illustrates a novel concept to treat aditus ad antrum block syndrome through an exclusive transcanal endoscopic approach. Granulation tissue and mucosal webs obstructing the pathways of ventilation from the tympanic isthmus to the mastoid space are removed endoscopically with sparing of mastoidectomy and preservation of mastoid mucosa.

Methods: A pre-operative CT scan of the temporal bone was obtained for surgical planning. The surgery was performed entirely through a transcanal endoscopic approach with rigid 0 and 30 degree endoscopes, 3 mm in diameter and 14 cm in length, connected to a video camera and high definition monitor. Inflammatory granulation tissue and mucosal webs obstructing the movement of the ossicular chain and the ventilation routes to the mastoid were removed with sharp dissection without mastoidectomy. The routes of ventilation to the mastoid were re-established and irrigated through a transcanal endoscopic limited atticotomy and the small scutal defect was repaired with a cartilage graft.

Results: Inflammatory granulation tissue and mucosal webs obstructing the pathways to mastoid ventilation were removed successfully through a transcanal endoscopic approach with integrity of the mastoid space and preservation of mastoid mucosa.

Conclusion: This endoscopic minimally invasive novel approach to mastoid ad antrum block syndrome focuses on functional restoration of the aeration pathways through the tympanic isthmus instead of removal of disease through mastoidectomy. With this approach the epitympanic and mastoid mucosa is preserved to maintain the important function of mucosal gas exchange, buffer mechanism and homeostasis of middle ear ventilation.

doi:10.1017/S0022215116005314

ID: IP035**Endoscopic Combined Approach for Attic Cholesteatoma with Mastoid Extension**Presenting Author: **Manuela Fina**

Manuela Fina

Assistant Professor, University of Minnesota

Learning Objectives: This eight minutes narrated surgical video demonstrates the surgical principles of the combined endoscopic and microscopic approach for an extensive epitympanic cholesteatoma with mastoid extension.

Introduction: This narrated video lecture illustrates the indications to utilize a combined technique with transcanal endoscopic atticotomy and microscopic mastoidectomy for cholesteatoma with mastoid antrum extension in a pediatric case.

Methods: A pre-operative endoscopic exam and a CT scan of the temporal bone were obtained for surgical planning. The endoscopic portion of the surgery was performed with rigid 0, 30 and 45 degree endoscopes, 3 mm in diameter and 14 cm in length, connected to a three chip video camera and high definition monitor. A microscopic mastoidectomy was performed to remove disease in the mastoid antrum.

Results: Cholesteatoma was removed in its entirety through a combined endoscopic and microscopic approach. The cholesteatoma extended medially to the ossicular chain and the head of malleus and incus were removed. Ossicular chain reconstruction was performed with autologous incus. The atticotomy defect was reconstructed with a composite graft of conchal cartilage and perichondrium. The patient was free of disease at second look transcanal endoscopic surgery with excellent hearing result.

Conclusions: Endoscopic ear surgery offers wide field visualization of the attic space and the mastoid antrum. When cholesteatoma has extension into the mastoid space posteriorly to the point of reach of the endoscopic technique, a microscopic mastoidectomy is required for complete eradication of mastoid disease. This surgical case demonstrates how the endoscopic and microscopic surgical approach to cholesteatomas are not exclusive of each other but they can be utilized in combination to fully visualize and remove extensive disease.

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ID: IP037**A case of idiopathic oculostapedial synkinesis without history of facial nerve palsy**Presenting Author: **Keishi Fujiwara**Keishi Fujiwara¹, Yasushi Furuta², Shinya Morita¹, Atsushi Fukuda¹, Akihiro Homma¹, Takatsugu Mizumachi¹, Satoshi Fukuda¹¹Hokkaido University, ²Teine-Keijinkai Hospital

Learning Objectives:

Objective: To report a case of idiopathic oculostapedial synkinesis without facial nerve disorder.

Patient: A 30-year-old woman with tinnitus synchronous with eye closure is presented. The patient had no history of facial nerve disorder.

Result: An impedance audiometer, in the absence of an auditory stimulus, was used to record tympanic membrane compliance without sound stimulation, revealing decreased compliance in the concomitant with eye blinking. Her symptoms disappeared spontaneously, so no intervention was undertaken.

Conclusion: Although oculostapedial synkinesis is often observed as one of the sequelae of facial nerve palsy, idiopathic oculostapedial synkinesis is very rare. The use of an impedance audiometer in the absence of an auditory stimulus is very useful for demonstrating objective changes in the compliance of the tympanic membrane. It is assumed that the cause of the synkinesis in our case was abnormal transmission of signals for orbicularis oculi muscle to the stapedial and orbicularis oris muscles rather than misdirected regenerating fibers. Resection of the stapedial muscle tendon should be considered if her symptoms recur.

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ID: IP038

Factors influencing the decision-making of cochlear implantation in congenital hearing loss: A retrospective cohort study

Presenting Author: **Takashi Fujiwara**
Takashi Fujiwara

Kurashiki Central Hospital

Learning Objectives:

Background / Objective: Cochlear implantations (CIs) are well recognized and accepted treatment for severe to profound congenital hearing loss, but CIs are not performed because of malformation, family attitude and others. We conducted retrospective chart review to examine the clinical factors influencing the decision making of CIs in congenital hearing loss.

Study Design: Retrospective chart review.

Methods: We included bilateral congenital hearing loss children who first visited Ehime Welfare Center for the Handicapped from April 2007 to December 2015, and met the criteria of the indication for Csl. To examine factors associated with opt-out cochlear implantation, we performed univariate analyzes of following factors; age, sex, birth weight, maternal age, cochlear malformation, multiple organ abnormalities, severe handicap, deaf family and availability of CI-rehabilitation service.

Results: During the study period, 38 bilateral congenital hearing loss children met the criteria for cochlear implantation. Of 38 children, 10 children were unwilling to use CIs. In univariate analysis, severe handicap and deaf family are correlated with opt-out CIs.

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ID: IP039

Diffusion-weighted MR imaging for evaluation of cholesteatoma and the value of T1 weighted MR imaging in the exclusion of the false-positive

Presenting Author: **Atsushi Fukuda**

Atsushi Fukuda, Shinya Morita, Keishi Fujiwara, Takatsugu Mizumachi, Yuji Nakamaru, Akihiro Homma, Satoshi Fukuda

Hokkaido University Graduate School of Medicine

Learning Objectives:

Introduction: Magnetic resonance imaging (MRI) is becoming increasingly used as a tool for cholesteatoma diagnosis. The purpose of this retrospective study was to assess a role of T1 weighted imaging (T1WI) in diagnosing recurrent temporal bone cholesteatoma with Diffusion-weighted MR imaging (DWI).

Method: We studied 44 patients (45 temporal bones) with preoperatively suspected cholesteatoma. Each patient underwent an MRI examination including both DWI and T1WI. Diagnosis of cholesteatoma was based on the evidence of a high intense image on DWI. Results of MRI were compared with operative diagnosis.

Result: The patients were consisted of 24 males and 20 females, ranging in age between 8 and 87 (median age = 53). DWI accurately predicted the presence of cholesteatoma in 31 of 36 cases, and it correctly excluded in 5 of 9 cases. False positives included 2 cholesterol granulomas, 1 schwannoma, and 1 fibrosis. False negatives included 4 small keratin pearls, 1 wetter debris caused by infections. Overall sensitivity and specificity for detection of cholesteatoma were 86.1% and 55.6%, respectively. Positive predictive value and negative predictive value were 88.6% and 50.0%, respectively. Overall accuracy for detection of cholesteatoma was 80.0%. Only 5.6% of cholesteatomas (2/36) showed high intensity on T1WI, on the other hand, 75.0% of false positives (3/4) showed high intensity on T1WI. When diagnosis of cholesteatoma was based on the evidence of both high intensity on DWI and low or intermediate intensity on T1WI, overall accuracy for detection of cholesteatoma increased to 82.2%.

Conclusion: The combination of DWI and T1WI may improve specificity and overall accuracy for detection of cholesteatoma.

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doi:10.1017/S0022215116005375

ID: IP040**Clinical and diagnostic peculiarities of middle ear cholesteatoma course in children**Presenting Author: **Eugene V. Garov**

Eugene V. Garov, Alexey Ivoylov, Andrey I. Kryukov, Natalia L. Kunelskaya, Eugene V. Garov, Valentina R. Pakina, Ekaterina E. Garova

L.I. Sverzhovski Scientific Research Clinical Institute of Otorhinolaryngology of Moscow Municipal Health Department, Russia

Learning Objectives:

Goal: To study clinical and diagnostic peculiarities of middle ear cholesteatoma in children with chronic suppurative otitis media.

Materials and methods: 139 children with chronic suppurative otitis media (CSOM); (3 to 18 years). Collection of anamnesis of life, diseases, complaints, otoendoscopy, CT of temporal bones, audiologic and microbiologic studies.

Results: Chronic tube tympanic suppurative otitis media (CTTSOM) was diagnosed in 90 patients, chronic attic-antrol suppurative otitis media (CASOM) was diagnosed in 49. Bilateral process was identified in 20 patients, left sided process was diagnosed in 79 patients and right sided process was diagnosed in 60 patients. Duration of CSOM constituted 3–14 years in 78.5%, it started in age of 1–3 years. At CTTSOM perforation of ear-drum pars tensa occurred in 10(9.7%) patients, and central one occurred in 93(90.3%). At CASOM defect of pars flaccid occurred in 38(63.8%), and subtotal one occurred in 18 (36.2%). Monoflora: St.aureus (27), Ps.aeruginosa (22), St.epidermidis (11), Kl.pneumonia (10), Morganella morganii (7), Str.pyogenes (6), E.coli (5), 33 patients showed mixed flora at CASOM, 25 - didn't show flora growth at CTTSOM. Study of hearing: conductive hearing loss at CTTSOM and mixed form of hearing loss with hearing thresholds by bone conduction constituted 10.0 ± 0.6 dB- 20.0 ± 1.8 dB at CASOM, 100% speech discrimination without recruitment. CT-symptoms of middle ear cholesteatoma were diagnosed in 33 patients with CASOM, and in 8 - with CTTSOM. In all cases of follow-up cholesteatoma diagnosis was confirmed with intraoperative findings.

Conclusions: CASOM in children is followed by cholesteatoma development in 67.3% of cases, and CTTSOM is followed by cholesteatoma in 8.9%. Registration of sensorineural component, 100% speech discrimination, and absence of recruitment indirectly indicate to cholesteatoma process in ear. CT of temporal bones is a "golden standard" in diagnostics of ear cholesteatoma.

ID: IP041**Modern methods of chronic suppurative otitis media with cholesteatoma surgery**Presenting Author: **Eugene V. Garov**

Eugene V. Garov, Andrey I. Kryukov, Alexey Ivoilov, Nadezhda G. Sidorina, Ekaterina E. Garova

L.I. Sverzhovski Scientific Research Clinical Institute of Otorhinolaryngology of Moscow Municipal Health Department, Russia

Learning Objectives:

Goal: Choice of optimal variant of surgical intervention at middle ear cholesteatoma allowing to achieve curing and hearing improving (hearing keeping) effect at minimum surgical injury.

Materials and methods: 3,468 surgeries were performed on temporal bone structures, 2,415 (70%) of them were performed in patients with CTTSOM. Different variants of tympanoplasty were performed in 1,708 (70.7%) of patients and treating surgeries with tympanoplasty at middle ear cholesteatoma were performed in 594 (24.6%) patients.

Results: Cholesteatoma surgery confirms predomination of using of "closed" (54.6%) and "semi-open" (41%) variants of surgery. Transchannel (intrameatal and endaural) method is applied at limited cholesteatoma, and transmastoidal method is applied at advanced condition. Cholesteatoma relapses (up to 32%) at revision surgery after "closed" variants predefined the interest to "semi-open" methods, when posterior wall of external ear duct is removal for better treatment and the cavity created undergoes tympanoplasty and mastoidoplasty. Use of patient's material (fascia, gristle, periosteum and bone chips) at any variants of surgery provides rigidity of the constructions created to retraction and good adaptation in site of transplantation, as well as low cost of the method. Cholesteatoma in tympanic form is identified in 38% patients, that defines the necessity of early surgical intervention and careful revision of drum cavity. Choice of transchannel method and surgery only in scope of tympanoplasty is explained by its high efficiency in 92.4% patients with mesotympanitis.

Conclusions: Cholesteatoma of middle ear occurs at any form of CSOM. The choice of its successful surgical treatment is based on diagnostics combined with modern methods of verification and use of efficient treating methods of surgery with elements of reconstruction of middle ear structures.

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ID: IP042**“Phone a friend” - three challenging cases, one invaluable friend**Presenting Author: **Sherif Habashi**Sherif Habashi, Daniel Gjoni, Nazan Can Guru Naidu
*Royal Free London NHS Foundation Trust**Learning Objectives:* Developing a close relationship with a senior colleague who is readily accessible in an emergency early in one's career can pay huge dividends.*Introduction:* No matter how long a surgeon has been in practice, from time to time they will inevitably find themselves in an unexpected situation where they are in difficulty and out of their depth. At such times it is vital to know where to turn for help.*Method:* We describe three cases over a 20 year period which illustrate the value of having such a friend and colleague to turn to.

Case 1: a 60 year old female who had undergone a modified radical mastoidectomy over 20 years previously. She had had several episodes of facial palsy associated with an infected mastoid cavity which had resolved after microsuction under GA. On this occasion a complete palsy persisted for 3 weeks despite microsuction and a decision was made to explore the ear. The nerve was found to be dehiscent and attenuated to less than a quarter of its normal calibre at the second genu. Telephone advice was to excise the damaged segment, mobilise, reroute and perform primary end to end anastomosis.

Case 2: a 50 year old female presented with a persistent ear discharge after grommet insertion for a middle ear effusion. CT imaging suggested chronic mastoiditis, however, upon exploration a dehiscent tegmen and middle fossa dura was found with herniated temporal lobe and profuse CSF leakage. Telephone advice was to resect the herniated brain, repair the dura with fascia, crushed muscle and Surgicel before obliterating the mastoid.

Case 3: a 10 year old girl undergoing tympanoplasty had life-threatening bleeding from a dehiscent and massively dilated sigmoid sinus. Telephone advice was to repair the leak with fascia, crushed muscle, Floseal, Surgicel and bone wax.

Results: The first patient recovered facial nerve function to HB grade 2–3. The second and third patients had uneventful and complete recoveries without the need for further surgery.*Conclusion:* Contacting an experienced colleague by telephone from the operating theatre can often save the day.

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ID: IP043**Ten years after the 7/7 bombings - an otologic perspective**Presenting Author: **Sherif Habashi**Sherif Habashi, Ghous Handoo
*Royal Free London NHS Foundation Trust**Learning Objectives:* Physical injuries suffered by victims of terrorism may be identical to those caused by accident. However, the psychological impact of terrorism may worsen the prognosis for fully recovery. It is important that victims of terrorism receive the most expert assistance at the earliest possible stage if they are to have the best chance of complete recovery from their physical injuries.*Introduction:* The London bombings of 7th July 2005 left 56 dead (including the perpetrators) and over 700 injured. Ear damage is extremely common following exposure to explosions. Those injuries include tympanic membrane rupture, which may or may not heal spontaneously, sensorineural hearing loss, tinnitus, and vestibulopathy. The prognosis is variable and may be influenced by many factors.*Method:* We present three patients treated in our institution who each suffered ear damage during the 7/7 bombings.

Case 1: a 19 year old autistic man sustained a ruptured left tympanic membrane and when initially seen had an actively discharging middle ear. Microsuction was performed and topical antibiotic drops prescribed.

Case 2: a 60 year old civil servant sustained a central tympanic membrane perforation with associated mixed hearing loss and tinnitus. After this failed to heal tympanoplasty was performed.

Case 3: a 21 year old lady sustained bilateral tympanic membrane perforations which failed to heal. She underwent surgery on both ears including revision on the first side.

Results: The first patient's tympanic membrane healed spontaneously but he represented several times with otitis externa in the previously damaged ear. The second patient's surgery was successful in closing the perforation but he is left with persistent tinnitus and is now using hearing aid. The third patient had an iatrogenic middle ear cholesteatoma following her first operation resulting in ossicular erosion. After revision surgery and repair of the contra lateral perforation she had been left with mild bilateral hearing loss. 10 years on she has tinnitus which at times is disabling, recurrent BPPV and chronic imbalance.*Conclusion:* Blast injury to the ear can result in a spectrum of injuries which may or may not leave lasting disability. The psychological trauma inflicted on victims of terrorism can have a significant impact on their ability to cope with tinnitus and vestibular symptoms.

doi:10.1017/S0022215116005405

ID: IP044**Life Threatening Bleeding during Tympanoplasty in a Child**Presenting Author: **Sherif Habashi**

Sherif Habashi, Vijendra Ingle
Royal Free London NHS Foundation Trust

Learning Objectives: A high jugular bulb is a common vascular anomaly and the possibility of dehiscence should always be anticipated when pre-operative imaging is not available. If it is accidentally damaged and bleeding occurs, the ear should be packed and the procedure abandoned.

Introduction: Anatomic variations of the venous sinuses of the dura mater, however infrequent, may present puzzling diagnostic and operative problems. A high dehiscent jugular bulb is one of the most common and if not anticipated can present a hazard when performing middle ear surgery.

Method: We report the case a 10 year old girl with bilateral dry central tympanic membrane perforations who was admitted for right tympanoplasty. Through a post-aural approach temporalis fascia was harvested and the edges of the perforation freshened. A tympano-meatal flap was raised and as the annulus was lifted a sudden gush of blood ensued. A dehiscent jugular bulb was recognised. Instead of simply packing the ear and abandoning the procedure a decision was made to explore the mastoid in an attempt to control bleeding by compressing the sigmoid sinus so that the procedure could be completed. This greatly worsened the problem as the sigmoid sinus was huge, dehiscent and totally filling the mastoid. This started to bleed even more profusely. Telephone advice was sought from an eminent skull base surgeon who warned that an attempt to occlude the sigmoid sinus could compromise cerebral venous drainage if the contralateral sinus was vestigial. He advised the use of Floseal, Sugicel, crushed temporalis muscle and bone wax. Haemostasis was rapidly achieved and the tympanoplasty completed.

Result: Post-operative recovery was uneventful. Successful closure of the perforation and improved hearing was achieved. Subsequent CT scanning showed good venous flow bilaterally (images).

Conclusion: A high jugular bulb is a common vascular anomaly and the possibility of dehiscence should always be considered when pre-operative imaging is not available. The decision to open the mastoid instead of simply packing the ear canal and abandoning the procedure was misguided and could easily have resulted in serious complications. It should not have been considered in the absence of pre-operative imaging.

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ID: IP045

The Role of Surgery in the Management of Malignant (Necrotising) Otitis Externa

Presenting Author: **Sherif Habashi**

Sherif Habashi, Ferzana Islam, Daniel Gjoni
Royal Free London NHS Foundation Trust

Learning Objectives: To highlight the role of surgery in the management of malignant (necrotising) otitis externa.

Introduction: Malignant (Necrotising) Otitis Externa (MOE) was first described in 1959 as a pseudomonas osteomyelitis of the temporal bone in an elderly diabetic. Subsequent single case reports appeared in the literature. It was said to be an extremely rare condition. Although a number of early publications reported surgical intervention, the prognosis was very poor and the mortality high. By the time the senior author was in training, the standard teaching was that surgery had no role to play in the management of MOE.

Over the past 20 years our experience has been that the incidence of MOE has increased dramatically. The role of fungal infection in conjunction with pseudomonas may make successful treatment more difficult.

In a small but significant number of our patients surgery has been used as an adjunct to medical therapy.

Methods: We report a series of 4 patients with MOE who all had tympanomastoid surgery as part of their treatment. All had had uncontrolled pain and in two cases facial palsy was an indication. In one the palsy had been present for over three months.

Results: Following surgery all four patients had significant and rapid control of their pain. The two patients who had had facial palsies both recovered, one completely and rapidly and the other to a House-Brackmann grade II after 9 months.

Conclusions: We are seeing far more patients with MOE than ever before. We postulate why this might be.

While aggressive medical therapy is vital, surgery should be considered in the management of patients with MOE when the symptoms and clinical signs are progressing despite adequate medical treatment. Facial palsy should be considered as an indication for early surgery in MOE just as it would be in other inflammatory diseases of the temporal bone.

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ID: IP046

Transmastoid middle fossa craniectomy for the supralabyrinthine lesion

Presenting Author: **Masashi Hamada**

Masashi Hamada, Kyoko Odagiri, Momoko Tsukahara,
Masahiro Iida
Tokai University

Learning Objectives:

Introduction: For a petrous apex lesion with serviceable hearing, the middle fossa (MF) craniotomy combined with transmastoid approach (TMA) is usually selected to preserve the labyrinth. However, this combination seems too invasive if the pathology is localized rather laterally. We have made a technical modification on TMA so that we can access a supralabyrinthine lesion more easily with an addition of partial MF craniectomy.

Case presentations: Case 1 was a 31-year-old female with right conductive hearing loss and no episodes of facial paralysis. CT/MRIs revealed a facial neuroma located in the genu through the tympanic segment. During the TMA the tumor was found to involve the labyrinthine segment, and thereby supralabyrinthine MF plate was drilled out to search the normal facial nerve proximally. This addition of partial craniectomy facilitated successful removal and cable graft.

Case 2 was a 42-year-old male with right conductive hearing loss. CT scans showed an epitympanic cholesteatoma extending to supralabyrinthine cells. Since the pathology was intraoperatively found to extend over the labyrinth and to invade the superior semicircular canal, tentative removal of the MF plate was decided during the TMA to achieve the complete removal without damaging the labyrinth.

Discussion: MF craniotomy usually needs an assistance of neurosurgeons, and therefore this approach seems difficult to add to TMA in a single operation depending on the intraoperative findings. Supralabyrinthine lesions still have a chance to be removed via TMA alone. If the pathology is found to extend more medially than expected during the TMA, an additional removal of the MF plate enables us to treat the lesions more easily under the more familiar surgical view.

Conclusion: Transmastoid MF craniectomy provides ear surgeons with better surgical access for laterally localized lesions in the petrous apex, and is indicated into supralabyrinthine cholesteatomas and facial neuromas.

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ID: IP047

The Natural History of Advanced Pars Tensa Retraction Pockets

Presenting Author: **John Cutajar**

John Hamilton, John Cutajar, Maryam Nowghani
Gloucestershire Hospitals NHS Trust

Learning Objectives:

Intro: The limited evidence available to guide management has rendered very controversial the management of pars tensa retraction pockets.

Since 2003, we have adopted a policy of minimal intervention for pars tensa retraction pockets and this has allowed us to monitor the natural behaviour of this disorder.

Method: Successive patients with pars tensa retraction pockets that a) contacted the promontory yet b) were not accumulating keratin (“advanced retraction pockets”) have been monitored at least once a year and followed either until surgery was required, the patient was lost to follow-up or some other pathology intervened. Follow-up was censored at five years.

Results: 95 cases were enlisted and followed up.

25% ears advanced to need surgery.

40% ears remained advanced without further progression.

38% ears returned to normal.

4% ears developed pars tensa perforation.

3% ears developed attic cholesteatoma.

Conclusions: Only a minority of advanced pars tensa retraction pockets progress to require surgery.

More advanced pars tensa retraction pockets return spontaneously to normal than progress to require surgery.

Some ears that present with a retracted pars tensa progress to develop attic retraction and then attic cholesteatoma, without developing cholesteatoma via the pars tensa.

Learning Points: It is not correct to consider an advanced pars tensa retraction pocket as necessarily pre-cholesteatoma.

Because most advanced pars tensa retraction pockets do not progress to become cholesteatoma, surgery on advanced pars tensa retraction pockets cannot be justified on the grounds that it is prophylaxis against the development of cholesteatoma.

Attic and pars tensa retraction disease sometimes have a common aetiology.

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ID: IP048

Posterior ear canal reconstruction as a simple alternative to mastoid obliteration

Presenting Author: **Andrew Beynon-Phillips**

John Hamilton¹, Andrew Beynon-Phillips²
¹Gloucestershire Hospitals NHS Trust, ²Queen Elizabeth Hospital Kings Lynn NHS Trust

Learning Objectives:

Intro: The treatment of discharging mastoid cavities is hampered by long-term deterioration of the surgical reconstruction.

We hypothesised that it would be optimal to use a graft that would become incorporated into, and indistinguishable from the skull bone.

We developed a simplified technique of posterior canal wall reconstruction using a free cortical bone graft in patients who have discharging mastoid cavities.

Method: Technique: Reconstruction of the posterior canal wall with a free cortical bone graft harvested from the cortex of the mastoid process.

Patients: 40 patients with discharging mastoid cavities.

The following were assessed at one year following surgery:

1. Integrity of the barrier formed by the cortical bone graft.
2. Integrity of the keratinising epithelium of the ear canal.
3. Patient report of ear discharge.

Results: Adequate bone grafts were obtainable in all cases.

An intact barrier between the mastoid cavity and a new, physiological ear canal were maintained at one year in all cases, bar one, when a recurrent cholesteatoma developed through a defect between the graft and facial ridge, whereafter the technique was modified.

All but one patient grew intact keratinising epithelium lining their ear canal and tympanic membrane. Healing was initially prolonged, so a pericranial flap was incorporated into the technique.

All but one patient reported a dry ear at one year.

The small number of revision operations allowed us to confirm that the bone grafts had become fully incorporated into the temporal bone.

Conclusions: Reconstruction of the posterior ear canal using a cortical bone is an effective procedure for treating mastoid cavities which are unstable and symptomatic.

Learning Points: Cortical bone becomes vitalised and incorporated into the skull and so has the potential to be exceptionally robust in the long term.

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ID: IP049

A pilot study to investigate the therapeutic effect of Valsalva maneuver on otitis media with effusion in adults

Presenting Author: **Jung ju Han**

Jung ju Han¹, Woo Jin Kim¹, Dong Kee Kim², So Young Park³, Hyun Yong Lee¹, Hyun Woo Lim¹, Shi Nae Park¹

¹The Catholic University of Korea, Seoul St. Mary's Hospital, ²The Catholic University of Korea, Daejeon St. Mary's Hospital, ³The Catholic University of Korea, Yeouido St. Mary's Hospital

Objectives: This pilot study was performed to investigate the therapeutic effect of Valsalva maneuver on otitis media in adults and to evaluate the prognostic factors for the good response.

Materials and methods: Thirty nine ears of 32 adult patients who were diagnosed as otitis media with effusion and managed by one-week Valsalva maneuver (>30/day) without any other medication were included in this study. Its therapeutic efficacy was evaluated and the prognostic factors which predict the response of Valsalva maneuver were analyzed by comparing various clinical and audiologic factors between success and failure groups.

Results: Mean duration of otitis media in the study subjects was 30.9 days (SD 31.6 days). Success rate of 1-week Valsalva maneuver as a single therapeutic modality was up to 64.1% (25/39 ears) and hearing were significantly recovered in success group. No recurrence or side effects were observed. Successful Valsalva maneuver checked and confirmed as bulging of tympanic membrane by otoendoscopic examination was an excellent indicator for therapeutic response in a week. ($p < 0.05$) Age, sex, duration of otitis media, history of previous upper respiratory tract infection, initial hearing levels and type of audiogram were not significant prognostic factors for therapeutic efficacy of Valsalva maneuver. *Conclusion:* One-week Valsalva maneuver

seems to be considered as a first line therapeutic modality in otitis media with effusion in adult patients who demonstrate the successful maneuver result on oto-endoscopic examination.

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ID: IP050

Temporal bone HRCT features of the congenital middle ear cholesteatoma

Presenting Author: **Yuechen Han**

Yuechen Han¹, Zhaomin Fan², Dong Chen², Li Li², Zhen Jiang², Haibo Wang²

¹Eye & Ear Infirmary of Shandong Provincial Hospital Group, ²Department of Ear Surgery, Eye & Ear Infirmary of Shandong Provincial Hospital Group

Learning Objectives:

Objective: To find out the features of the temporal bone high resolution computer tomography (HRCT) of the congenital cholesteatoma of middle ear.

Method: The HRCT image of 29 patients (30 ears) of congenital middle ear cholesteatoma were reviewed retrospectively and the location of the lesion, the type of mass, the erosion of the ossicular chain and other malformation of the middle ear were Investigated. All of the cases were confirmed by operation and pathology.

Result: Of these 29 patients (30 ears) with congenital middle ear cholesteatoma, the cholesteatoma localized to the tympanic cavity in 18 patients while the mastoid cavity was involved together with the tympanum in 12 ears. According to the shape of the mass, 21 cases were classified as open type while the other 9 cases were close type. The ossicles were affected in all of these patients. Erosion of the long process of the incus combined with super structure of the stapes, which was detected in 29 ears, was most common.

Congenital malformation of ossicular chain was found accompanied with the cholesteatoma in 3 cases. In addition, abnormal hyperosteogeny was seen in 2 cases. The facial nerve canal erosion was identified in 3 cases and the semicircular canal fistula was found only in 1 patient.

Conclusion: Temporal bone HRCT was very helpful for the early diagnosis of the congenital middle ear cholesteatoma. The open type cholesteatoma were much more common than the close type in our clinic. Other malformation of the middle ear sometimes could be found with the congenital middle ear cholesteatoma together.

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ID: IP051

Miringoplasty and Tympanoplasty without Mastoidectomy

Presenting Author: **Alejandro Harguindey Antolí-Candela**

Alejandro Harguindey Antolí-Candela¹,
Francisco J. Olarieta Soto², Francisco Antolí-Candela Cano²

¹*Instituto Otorrinolaringológico de Madrid (IOM)*, ²*Instituto Otorrinolaringológico de Madrid (IOM)*

Learning Objectives:

Introduction: In active Chronic Ear Disease (CED) and sequelae of CED without Cholesteatoma we perform Miringoplasties and Tympanoplasties without Mastoidectomy to reconstruct the sound transmission mechanism.

In this course we describe our surgical approaches and the materials that we use for the reconstruction of the ossicular chain. We tend to favor the use of autologous grafts whenever possible such as temporalis muscle fascia, tragal cartilage and remodeled incus. In some cases we also use titanium TORP and otologic cement depending on the existing viable remnants.

Material and method: For the purpose of this course we have revised 50 cases that had undergone Miringoplasties or Tympanoplasties. In the 50 cases we describe the procedure used to reconstruct the tympanic membrane and the ossicular chain depending on the pathology found in each case.

Results:

1. - The most frequent approach has been retroauricular (85%).
2. - In 50% of the cases the tympanic membrane was grafted with fascia (50%). In the remaining 50% the membrane was grafted with tragal perichondrium or periosteum obtained from the mastoid.
3. - The graft was positioned in two pieces and overlaid to the despithealized tympanic remnants leaving the malleus handle between the two grafts (Double Overlay Graft, DOG).
4. - The results showed that in 94% of the cases the tympanic membrane remained closed 3 years after surgery.
5. - There was a significant hearing improvement in 80% of the cases. In those cases the residual air bone gap was less than 20 dB.

Conclusions: Miringoplasties and Tympanoplasties without Mastoidectomy have excellent results in the majority of cases. Both grafts take and hearing improvement is frequent enough as to recommend surgery as the best treatment choice. The adequate selection of cases for surgery, some technical aspects and thorough follow up of the patient are considered critical to obtain good and long lasting results.

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ID: IP052

Cholesteatoma accompanied abnormal ossification; Report of two cases

Presenting Author: **Yuko Hata**

Yuko Hata¹, Taeko Okuno¹, Kazumi Ichinose²,
Youko Yamazaki¹

¹*Mitsui Memorial Hospital*, ²*Tokyo Woman's Medical University*

Learning Objectives: Case study.

It is well known the cholesteatoma causes bone erosion and destruction of ossicular chain. We experienced two cases of cholesteatoma accompanied by abnormal ossification around ossicles which showed fixation to the wall of antrum or bony wall of middle cranial fossa. Case 1 is a 39-year-old man. He visited our hospital complained hearing loss of his left ear about one year ago. He also complained otorrhea of left side six months ago, cured spontaneously. 10 years ago he had visited our hospital for his right ear surgery, then an otomicroscopic examination of his left ear showed only dry small retraction pocket. But this time the retraction pocket of his left ear had been enlarged. Computed tomography scanning (CT) revealed deformity of ossicles. An operation of his left ear was performed. Abnormal ossification was seen around malleus head and Incus body and fixed the wall of antrum. Isolated cholesteatoma was existed behind the malleus head. Case 2 is a 45-years-old woman. At the age of 23, her left ear had been operated for cholesteatoma in our hospital. 8 years later she visited our hospital for his right otalgia. An otomicroscopic examination of her right ear revealed the retraction pocket with large squamous debris. By conservative treatment her otalgia was cured and the retraction pocket was cleaned. CT revealed only small soft tissue in attic. At this time the age of 45, the debris of the retraction pocket couldn't be removed for pain. CT revealed large soft mass with defect of bony wall of middle cranial fossa. An operation of her left ear was performed. Ossicles fixed wall of antrum and isolated cholesteatoma by the abnormal ossification was found. It will be necessary to take into consideration of the existence of isolated cholesteatoma by abnormal ossification.

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ID: IP053

Simultaneous cochlear implantation and labyrinthectomy for advanced Ménière's disease

Presenting Author: **Rebecca Heywood**

Rebecca Heywood¹, Marcus Atlas²
¹*Ng Teng Fong General Hospital*, ²*Ear Science Institute Australia*

Learning objectives:

1. Understand the challenges in managing intractable vertigo in Ménière's disease.
2. Review the literature on cochlear implantation outcomes in Ménière's disease.
3. Learn about simultaneous labyrinthectomy and cochlear implantation as an emerging technique in the management of Ménière's patients with intractable vertigo.

Introduction: Patients with Ménière's disease can develop unaidable sensorineural hearing loss. Cochlear implantation

has recently been utilised in this group with favourable outcomes. A more challenging group are those with intractable vertigo and they have traditionally posed a significant management dilemma.

Methods: Retrospective case note review was performed in a tertiary referral centre. Three female patients with recurrent incapacitating attacks of vertigo despite conservative management underwent simultaneous labyrinthectomy and cochlear implantation. Two patients had unaidable hearing preoperatively. One patient had moderate-severe sensorineural loss and was suffering from frequent debilitating drop attacks that had resulted in injury.

Results: There was complete resolution of vertigo in all patients in our series. Speech perception in quiet and ability to hear in background noise improved in all cases. Review of the literature demonstrated a small number of cases worldwide in whom simultaneous labyrinthectomy and cochlear implantation have been performed with successful outcomes.

Conclusion: Surgical labyrinthectomy is an effective method for elimination of vertigo in patients with Ménière's disease. The major disadvantage in the past was loss of residual hearing. Cochlear implantation is now an option in these patients. The benefits of simultaneous labyrinthectomy with cochlear implantation include prevention of implantation of a fibrosed or ossified cochlea, a decrease in the duration of deafness and a single operative procedure. This technique should be considered as a management option in carefully selected patients.

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ID: IP054

Magnetic Resonance Imaging surveillance after subtotal petrosectomy and blind sac closure: A review of radiological findings and long term follow up

Presenting Author: **Rebecca Heywood**

Rebecca Heywood¹, Rudolf Boeddinghaus², Katherine Pollaers³, Peter Friedland³, Marcus Atlas⁴

¹Ng Teng Fong General Hospital, ²Perth Radiological Clinic, ³Sir Charles Gairdner Hospital, ⁴Ear Science Institute Australia

Learning objectives:

1. Learn about the MRI features of the temporal bone post SP BSC.
2. Understand more about the behaviour of the temporal bone when it has been isolated from the external environment.
3. Understand the role of MRI in surveillance of the temporal bone post SP BSC.

Introduction: Long term follow up is recommended following subtotal petrosectomy (SP) with cavity obliteration and blind sac closure (BSC) of the external auditory canal to detect recurrent or iatrogenic cholesteatoma and chronic otitis media (COM). Follow up has historically been a

challenge both clinically and radiologically. Recent advances in MRI have transformed our ability to survey patients post SP BSC. The objectives of this study were to: i. Characterise the MRI features post SP BSC; ii. Assess the behaviour of the temporal bone and disease persistence/progression post SP BSC; iii. Classify the radiological features and define their consequences for clinical care.

Methods: Retrospective case note review was performed in a tertiary referral hospital of 23 patients who underwent SP BSC between November 2004 and October 2013. MRI surveillance was carried out over a mean follow up period of 48 months (range 14–116). MRI features over time were compared to clinical course and surgical findings.

Results: Otitis media with effusion is a common finding in the unventilated temporal bone but appears to have little if any clinical consequence. Revision surgery was performed on clinical grounds in four patients (17%) and concerning imaging features but no clinical concerns in three patients (13%). Radiological findings correlated with operative and histological findings for cholesterol granuloma and mucosal COM but there was discrepancy in the diagnosis of cholesteatoma.

Conclusions: The MRI features of the temporal bone post SP BSC are described. A grading system for radiological findings is proposed to guide surveillance and possible further surgical intervention.

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ID: IP055

Hearing loss and cognitive decline in Singapore: status quo of an island nation

Presenting Author: **Rebecca Heywood**

Rebecca Heywood¹, Priyanka Vankayalapati¹, Dona Jayakody², Rob Eikelboom², Gary Lee¹, Jiaying Liu¹, Vyas Prasad¹, Euan Murugasu¹, Marcus Atlas²

¹Ng Teng Fong General Hospital, ²Ear Science Institute Australia

Learning objectives:

1. Understand the challenges related to hearing health and cognitive decline in seniors facing a small country that has undergone rapid development over the last 50 years.
2. Identify ways that may start to address these through education and research.

Introduction: The burden of dementia continues to rise worldwide. Hearing loss has been independently associated with accelerated cognitive decline and identified as an independent risk factor for all-cause dementia. Singapore is a small country facing a rapidly ageing population. This study aims to review the current status of hearing health and cognitive decline in seniors in Singapore.

Methods: A literature search of articles published in English was conducted based on PRISMA guidelines.

Results: The prevalence of dementia is estimated to be 10% in those ≥60 years and increases with age. Interethnic

differences have been identified (lower in ethnic Chinese compared to Malays and Indians). Data estimating the prevalence of hearing loss in ageing Singaporeans is scant. Thresholds of >40 dB in the better ear were found in 54% and in at least one ear in 87%. Untreated hearing loss in the elderly results in significant decline in the quality of life of both the individual and their family. Self-perception of hearing loss is a very poor indicator of the presence of hearing loss. Between 20 and 33% of hearing impaired seniors were willing to consider a hearing aid; between 23 and 83% felt that it was unnecessary. Seniors who are independent in their activities of daily living (ADLs) are more likely to consider hearing aids than those who are ADL dependent and housebound.

Conclusions: Hearing loss and cognitive impairment will become increasing public health concerns. Further studies assessing whether the treatment of hearing loss can slow the rate of cognitive decline among older adults are required.

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ID: IP056

Transient hearing loss and objective tinnitus induced by mouth opening: a rare connection between the temporomandibular joint and middle ear space

Presenting Author: **Hiroshi Hidaka**

Hiroshi Hidaka¹, Yasuko Tatewaki², Maya Sakamoto³, Toshimitsu Kobayashi⁴, Ryoukichi Ikeda⁴, Yu Yuasa⁵, Ryo Yuasa⁵, Kazuhiro Nomura⁶, Daisuke Yamauchi⁶, Yukio Katori⁶

¹Tohoku University Graduate School of Medicine, ²Department of Diagnostic Radiology, Tohoku University Graduate School of Medicine, ³Department of Oral Diagnosis, Tohoku University Graduate School of Dentistry, ⁴Center for Otologic Surgery, Senenrifu Hospital, Rifu, ⁵Sendai Ear Surgicenter, ⁶Department of Otolaryngology-Head and Neck Surgery, Tohoku University Graduate School of Medicine

Learning Objectives:

Objectives: To describe objective tinnitus complicated with transient low-tone hearing loss coinciding with mouth opening, which was related to the connection between the mandibular fossa and middle ear space.

Patients: A 41-year-old man presented with tinnitus, ear fullness, and hearing loss in the left ear on mouth opening.

Main Outcome Measures: Clinical case records, audiological data, and radiological analyses including computed tomography (CT) and magnetic resonance imaging.

Results: Hearing thresholds on the ipsilateral side, which were evaluated with mouth opening, showed elevations of

approximately 20 dB in the frequencies below 1000 Hz. Again, peak pressure on the tympanogram deviated negatively to -220 mmH₂O under mouth opening without changing peak amplitude. These results showed that the tensor tympani would not have contributed to movement of the ear drum in the present case. High-resolution CT with multi-planar reconstruction showed a connection between the mandibular fossa and middle ear space, as revealed by a gas collection around the joint capsule evaluated in 2 phases (with and without mouth closing). Ear symptoms resolved after myringotomy.

Conclusions: Although an influence of temporomandibular disorder (TMD) on tinnitus perception has been debated, whether this association is causal or fortuitous has remained contentious. The present case showed a unique feature of tinnitus attributed to a connection between the mandibular fossa and middle ear space. This connection might be related to the petrotympanic fissure (with or without variant course), which is a narrow slit allowing the TMJ and middle ear space to communicate. Radiological analysis including high-resolution CT with multi-planar reconstruction referring to the petrotympanic fissure would be helpful to clarify the pathogenesis of patients suffering from otological symptoms related to TMD.

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ID: IP057

The mastoid tegmen: A new clinical radiological classification

Presenting Author: **Allan Ho**

Allan Ho, Sherif Idris, Youness El-Khalidy, Ravi Bhargava
University of Alberta

Learning Objectives: Variations in normal tegmen and inner ear anatomy.

Surgical considerations when operating near the tegmen.

Introduction: The tegmen is a thin, variable plate of bone that separates the mastoid and middle ear cavity from the intracranial compartment. Serious complications such as cerebrospinal fluid leakage, neural tissue injury may arise when operating near the tegmen. One important risk factor for dural complications is the low placement of the tegmen. This study aims to determine the radiographic location of the tegmen tympani using the lateral semicircular canal (LSCC) as a landmark in adult patients with normal temporal bones.

Methods: 100 high resolution temporal bone CT scans from patients with hearing loss were examined retrospectively. We included scans from adult patients with normal temporal bone anatomy and no previous ear surgery. The distance between the LSCC and the lowest point of the tegmen tympani was measured in both the sagittal and coronal planes. 60 patients with cholesteatoma having undergone mastoidectomy procedures within the past 6 years were also analyzed retrospectively.

Results: The mean tegmen height was 4.1 mm in the coronal plane and 2.5 mm in the sagittal plane. The measured heights using the LSCC as our landmark demonstrated a unimodal distribution with some variance.

Conclusions: We propose a new, simple and clinically practical tegmen CT classification using the LSCC as our landmark. Tegmens below 4.5 mm on coronal measurement and 2.5 mm on sagittal measurement are considered “low” (type A) whereas tegmens above these parameters are considered “high” (type B). This classification system applied to preoperative temporal bone CT might influence planning of middle ear and mastoid surgery. Our retrospective analysis of recent mastoidectomy patients showed that “low” tegmens were more likely to require a canal wall down mastoidectomy whereas “high” tegmens were more likely to require a canal wall up mastoidectomy.

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ID: IP058

Factors Affecting Hearing Aid Satisfaction in a Singapore Population

Presenting Author: **Eu Chin Ho**

Eu Chin Ho

Tan Tock Seng Hospital

Learning Objectives: Hearing aids greatly improves the quality of life in patients with hearing loss. Elderly patients with severe hearing loss and those who are fitted with bilateral Hearing aids benefited the most from their usage.

Introduction: This study analyzes factors that affect severity of hearing loss (HL) at presentation and hearing aid usage pattern among the Singapore hearing aid users.

Methods: Retrospective study with 643 subjects identified from audiometric records. Demographics (age, gender, race), Pure Tone Audiometry average (PTA0.5, 1, 2, 4 kHz), HA laterality (unilateral, bilateral), HA type and daily usage duration (<4hours, 4–7hours, >7hours) were collected. Severity of HL was classified as mild HL (21–40db), moderate (41–70db), severe HL(>71db).

Results: Patients had a mean age of 73.1 years (range: 22–113 years old). Patients presenting with mild HL were significantly younger than those with moderate-severe HL (64.1years vs 73.5years, $p < 0.001$). There were 327 males and 316 females, and gender did not influence severity of HL at presentation.

Race proportion was Chinese 87.9%, Malay 4.2%, Indian 5.8%, others 2.2%. Less Malay patients sought help for HL compared to the national racial composition.

Amongst the Malay patients, 48.1% of them had severe HL, which was the highest proportion within an ethnic group compared to 26.7% of Chinese 26.7%, 37.8% of Indian and 7.1% of other races; $p = 0.001$. This suggested that Malay patients usually presented late for their hearing problems. Mean age of Malay patients is younger than that of non-Malay patients (70.3years vs 73.2years, $p = 0.235$).

Lastly the more severe the HL, the longer the duration of daily HA usage. Most (45.8%) of the patients with severe HL use HA for more than 7 hours daily (vs. 25.3% for 4–7hrs, 22.5% for <4hrs, $p = 0.016$). Unilateral HA was more popular than bilateral HA in all degree of HL.

Conclusion: Younger patients presented with milder degree of hearing loss. Though less Malay patients sought treatment for HL, they mostly presented with greater hearing loss severity at a younger age. Severity of hearing loss led to longer daily usage of HA.

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ID: IP059

Hearing impairment among Nasopharyngeal Cancer (NPC) survivors

Presenting Author: **Eu Chin Ho**

Eu Chin Ho¹, Yue Yu², Seth Yeak²

¹Tan Tock Seng Hospital, ²Yong Loo Lin School of Medicine, National University of Singapore

Learning Objectives: To evaluate hearing impairment and other otological symptoms in NPC survivors To evaluate hearing aid usage in this population of patients.

Introduction: As the treatment outcome for nasopharyngeal cancer (NPC) patients continues to improve, there is an increasing pool of survivors. The treatment is not without its costs and many survivors suffer from hearing impairment that can lead to deterioration in quality of life. Hearing aids may help but uptake is generally low. We seek to investigate hearing and ear problems as well as acceptance of hearing aids among NPC survivors.

Methods: A cross-sectional survey was conducted among 35 NPC survivors who attended 2 NPC educational talks.

Results: Among the 35 patients recruited, 77% have hearing problems with 5 having both ears affected. The mean duration to onset of hearing loss post treatment is 3.08 years. Treatment modality (Chemoradiotherapy vs Radiotherapy only) did not affect prevalence and degree of hearing loss. Among those with self-reported hearing problems, 43% thinks that the hearing loss is moderate to severe, and more than 50% feels that it has caused them disability; a common reason cited was difficulty in communication. However, only 30% of patients are currently using hearing aids. Severity of hearing loss and hearing aid usage were correlated with $r = 8.563$, $p\text{-value} = 0.003$. Interestingly, 47% of the patients with hearing problems were never offered hearing aids during the follow-ups. Among those who are currently wearing hearing aids, only 63% wear it for more than 8 hours per day. Besides hearing impairment, 14% have recurrent ear infections and 26% needs to have their ears cleaned regularly. 87% of the patients suffers from other otological symptoms, the most common being tinnitus and sensation of blocked ears.

Conclusion: Hearing impairment is a common problem, causing significant disability among NPC survivors. However, usage of hearing aids is low. Our results suggest that beyond the surveillance of cancer recurrence, physicians should take an active role in assessing patient’s hearing impairment and suitability of hearing aids.

doi:10.1017/S0022215116005569

ID: IP060**Autoimmune inner ear disease presenting as Menière's Disease**Presenting Author: **Eu Chin Ho**Eu Chin Ho, Yao Guang Leow
*Tan Tock Seng Hospital**Learning Objectives:* To highlight Autoimmune Inner Ear Disease as a condition that may mimic Meniere's Disease.*Introduction:* Autoimmune inner ear disease (AIED) is a rare cause of sensorineural hearing loss, accounting for less than 1% of all cases. However, it is also one of the few forms of sensorineural deafness that can potentially be treated. The diagnosis of AIED may be missed for several years as it often mimics the symptoms of other inner ear pathologies such as Menière's disease (MD), with up to 50% of patients meeting the criteria for MD.*Method & Results:* We present a 52-year-old man, previously diagnosed with MD, manifesting the classical symptoms – sensorineural deafness, tinnitus, aural fullness and episodic vertigo. 4 years after the onset of MD symptoms, he was discovered to have autoimmune-associated conditions, namely psoriasis, joint pains and anterior uveitis. Given the patient's autoimmune-related diseases, we suspected the diagnosis of AIED and started him on a therapeutic trial of steroids. He responded favorably to the therapy, and was subsequently switched to a steroid-sparing immunomodulator treatment. His vestibular symptoms were abolished and there was also significant sustained improvement in his hearing tests, demonstrating an autoimmune cause for his audiovestibular symptoms.*Conclusion:* Our case report illustrates the difficulty in differentiating the idiopathic MD from AIED. As the history was typical of MD, it was easy to have concurred with the initial diagnosis. However, this patient had features of autoimmune diseases that raised our suspicion of AIED. The response to immunosuppressant therapy confirmed an autoimmune etiology for his symptoms.

With no diagnostic tests to confirm AIED available, clinicians must maintain a high index of suspicion when treating patients with symptoms of MD who have one or more autoimmune conditions, bilateral symptoms, or a rapid progression of disease. Starting the patient on a trial of treatment with steroids and monitoring his response closely can often be a simple way of confirming the diagnosis.

doi:10.1017/S0022215116005570

ID: IP061**Efficacy of a parametric assistive listening system to enhance the audibility and intelligibility of speech**Presenting Author: **Eu Chin Ho**Eu Chin Ho¹, Medapati Vijay Reddy¹, Santi Peksi²,
Woon Seng Gan²¹*Tan Tock Seng Hospital*, ²*School of Electrical & Electronic Engineering, Nanyang Technological University, Singapore**Learning Objectives:* Parametric speaker system can be used for targeted sound delivery to the hearing impaired.*Introduction:* An ultrasonic transducer together with a traditional transducer were implemented as a Parametric Assistive Listening System (PALS), to produce a directional narrow beam of sound at a target location. We aim to investigate the efficacy of utilizing PALS when compared to a traditional transducer.*Methods:* This abstract is part of a currently ongoing (n = 300), double blinded controlled study. The system was constructed such that the PALS can be enabled (parametric condition) or disabled (non-parametric condition). Under non parametric condition, the system acts like a traditional omnidirectional transducer.*Results:* We present the initial analysis of the data available from some subjects with normal hearing (n = 10) and mild hearing loss (n = 10). Free-field hearing thresholds and speech discrimination scores in +10 dB SNR using recorded NAL-AB words were studied in both the transducer conditions. The order of transducer conditions were randomized such that both the subject and the tester were blinded to the condition being tested. Parametric condition resulted in a significantly improved (>30%) speech discrimination scores in both the groups tested.*Conclusion:* Results of this small sample data available so far are in support of PALS for superior audibility as well as speech intelligibility. Further data collection is under way from a population of normal hearing and various degrees of hearing loss.

doi:10.1017/S0022215116005582

ID: IP062**Factors Affecting Attitudes towards Loss of Hearing in Individuals with Unilateral Hearing Loss**Presenting Author: **Eu Chin Ho**

Eu Chin Ho, Naresh Durisala

*Tan Tock Seng Hospital**Learning Objectives:* To identify the factors that affect attitudes towards unilateral hearing loss.*Background:* The present study is aimed at investigating if attitudes towards loss of hearing (ALHQ) questionnaire subscale scores in unilateral hearing loss participants are comparable to the established normative data, and also to study if age, gender, duration, tinnitus, cause and degree of hearing loss have any effect on their attitudes.*Participants:* A total of 29 unilateral sensorineural hearing loss case files from both genders (11 male, 18 female) with a mean age of 56.3 years were reviewed retrospectively.

Results: No significant difference in the mean score was observed between the present study and the normative data. There was a significant effect of tinnitus & cause of hearing loss on denial of hearing loss subscale and significant association between duration of hearing loss and negative coping strategies subscale. No significant effect of age, gender and degree of hearing loss was noticed on any subscales.

Conclusion: These results suggest that the identification of such factors during routine audiological evaluation can assist the clinician in planning appropriate intervention strategies.

doi:10.1017/S0022215116005594

ID: IP063

Translation and Cross-cultural Adaptation of Hearing Handicap Inventory for the Elderly - Screening (HHIE-S) in the Bilingual Singapore Population - A Pilot Study

Presenting Author: **Eu Chin Ho**
Eu Chin Ho, Deborah Lim, Seth Yeak
Tan Tock Seng Hospital

Learning Objectives: Commonly used hearing questionnaires can be translated and cross-culturally adapted into non English languages using a validated translation process.

Introduction: This study aims to to preliminarily assess the validity and reliability of a Mandarin translation of the HHIE-S questionnaire and measure its feasibility.

Method: We adopted a translation process adapted from the MAPI Institute for cross-cultural studies, involving 3 independent forward translations by clinicians, 1 back-translation by a non-clinician and final consensus by a review panel.

15 bilingual patients at Tan Tock Seng Hospital completed the Mandarin HHIE-S after their audiometric assessment. At an interval of about 30 minutes later, patients completed the English HHIE-S. They were given the same Mandarin HHIE-S and instructed to complete one week later.

Results: Mean age of all participants is 70.4 (Standard Deviation 4.42) and mean pure tone audiometry (PTA_{0.5,1,2,4kHz}) of the better ear was 34.58 dB (Standard Deviation 14.34). Self-rated English and Mandarin language proficiencies were comparable.

Validity of Mandarin HHIE-S

1. Mandarin and English total scores are significantly correlated, showing a strong positive relationship (Pearson Coefficient 0.885, $p < 0.001$).
2. Analysis of HHIE-S categories of non-significant hearing-loss and Significant hearing-loss with corresponding categories on Gold Standard criterion of PTA_{0.5,1,2,3kHz} showed poor agreement (Kappa coefficient = 0.0367, < 0.2). User feedback was sought regarding problematic questions.

Reliability

1. Internal consistency of the 10 items in the Mandarin HHIE-S is good with a Cronbach's alpha of 0.8499 (> 0.8).
2. Test-retest reproducibility of the first and second Mandarin HHIE-S at one-week interval is strong. Among 80% of patients, difference between the 2 mandarin scores is less than 5.

User acceptance scores were positive in terms of readability, comprehensibility and relevance.

Conclusion: The Mandarin HHIE-S demonstrated high reliability though low validity. A larger scale validation study incorporating user feedback from this pilot study should be carried out in the future.

doi:10.1017/S0022215116005600

ID: IP064

Utility of WHODAS 2.0 (Quality of Life Assessment) in detecting Changes in Quality of Life in Hearing Impairment

Presenting Author: **Eu Chin Ho**
Eu Chin Ho

Tan Tock Seng Hospital

Learning Objectives: WHODAS 2.0 may not be sensitive enough in detecting quality of life change in hearing-related disability.

Introduction: The objective of this study is to evaluate the relationship of pure tone audiogram (PTA) score, screening questionnaire and quality of life assessment via World Health Organisation Disability Assessment Schedule 2.0 (WHODAS 2.0) in our Singaporean population.

Methods: A retrospective review of 56 participants who were recruited for hearing screening held in a Singaporean Tertiary General Hospital from 29–30th May 2013 was done. Information recorded include general demographics, self-perception of hearing level, Hearing Handicap Inventory for Elderly Screening (HHIE-S) for participants > 60 years old, Hearing Handicap Inventory for Adults (HHIA) for participants PTA (0.5, 1, 2, 4 kHz) done by an experienced audiologist. WHODAS 2.0 was measured as a total global score (maximum: 100) as well as specific domain scores for 6 domains: Cognition, Mobility, Self-Care, Getting along, Life activities and Participation.

Results: The mean total WHODAS score was 42.3 (Range: 32–96, SD: 14.5). Mean specific domain scores include: Cognition at 8.9 (Range: 6–19, SD: 3.6), Mobility at 6.6 (Range: 5–17, SD: 3.02), Self-Care at 4.4 (Range: 5–12, SD: 1.53), Getting along at 6.1 (Range: 5–17, SD: 2.49), Life activities at 5.14 (Range: 4–14, SD: 2.54).

There was no significant correlation found between total WHODAS score and PTA score of better ear ($p = 0.322$) and between domain specific WHODAS score and PTA score, except for the Getting Along domain ($r = 0.26$, $p = 0.031$). There was also no significant correlation found between HHIA or HHIE and any WHODAS score (all $p > 0.05$).

Conclusion: WHODAS 2.0 may not be sensitive enough in detecting quality of life change in hearing-related disability in our Singapore population.

doi:10.1017/S0022215116005612

ID: IP065

**B-Cell Lymphoma of the Temporal bone:
A rare presentation**

Presenting Author: **Eu Chin Ho**

Eu Chin Ho, Shirish Johari
Tan Tock Seng Hospital

Learning Objectives: To highlight the need to be vigilant for unusual diagnoses that may mimic common otological conditions.

Introduction: To report a case of temporal bone B cell lymphoma.

Methods: Review of inpatient case notes of patient with atypical presentation of lymphoma.

Results: Temporal bone involvement by malignancies, primary or secondary, is rare. Diagnosis is frequently delayed as the symptoms mimic more common otological conditions like otitis external or media. Involvement of cranial nerves or cochleovestibular system may occur in advanced cases. More commonly, the bone involvement is due to direct extension of locally invasive squamous or adenocarcinomas of ear. Primary B cell bone lymphomas are also a rare entity and the presentation is usually with pain, swelling or fracture of involved bones. Mastoiditis due to destruction of underlying temporal bone by malignant lymphoma has only been reported in about 20 cases in the literature. We describe a case of primary B cell lymphoma presenting with radiological evidence of mastoiditis, skull base osteomyelitis and sigmoid sinus thrombosis. Patient was initially treated with broad-spectrum antimicrobials and it was not until development of facial palsy that a decision of mastoid exploration was made. Histopathological examination confirmed infiltration of temporal bone by malignant B cells. Staging studies including a diagnostic bone marrow biopsy diagnosed the patient with stage IV primary diffuse large B cell lymphoma of the bone. Treatment was initiated with multi-agent chemotherapy with good results.

Conclusion: Atypical presentation of otological signs and symptoms refractory to medical management requires a thorough evaluation and consideration of uncommon differentials. A high index of suspicion towards temporal bone malignancies may be helpful in timely diagnosis.

doi:10.1017/S0022215116005624

ID: IP066

**Treatment and Outcome of Otitis Media
With Effusion in Cleft Palate Patients**

Presenting Author: **Yingmin Hoe**

Yingmin Hoe
KK Women's and Children's Hospital

Learning Objectives: This study aims to investigate the impact of OME in children with cleft palate.

Objective: Otitis media with effusion (OME) is common in children with cleft palate due to Eustachian tube dysfunction. This study aims to investigate the impact of OME in children with cleft palate.

Study Design: Retrospective case series.

Methods: The case records of patients with cleft palate were analyzed for: type of cleft, age at which repair of cleft palate was performed, age of presentation to the otolaryngologist, age at which Myringotomy and Tympanostomy (M&T) was done, total number of M&Ts performed and associated congenital syndromes.

Results: M&Ts- Out of 600 cleft palate and lip patients, 204 required M&T. 26.5% required ≥ 3 M&T and 12.3% required ≥ 4 M&T. 86.8% of the patients presented early.

Syndromic patients- 15.7% were syndromic with Pierre Robin being the most common syndrome. They did not require more surgery ($p=0.713$) nor presented to an Otolaryngologist earlier ($p=0.281$) than their non-syndromic counterparts.

Type of cleft- 22.1% had unilateral cleft lip and palate, 32.8% had bilateral cleft lip and palate, 40.7% had posterior cleft palate and 4.4% had submucous cleft palate. Patients with bilateral cleft lip and palate required more M&Ts than those with posterior and submucous clefts ($p=0.16$).

Conclusion: OME in cleft palate patients should be actively identified and addressed early, before the development of significant disability. A proportion of patients will have recurrent OME and caregivers should be aware of the need for multiple procedures and long term follow up. Opportunities for combined surgery should be pursued.

doi:10.1017/S0022215116005636

ID: IP067

**Measurement of the Correlation of
Implant Stability Quotient with Abutment
Length for a Bone Anchored Hearing
Implant System**

Presenting Author: **Morten Høgsbro**

Morten Høgsbro
Aalborg University Hospital, Aarhus University
Hospital

Learning Objectives: Basic physical principles for the correlation between abutment length and Implant Stability Quotient (ISQ) How these principles translates to a

laboratory measurement of the correlation of ISQ with abutment length. Implications of the measurements for future studies and clinical measurements.

Introduction: Objective: To quantify the influence from abutment length on measured Implant Stability Quotient (ISQ) for a bone anchored hearing implant system.

Method: Design: Laboratory measurements on temporal bones. The Ponto Wide Implant (Oticon Medical AB, Askim, Sweden) was implanted in temporal bones and measurements of ISQ were made on implant level and for the 6 mm, 9 mm, 12 mm and 14 mm abutments using The Osstell ISQ and SmartPegs (Osstell, Göteborg, Sweden) type 09 (implant level) and type 55 (abutment level). By varying the insertion torque and implantation site, a broad span of implant level ISQ measurements was obtained and compared with the measurements on abutment level. The validity of the data was secured by measuring implant level ISQ before and after measurements on abutment level.

Results: For each abutment length a linear relationship existed between the implant level and the abutment level ISQ throughout the span of ISQs. The slopes for the linear correlations were similar for the different abutments lengths. The relationship for the ISQ as a function of abutment length throughout the span of implant level ISQs was also linear and the slope was measured to be $-3.1 \text{ ISQ/mm} \pm 0.2 \text{ ISQ/mm}$ (standard error of estimate).

Conclusion: The measured correlation between ISQ on implant and abutment level for a bone anchored hearing implant system revealed that the difference in ISQ for different abutment lengths is an additive constant independent of implant level ISQ. This relationship can be used for pooling mean results in clinical studies where different abutment lengths are used.

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ID: IP068

Evaluation of a New Powerful Sound Processor for Bone-Anchored Hearing

Presenting Author: **Myrthe Hol**
Myrthe Hol, Arjan Bosman, Ivo Kruyt, Emmanuel Mylanus, Ad Snik

Radboudumc

Learning Objectives:

Introduction: Patients with profound hearing loss for instance as a result of cholesteatoma surgery, may experience problems with air-conduction hearing aids due to tightly fitted ear moulds and/or maximum gain restrictions by acoustic feedback. In profound mixed hearing loss that consists of a moderate sensorineural loss with a large air-bone gap a powerful direct-drive bone-conduction device (BCD) is a viable alternative for a conventional hearing aid, owing to the relatively favourable bone-conduction thresholds.

Until recently, the body-worn Baha Cordelle II processor was the only alternative for patients with a profound mixed hearing loss that needed a BCD. Recently, the head-worn

Cochlear Baha 5 SuperPower Sound Processor (SP5) was introduced, which offers more advanced signal processing and wireless capabilities that may further improve the hearing experience for this patient population. In this study we will compare the performance of both devices.

Objective: We will evaluate the performance of the Baha SP5 relative to the Baha Cordelle II. The objective evaluation comprises aided thresholds, speech perception in quiet and in noise, and loudness growth measures. For the subjective evaluation questionnaires will be used.

Methods: Performance of the Baha SP5 and Baha Cordelle II will be evaluated in a group of 10 experienced Baha Cordelle users. Measures comprise free-field aided thresholds and speech perception in quiet with standard Dutch CVC monosyllables and speech perception in noise with the digits-in-noise test. Additionally, loudness growth will be measured for both devices. The performance of either device in real life will be evaluated with APHAB, SSQ, and proprietary questionnaires. The efficacy of wireless sound transmission with Baha SP5 when using the telephone or watching TV will be evaluated with a proprietary questionnaire.

Results: of this study will become available early Spring 2016. Results will be presented at the conference.

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ID: IP069

Systematic review: the radiological and histological evidence of cochlear trauma following implant insertion

Presenting Author: **Emma Hoskison**

Emma Hoskison¹, Scott Mitchell², Emilie Harterink³, Chris Coulson⁴

¹City Hospital, Birmingham, ²Russells Hall Hospital, Dudley, ³Queen Elizabeth Hospital, Birmingham, ⁴Queen Elizabeth Hospital, Birmingham

Learning Objectives: A systematic review to assess the radiological and histological evidence of cochlear trauma following cochlear implant insertion.

Introduction: Cochlear implantation (CI) has developed from its origins in the 1980s. Initially, CI was for profound bilateral hearing impairment. However, as candidacy for CI has become more relaxed, there is an increasing emphasis on hearing preservation.

Evidence supports the position that full electrode insertion in an atraumatic fashion into the scala tympani (ST) provides optimal hearing outcomes (Ashendorff et al 2005, Shepherd 1993, Finley et al 2008).

The main aim of this systematic review was to elucidate the degree of trauma associated with CI.

Methods: A systematic literature search was undertaken using PubMed Medline. A grading system described by Eshraghi (2003) was used to classify cochlear trauma. Both radiological and histological studies were included.

Results: Twenty one papers were identified which were relevant to our search. In total, 686 implants were inserted and 121 (17.6%) showed evidence of trauma. The cochleas with trauma had basilar membrane elevation in 10.5%, ruptured in 12.9%, the electrode passed from the ST to the scala vestibuli (SV) in 71.8% and there was grade 4 trauma consisting of spiral lamina or modiolus fracture and tear of the SV, in 4.8%.

The studies used a variety of histological and radiological methods to assess for evidence of trauma. A majority (57%) used histology either alone or with radiology (CT or x-ray). A majority of studies used cadaveric temporal bones (67%).

Conclusions: Minimising cochlear trauma during implant insertion is important to preserve residual hearing and optimise audiological performance. An overall 17.6% trauma rate suggests that CI could be improved with more accurate and consistent electrode insertion such as robotic guidance. The correlation of cochlear trauma with post-operative hearing has yet to be determined.

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ID: IP070

Is a retraction pocket an epithelial migration, intended to contact and cure an underlying inflammation, as a self-healing mechanism?

Presenting Author: **Karl-Bernd Hüttenbrink**

Karl-Bernd Hüttenbrink
University Clinic Cologne

Learning objectives: Complete drill out of all granulations and prevention of adhesions with silicone sheathing of mucosa can reduce the risk of cholesteatoma recurrence.

Introduction: Theories on retraction pocket pathogenesis lack convincing proof. A new concept interprets the mysterious ingrowth of skin as a basic principle of healing as seen in other regions of the body.

Methods: Retrospective analysis of the interrelation of retraction pockets and underlying granulation tissue in 253 cholesteatoma revision surgeries in the last decade. Literature research on pathogenesis of cholesteatoma.

Results: Self-cleaning retraction pockets over non-inflamed mucosa remained stable. A retraction did not develop over well-aerated areas with unimpeded mucosal drainage. A new retraction was always contacted active granulation, which had either persisted or emanated from a former cholesteatoma surgery. Findings from experimental and clinical data in literature are in agreement with this new concept.

Conclusions: The pathogenesis of a retraction is interpreted as a natural attempt of the body to cure an underlying inflammation in a cavity. Analogue phenomena exist e.g. in the migration of the omentum towards a local inflammation in the abdomen. Based on this pathomechanism, the prophylaxis against a recurrent cholesteatoma therefore should combine a meticulous cleaning of all pneumatic cells from infectious granulation and establish a free drainage of all cavities of the middle ear into the tubal orifice, avoiding a

blockage on the path of mucosal clearance. Rhinosurgery also insists on an unblocked drainage of the operated sinus. In cholesteatoma surgery, thin silicone foils should cover all non-mucosa-coated surfaces behind the tympanic membrane and also in the epitympanon and, if necessary, reaching back to the antrum, ending on the mucosa of the tubal entrance. Gas production of the healthy middle ear mucosa can recover, and the risk of a recurrent retraction is reduced.

doi:10.1017/S0022215116005673

ID: IP071

A New Simple Radiological Scoring System for Classifying the Tegmen of the Mastoid

Presenting Author: **Sherif Idris**

Sherif Idris, Youness Elkhaldy, Ravi Bhargava, Allan Ho
University of Alberta

Learning Objectives:

- Variations in normal tegmen and inner ear anatomy.
- Surgical considerations when operating near the tegmen.

Introduction: The tegmen is a thin plate of bone that separates the mastoid and middle ear cavity from the intracranial compartment. The tegmen has a very variable shape, and complications may arise when operating near the tegmen. Notably, the dura may be exposed, and if this is gone unnoticed, serious intracranial complications may result, including cerebrospinal fluid leakage and neural tissue damage. One important risk factors for dural complications is low placement of the tegmen. The purpose of this study was to determine the radiographic location of the tegmen tympani in relation to the lateral semicircular canal in adult patients with normal temporal bones.

Methods: Patients who underwent high resolution temporal bone CT scanning as part of their workup for hearing loss were examined retrospectively. We included adult patients that had normal temporal bone anatomy and no previous ear surgery. The distance between the lateral semicircular canal and the lowest point of the tegmen tympani was measured in both the sagittal and coronal planes.

Results: A total of 100 temporal bones were assessed. The mean tegmen height was 4.1 mm in the coronal plane and 2.5 mm in the sagittal plane. The measured tegmen heights demonstrated a unimodal distribution with some variance.

Conclusions: Our results demonstrate that there is generally one average tegmen height, with a range of variation around this point. Based on this finding, we propose a limited tegmen height classification scheme. Tegmens below 4.5 mm on coronal measurement and 2.5 mm on sagittal measurement are considered "low" (type A) whereas tegmens above these parameters are considered "high" (type B). This classification system might have implications in prognosticating patients undergoing middle ear surgery using preoperative temporal bone CT.

doi:10.1017/S0022215116005685

ID: IP072**A New Simple Radiological Scoring System for Classifying the Tegmen of the Mastoid**Presenting Author: **Sherif Idris**Sherif Idris, Youness Elkhaldy, Ravi Bhargava, Allan Ho
*University of Alberta**Learning Objectives:*

1. Variations in normal tegmen and inner ear anatomy.
2. Surgical considerations when operating near the tegmen.

Introduction: The tegmen is a thin, variable plate of bone that separates the mastoid and middle ear cavity from the intracranial compartment. Because of its location, serious complications such as cerebrospinal fluid leakage and neural tissue damage may arise when operating near the tegmen. One important risk factor for dural complications is low placement of the tegmen. This study aims to determine the radiographic location of the tegmen tympani using the lateral semicircular canal as a landmark in adult patients with normal temporal bones.

Methods: 100 high resolution temporal bone CT scans from patients worked up for hearing loss were examined retrospectively. We included scans from adult patients with normal temporal bone anatomy and no previous ear surgery. The distance between the lateral semicircular canal and the lowest point of the tegmen tympani was measured in both the sagittal and coronal planes. 60 patients with cholesteatoma having undergone mastoidectomy procedures within the past 6 years were also analyzed retrospectively.

Results: The mean tegmen height was 4.1 mm in the coronal plane and 2.5 mm in the sagittal plane. The measured heights demonstrated a unimodal distribution with some variance.

Conclusions: We propose a simple and practical tegmen classification scheme. Tegmens below 4.5 mm on coronal measurement and 2.5 mm on sagittal measurement are considered “low” (type A) whereas tegmens above these parameters are considered “high” (type B). This classification system applied to preoperative temporal bone CT might influence planning of middle ear and mastoid surgery. For instance, from our retrospective analysis of recent mastoidectomy patients, “low” tegmens were more likely to require a canal wall down mastoidectomy whereas “high” tegmens were more likely to require a canal wall up mastoidectomy.

doi:10.1017/S0022215116005697

ID: IP073**Anatomical findings of bony portion of Eustachian tube**Presenting Author: **Ryoukichi Ikeda**Ryoukichi Ikeda¹, Hiromitsu Miyazaki¹, Tetsuaki Kawase², Yukio Katori², Toshimitsu Kobayashi¹¹Sen-En Rifu Hospital, ²Tohoku University
*Otolaryngology-Head and Neck Surgery**Learning Objectives:*

Introduction: The Eustachian tube (ET) consists of an osseous and of a cartilaginous part which measure one thirds to two thirds of the overall length, respectively. Savic et al. reported that the shapes of bony portion of ET are divided into three groups (triangular, rectangular and irregular).

Methods: Bony portion of ET was examined by computed tomography (CT) in patulous Eustachian tube, chronic inflammation middle ear diseases and control group. The aeration of mastoid was also examined.

Results: The group with poor aeration of mastoid is significantly higher rate of triangular shape than good aeration group. In addition, the bone between cochlea and carotid artery in poor mastoid aeration group is thicker than good aeration group.

Conclusions: The shapes of the tympanic orifice and bony portion of the ET are various. The shapes of bony portion of ET are related to aeration of the mastoid cell. It is important to evaluate bony portion of ET before transtympanic ET surgery.

doi:10.1017/S0022215116005703

ID: IP074**Subtle open-type congenital cholesteatoma should be distinguished from congenital ossicular anomaly -Endoscope assisted microscopic trans canal approach-**Presenting Author: **Amiko Ishii**

Amiko Ishii, Katsumi Takizawa, Wakako Nakanishi, Kazunari Okada, Chikako Yamada, Hiroko Monobe

*Japanese Red Cross Medical Center**Learning Objectives:*

Introduction: Open-type congenital cholesteatoma (OCC) of the middle ear is relatively rare. It is also difficult to diagnose correctly preoperatively because the clinical presentation is very similar to that of congenital ossicular anomaly (COA). Here, we present a case report of middle ear OCC masquerading as COA.

Case presentation: A 12-year-old Japanese boy with a history of imperforate anus and spinal anomalies presented with a 1.5-year history of left-sided hearing loss. The external auditory canal and tympanic membrane were normal on both sides. Pure tone audiometry showed a 44-dB conductive hearing loss. High-resolution temporal bone computed tomography (TBCT) showed a defect in the long process of the incus and the stapes suprastructure, and a small shadow near the stapedial tendon. An endoscope-assisted microscopic transcanal approach was used to identify the

ossicular defect (as expected) and an OCC extending from the stapedial tendon to the promontory. We removed the entire OCC and reconstructed the ossicular chain with tragal cartilage. The postoperative air–bone gap was 9.4 dB.

Conclusions: OCC often presents in a way very similar to COA, with conductive hearing loss and an intact tympanic membrane. However, a history of progressive hearing loss and the presence of a subtle soft tissue density on TBCT are suspicious of OCC, rather than COA, in which the hearing loss is of a congenital nature. In this patient, the cholesteatoma was located in the sinus tympani around the stapedial tendon and was difficult to assess with an operating microscope. In lesions of the sinus tympani and facial recess, endoscope-assisted microsurgery can facilitate cholesteatoma removal and reduce the risk of recurrence.

doi:10.1017/S0022215116005715

ID: IP075

Interaction between keratinocytes and fibroblasts induces osteoclastogenesis: a mechanism underlying cholesteatoma-induced bone destruction

Presenting Author: **Yoriko Iwamoto**

Yoriko Iwamoto, Yumi Ohta, Ryusuke Imai, Tetsuo Morihana, Hidenori Inohara

Osaka University

Learning Objectives:

Bone is a highly dynamic organ, which is maintained by a balance between bone-resorbing osteoclasts and bone-forming osteoblasts. Increased osteoclast activity shifts the balance toward bone resorption, cause bone destructive diseases such as rheumatoid arthritis and periodontitis. Ectopic induction of receptor activator of nuclear factor kappa-B ligand (RANKL), a regulator of osteoclast differentiation, leads abnormal osteoclastogenesis. For example, in rheumatoid arthritis, synoviocyte is known as a major source of RANKL.

Cholesteatoma is a non-neoplastic lesion arising in middle ear, which consists of hyperkeratinizing epithelial layer and fibrous connective tissue. Due to its bone destructive character, it can cause severe complications. However the mechanism of the bone destruction by cholesteatoma remains to be elucidated.

In this study, we established cholesteatoma-like mass composed of mouse ear pinna-derived keratinocytes and fibroblasts on the calvarial bone of mouse. Histological analysis revealed the experimental mass lesion induced osteoclastogenesis on the bone surface. In addition, we succeeded in establishing an in vitro coculture system of keratinocytes, fibroblasts and osteoclast precursors, and found that keratinocytes stimulate the induction of RANKL in fibroblasts, which leads to osteoclastogenesis.

Thus, this study demonstrates that interaction between keratinocytes and fibroblasts is involved in the differentiation of osteoclasts, which may provide the molecular basis of a new therapeutic strategy for cholesteatoma-induced bone destruction.

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ID: IP076

LION Surgery Broadcasts: Communal viewing benefits with perceived quality of transmission, surgery and discussion

Presenting Author: **Steve Backhouse**

Vibha Jaiswal¹, Vibha Jaiswal¹, Alice Davies², Ryan Murphy², Razun Miah², David Owens³, Steve Backhouse⁴

¹ENT Surgery, Wales Deanery, UK, ²Audiology Department, Bridgend Hospital, Wales, UK,

³ENT Department, University Hospital of Wales, Cardiff, UK, ⁴Chole

Learning Objectives: To improve otological surgical knowledge & techniques.

The Live International Otolaryngology Network (LION) aims to promote high quality medical and continuous surgical education programmes, seeking to improve knowledge and skills of practicing otolaryngologists. LION's purpose is to achieve a worldwide permanent interactive network within ENT, promoting distant learning using videoconferencing technology. Theoretically internet webcasts provide a cost effective, environmentally friendly way for otolaryngologists to access CPD.

Preparations were made on the 12th May 2015 in order to maximise this opportunity in South Wales for ENT surgeons and allied health professionals. We organised a 'communal' viewing to promote open discussion between allied professionals in attendance and assess the educational experience by targeted questionnaires to give validity for CPD accreditation by RCSEdinburgh and ENTUK. 15 delegates attended (5 ENT consultants, 6 ENT trainees, 1 ENT SAS, 2 audiologists & 1 audiology student). 71% had watched a LION broadcast previously and all felt that the communal broadcast was better than viewing alone, that they would re-attend a communal LION broadcast in the future, and would recommend such to a colleague. Perceived broadcast transmission quality, surgical technique and discussion were generally good across both channels.

Communal viewing of the LION broadcast was well received by all delegates. The following improvements were suggested: wider advertisement, simultaneous screening of broadcast channel 1 and 2, and a second screen in each room for background information/ case studies. Although the numbers are small, feedback for individual surgeons and procedures will allow quality assurance and improvement for the next broadcast.

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ID: IP077

Climbing up the learning curve in totally endoscopic cholesteatoma surgery

Presenting Author: **Adrian James**

Adrian James, William Parkes
University of Toronto

Learning Objectives:

Introduction: Totally endoscopic ear surgery (TEES) facilitates cholesteatoma treatment giving enhanced visualization of middle ear recesses without the post-operative morbidity of open surgery. TEES is not as yet an acceptable option for all cases, or indeed all surgeons. This study reports on factors influencing the adoption of TEES in paediatric cholesteatoma by a single surgeon.

Methods: A paediatric cholesteatoma surgery database, maintained over an 11 year period, was searched to determine the proportion of cases completed by TEES or an open post-auricular approach each year. Comparison was made with factors potentially linked to the surgeon's ability to perform TEES including extent of cholesteatoma, patient age, availability of equipment and attendance at endoscopic courses.

Results: Of 649 surgeries 86 were by TEES and 37 by endoscope transcanal with microscope-guided assistance. The proportion of TEES cases per year increased from 1/75 (1%) to 35/57 (61%) over the last 7 years. Empirically, this increase correlated with acquisition of specialised instruments and attendance at courses. Overall, TEES cases were less extensive (median Mills stage: 1 versus 2; $p < 0.001$, MannWhitney) but similar in age (median 11.5 v 10.8 yr NS, MannWhitney). Over the last 50 open cases, extent of disease (54%), narrow ear canal (30%) and defect too large for reconstruction (12%) were noted as the commonest factors for utilising an open approach. Most recently, endoscopic canalplasty and non-autogenous grafts have further increased the range of TEES.

Conclusions: Cholesteatoma can be treated in a majority of children with TEES, but an open approach is still required when the ear canal provides inadequate access to the limits of the disease. The surgeon's ability to complete TEES is enhanced by appropriate training, acquisition of specialist instruments, motivation and experience. Development of surgical techniques is allowing a greater proportion of cases to be completed endoscopically.

doi:10.1017/S0022215116005740

ID: IP078

Extratympanic imaging of middle and inner ear structures of the mouse and rat model using optical coherence tomography(OCT)

Presenting Author: **Hee Jeong Jeong**

Hee Jeong Jeong, Se-Joon Oh, Soo-Keun Kong
Pusan National University Hospital

Learning Objectives:

Background and Objective: Noninvasive middle and inner ear imaging using Optical Coherence-Tomography (OCT) presents some unique challenges for real-time, clinical use in animals and humans. OCT has been used in other fields for obtaining high-resolution cross-sectional images of the tissue. The goal of this study was to investigate whether

OCT provides information about the middle and inner ear microstructures in both rats and mice by extratympanic approach.

Materials and Methods: Six BALB/c mice and Sprague Dawley rats were enrolled to the experiment, and to acquire an image of the entire tympanic membrane, the auricle and cartilaginous external auditory canal were removed, the swept-source OCT system was tested to identify the middle and inner ear microstructures. After that, the TM and bulla were removed to confirm whether more detailed middle and inner ear images might be obtained.

Results: It was possible to image through the tympanic membrane extratympanically and into the middle ear cavity involving several middle ear structures in both rats and mice. We could also obtain the inner ear images through the otic capsule and into the cochlea in the mice by extratympanic approach. However, the bulla should be removed to provide the inner ear structural images in the rats. The whole cochlea of the apical, middle and basal turn could be visualized and the bony thickness of the otic capsule covering the cochlea could also be measured simultaneously.

Conclusions: OCT is a promising technology to noninvasively assess middle ear and inner ear microanatomy in both mice and rats. These findings are meaningful because there were no previous report to describe the middle and inner ear structure looking by extratympanically. This imaging informations can be useful in the diagnosis of diseases of the middle and inner ear if it is clinically applied through further studies.

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ID: IP079

The Perioperative Strain Changes of Chronic Otitis Media Surgery

Presenting Author: **Su Hee Jeong**

Su Hee Jeong, Soonil Yoo, Sungwoo Han, Geun Jeon Kim, Jin Bu Ha, Dong-Kee Kim

College of Medicine, The Catholic University,
Korea

Learning Objectives: chronic otitis media culture strain.

Introduction: The perioperative prophylactic antibiotic of chronic otitis media (COM) surgery is selected based on the result of preoperative bacterial culture. Learning objectives: To investigate the changes of strains of middle ear through COM surgery, we conducted bacterial culture before, during, and after COM surgery. Method: We analyzed the medical records of 156 patients who received COM surgery at Daejeon St. Mary's Hospital from March 2012 to September 2015. Preoperative bacterial culture was conducted with otorrhea or swap of middle ear mucosa, intraoperative culture was conducted with granulation tissue in either the middle ear or mastoid cavity, and postoperative culture was selectively conducted when otorrhea was developed after surgery. Results: Sixty cases of tympanoplasty only and 96 cases of both tympanoplasty and mastoidectomy were performed for 111 cases of COM-without-cholesteatoma and 45 cases of COM-with-cholesteatoma. The growths of

bacteria were observed in 71 patients (45.5%) of preoperative culture, in 21 patients (13.5%) of intraoperative culture, and in 7 patients (4.5%) of postoperative culture. Methicillin-resistant staphylococcus (MRSA) was identified most commonly in all of tests, and it was identified from 23 of 71 cases (32.4%), 11 of 21 cases (52.4%), and 5 of 7 cases (71.4%), respectively, and the percentage of MRSA was increased from the intraoperative to postoperative identification tests. In 23 cases of MRSA in preoperative tests, 6 cases showed MRSA also in intraoperative tests, and 3 cases showed MRSA in postoperative tests. Conclusions: The distribution of strains in middle ear was changed through COM surgery, and the percentage of resistant strains, in particular, MRSA was increased. But, the bacterial culture results of post-operative otorrhea showed lower agreement with that of pre-operative or postoperative culture, and the re-identification of strains is needed.

doi:10.1017/S0022215116005764

ID: IP080

cVEMP testing in trans-mastoid occlusion surgery for superior semicircular canal dehiscence

Presenting Author: **Suzanne Jervis**

Suzanne Jervis¹, Maarten de Wolf², Jeyanthi Kulasegarah¹, Karen Lindley¹, Richard Irving¹

¹University Hospitals Birmingham NHS Trust,

²Dept of Otorhinolaryngology, Academic Medical Centre, Amsterdam

Learning Objectives:

Introduction: Semicircular canal dehiscence syndrome (SCDS) is caused by a bony defect of the superior semicircular canal, resulting in autophony, bone conduction of bodily sounds and pseudo conductive hearing loss. Vestibular manifestations include sound- or pressure-evoked vertigo. cVEMP (cervical vestibular evoked myogenic potential) testing is used as the diagnostic gold standard in addition to CT scanning. The aim was determine the pre and post-operative cVEMP changes in patients undergoing transmastoid occlusion surgery for SCDS.

Methods: All patients suggestive of SCDS underwent CT scanning and cVEMP testing. All those with positive findings for both (dehiscent superior canal and asymmetrical cVEMP thresholds >35%) then underwent surgery. cVEMP thresholds were measured 3 months post-operatively in a standardised manner. Asymmetry between ears was assessed by means of the Jonkees formula and diagnostic of SCDS when greater than 35%. Data was identified and collated retrospectively.

Results: Twenty patients, with 22 affected ears underwent surgical occlusion with pre-operative and post-operative cVEMP testing. All patients with unilateral SCDS had asymmetrical cVEMP thresholds >35% with a mean of 164% (N = 14, SD 224). In the 17 ears with recordable cVEMPS, all demonstrated normalisation of thresholds except in one, who had persistent symptoms and BPPV. In 10 out of 12 unilaterally affected patients, the postoperative cVEMP threshold was less than or equal to the contralateral

ear. In two patients there were no recordable thresholds in the contralateral ear.

Conclusion: cVEMP testing continues to be a valuable assessment tool in patients with symptoms suggestive of SCDS. Our results show that with the transmastoid occlusion technique, the post-operative cVEMPs return to normal (as compared with their contralateral side) in the majority of cases.

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ID: IP081

The recovery of middle ear and mastoid cavity using T-tube in adhesive otitis media

Presenting Author: **Jae-hoon Jung**

Jae-hoon Jung, Il-Woo Lee, Seok-hyun Kim

Pusan National University/Yangsan Hospital

Learning Objectives:

The repeated dysfunction of Eustachian tube repeatedly may occur acute, chronic serous otitis media that can exacerbate the tympanic membrane status as adhesive otitis media, which is a result of chronic inflammation of middle ear and mastoid cavity. It may occur erosion of ossicles, which can make conductive hearing loss or cholesteatomatous otitis media while in progress. We have experienced not only recovery of middle ear, mastoid aeration, but also recovery of hearing through using only ventilation T-tube for long period. The patients were 10-year-old female, 30-year-old female and 20-year old male who visited outpatients because of otorrhea and hearing disturbance. The T-tube were inserted at operating room under general or local anesthesia. The difference of air-bone gap between preoperative and postoperative hearing were 45 dB, 18 dB and 17 dB each, and each period of tubing were 53 months, 40 months and 26 months. All patients performed temporal bone computer tomography (CT) before surgery, and all of them showed soft tissue density in middle ear and mastoid cavity, and sclerotic mastoid bone changes. However all patients showed improvement of temporal CT finding without soft tissue density in middle ear and mastoid cavity postoperatively. We propose this treatment because it may be simple and have cost-benefit compared with other methods. However close observation of tympanic membrane perforation and recurrent otorrhea after tube insertion might be necessary.

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ID: IP082

Clinical and Audiological Characteristics of 1000 Hz Audiometric Notch Patients

Presenting Author: **Jae-hoon Jung**

Jae-hoon Jung¹, Il-woo Lee¹, Hyun-min Lee¹, Soo-Keun Kong², Se-joon Oh²

¹*Pusan National University/Yangsan Hospital,*
²*Pusan National University School of Medicine*

Learning Objectives:

Purpose: There are specific frequency hearing losses such as c4-dip(2kHz loss) in otosclerosis and c5-dip(4kHz loss) in case of noise induced hearing loss. The c3-dip(1kHz loss), however, is seldom mentioned in clinical field. We found a group of patient with 1 kHz hearing loss fortuitously and report it with review of literature.

Method: Tertiary academic referral center-based retrospective chart review and review of audiogram was done. Otologic history, audiogram, diagnosis, occupation, history of noise exposure were reviewed with chart and telephone interview. We compared the c3-dip group with 98 patients of c5-dip group(4kHz hearing loss group).

Results: Thirty one patients met the criteria of 1kHz audiometric notch. There are eleven males and 20 female with mean age of 40.6 years old. The pure tone threshold of 1kHz was 37.97 dB and the hearing threshold was 22.38 dB with other frequencies. Tinnitus was most the common complaints of c3-dip group compared with c5-dip group. The most common diagnoses of the c3-dip group were sudden sensorineural hearing loss(n = 8) and idiopathic tinnitus(n = 8). Female patients and unilateral cases were more common in c3-dip group than c5-dip group. Ear fullness was the more common symptom in c3-dip group than c5-dip group. The duration of occupation-related noise exposure was longer in c5-dip group than c3-dip group. The history of head or ear trauma was more frequent in c3-dip group than c5-dip group.

Conclusion: We defined a new clinical entity of 1 kHz hearing loss group as c3-dip group.

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ID: IP083

Perilymph Gush during the Stapedotomy for a Suspicious Osteogenesis Imperfecta Conductive Hearing Loss

Presenting Author: **Kyu Hwan Jung**

Kyu Hwan Jung
Sheikh Khalifa Specialty Hospital

Learning Objectives:

A 38-year-old woman visited our clinic with her left progressive hearing loss for 2 months. She had characteristic blue sclera and experienced frequent fractures from minor trauma in her teens. She looked normal in her appearance and stature. She did not have family history of hearing loss. Her ear drum was clear and pure tone audiogram showed left side 40 dB air-bone gap conductive hearing loss. Her right hearing was normal. Temporal bone CT revealed nothing special. Exploratory tympanotomy was performed to find stapes fixation and decided to do the stapedotomy. However, profuse perilymph gush developed when

performing the foot plate. Piston wire prosthesis was placed with struggling effort. Lumbar drain was placed right after finishing the operation. Although she had immediate post-operative dizziness, hearing loss, and tinnitus for 3 days, her hearing gradually improved and air-bone gap was closed 2 months after the surgery. Her good hearing was maintained for the 6 months on the follow-up audiogram.

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ID: IP084

Operative Management of External Auditory Canal Cholesteatoma

Presenting Author: **Hany Kamel**

Hany Kamel¹, Mark Sayles², Fahmy Fahmy³
¹*West Suffolk Hospital NHS Foundation Trust,*
²*Katholieke Universiteit Leuven – Belgium,*
³*West Suffolk Hospital NHS Foundation Trust-UK*

Learning Objectives:

We present our experience of Ten cases of EAC cholesteatoma treated in a UK district general hospital (serving a population of approximately 275,000) between 2007 and 2014. We discuss the clinical presentation, appropriate investigation, and subsequent surgical management of these cases. Cholesteatoma of the external auditory canal is rare, but has potential for serious complications such as erosion into the temporo-mandibular joint, facial nerve, and skull base. The most common presenting symptoms were unilateral otorrhoea and otalgia. Clinical findings included erosion of the inferior aspect of the bony canal wall, with accumulated keratin and bony sequestrum. Computed Tomography confirmed the presence of bony canal wall erosion, with an overlying soft-tissue attenuation mass in most cases. The middle ear was normal in most of cases. Examination under anaesthesia and biopsy of the EAC lesion was used to differentiate between EAC cholesteatoma, necrotising otitis externa, and squamous cell carcinoma of the EAC skin. Histological analysis of biopsy specimens showed keratin, with no evidence of malignancy. In each case, the disease was at a relatively advanced stage with erosion of the petrous temporal bone. Bony canal-meatoplasty was done via a post-auricular approach. The cholesteatoma was excised, and the resulting cavity was filled with grafted tragal cartilage and perichondrium or temporalis fascia to achieve a smooth, self-cleaning ear canal.

doi:10.1017/S0022215116005818

ID: IP085

Is There Hearing Loss In Sjogren's Syndrome? A Cohort Matched Cross-sectional Observational study

Presenting Author: **Usama Kamel**

Usama Kamel¹, Peter Maddison², Rhiannon Whitaker³

¹Milton Keynes University Hospital, ²Bangor University, Bangor, ³North Wales Organisation for Randomised Trials in Health (NORTH) · Clinical Trials Unit United Kingdom · Bangor

Learning Objectives:

Introduction: Previous studies showed inconsistent findings about deafness in Sjogren's syndrome(SS).

Aims: The study objective was to assess the prevalence of deafness in SS

Methods: A cohort matched, prospective, cross sectional observational study. Ethical approval was granted. Patient and control subjects gave informed consent. History and otoscopic examination of patient and control groups were performed. Pure tone audiogram was performed. Means of hearing thresholds at 0.25, 0.5, 1, 2, 3, 4, 6, & 8KHz were calculated in both groups.

SPSS statistical package was used for statistical analysis. SS patient hearing threshold was classified abnormal if the threshold was 20 dB at least worse at one or more frequencies compared to controls.

Results: 28 SS patients (F = 25:M = 3) with mean age 59 years old (range 36–83) according to the American European criteria for SS diagnosis and 34 controls (F = 32:M = 2) with mean age 56 years old (range 35–78) had been enrolled according to inclusion criteria.

Hearing acuity was found to be highly correlated with age (Pearson 0.707 p

Conclusions: These results suggest that SS does not have an effect on hearing levels. SSyndrome does not appear to be associated with hearing loss.

doi:10.1017/S002221511600582X

ID: IP086

What is the predominant presentation in Juba's ENT clinic?

Presenting Author: **Usama Kamel**

Usama Kamel

Milton Keynes University Hospital

Learning Objectives:

Introduction: A medical mission was set up in Juba. Juba has the only teaching hospital in South Sudan; it provides medical service to 9.8 m. Their Healthcare heavily depends on foreign aids and medical missions. South Sudan is a 4 year old country since they had independence.

Methodology: Registration and agreement with South Sudan Ministry of Health were pursued. Earlier communication to establish resources was sought. No previous ENT missionary Clinics were set up in the hospital, therefore this clinic had publicity through the ministry of health public announcement and TV adverts. Daily theatre sessions were allocated for the surgeries. One

ENT doctor ran the clinics, surgeries and on call for the week's mission. Database was setup for the clinic registry and patient management. The clinic was run for a morning and afternoon session. Theatre was run in the evening after clinics. Limited theatre resources made it difficult to perform microscopic and endoscopic surgeries.

Results: 129 cases seen in a week. 32% were allergic rhinitis, 15% otitis externa, 7% acute otitis media, 6% chronic suppurative otitis media and 6% recurrent tonsillitis. Fifteen cases (12%) had operations. Training sessions were also run to medical doctors to help them develop their ENT skills.

Conclusion: South Sudan ENT clinic presentations showed that third of cases were allergic rhinitis and a sixth were otitis externa. There is a great need for ENT service in South Sudan to help combat infections and common ENT conditions. Aid is needed to build ENT service in the capital.

doi:10.1017/S0022215116005831

ID: IP087

Management of labyrinthine fistula in cases with cholesteatoma

Presenting Author: **Rie Kanai**

Rie Kanai, Shin-ichi Kanemaru

Medical Research Institute, Kitano Hospital

Learning Objectives: To introduce our management strategy for labyrinthine fistula caused by cholesteatoma

Purpose: Complete removal of matrix on fistula and preservation of bone conduction (BC) hearing level are required in cases with labyrinthine fistulae (LF) caused by cholesteatoma. The purpose of this study is to introduce our management strategy for LF caused by cholesteatoma.

Study Design: Retrospective medical chart review.

Patients and methods: Twenty patients with LF caused by cholesteatoma (M: F = 11 : 9, mean age: 62.8) were enrolled in this study. All patients were underwent tympanomastoidectomy with removal of cholesteatoma matrix on fistula between April 2009 and February 2016. Location and depth of fistulae, surgical procedure how to seal fistulae, and change in BC hearing level before and after surgery were analyzed.

Summary of Results: Distribution of fistulae locations were lateral semicircular canal (N = 16), superior semicircular canal (N = 1), and multiple organs (N = 3) which included two cases with cochlear fistulae. Depth of fistulae revealed erosion of bony labyrinthine with intact endosteum (N = 8), opened perilymphatic space with perilymph leakage (N = 8), and destruction of membranous labyrinth (N = 4). Fistulae were closed by multi-layered reconstruction using fascia, bone putty with or without bone tips in 12 cases, by single-layered reconstruction using fascia or bone putty in 7 cases. Two cases showed scaled-out BC hearing level preoperatively. Postoperative BC hearing level analysis showed improvement more than 20 dB in 2 cases, preservation in 13 cases, and decreased more than 10 dB in 3 cases. BC hearing level was maintained in most cases.

Conclusion: Removal of cholesteatoma matrix and sealing should be performed in one-stage procedure in LF, because its disease progression and additional infection may cause. We think that the multi-layered reconstruction of LF is desirable to prevent postoperative perilymph leakage and deterioration of BC hearing level.

doi:10.1017/S0022215116005843

ID: IP088

Review on external auditory canal cholesteatoma and proposal of more clinical classification

Presenting Author: **Shoji Kaneda**

Shoji Kaneda, Masashi Hamada, Kyoko Odagiri, Momoko Tsukahara, Masahiro Iida
Tokai University

Learning Objectives:

Introduction: External auditory canal cholesteatoma (EACC) is a relatively rare disease and its etiology is uncertain. There seem no guidelines of its management throughout the world.

Methods: Eighteen ears of 17 cases with EACC, which we operated during the past 6 years, were reviewed on its extension and management.

Results: The median age was 58 years old (16–80). There are 4 males (1 with bilateral EACC) and 13 females. Preoperative CT showed the lesion localized in the EAC in 18 ears; only bony erosion in 5 ears and bony destruction in 13 ears. Out of 13 ears, extension to the middle ear was found in 2 ears, to the mastoid in 2 ears, and to the both in 2 ears. Canaloplasty alone was performed in 8 ears. Canaloplasty with mastoidectomy was performed in 1 ear. Tympanoplasty was performed in 9 ears; type I in 6, type IIIc in 2, and type W0 (without ossiculoplasty) in 1.

Discussion: Although Naim et al reported a classification of EACC based on macroscopic and histological criteria, we here propose alternative, more simple classification based on its extension and treatment modalities; Stage 0 : only surface lesion without bony lesion, Stage I: only bony erosion, Stage II: bony deficit localized in the external auditory canal, Stage III: invasion into the tympanic cavity (T), mastoid (M) or combined (T + M), Stage IV: the adjacent anatomical structure complications (e.g. facial palsy (FP), labyrinthine fistula (LF), petrous bone/skull base destruction (PB), and temporo-mandibular joint destruction (TJ)) Following our classification, there are 5 ears in Stage I, 7 in Stage II, 6 in Stage III (2 in T, 2 in M, and 2 in T + M), 0 in Stage IV. Conservative treatment is recommended in cases of Stage I EACC. For Stage II cases with severe otorrhea, canaloplasty may be needed. Cases of Stage III need tympanoplasty, mastoidectomy, or the both. Treatment for Stage IV cases needs more argument.

Conclusion: More clinically applicable classification of EACC is proposed.

doi:10.1017/S0022215116005855

ID: IP089

Regenerative treatment for tympanic membrane perforation with cholesteatoma, tumor, or severe calcification

Presenting Author: **Shin-ichi Kanemaru**

Shin-ichi Kanemaru, Rie Kanai
Medical research institute, Kitano Hospital

Learning Objectives: How to regenerate the TM with cholesteatoma, tumor, or severe calcification.

Background: We developed a new regenerative treatment for large tympanic membrane (TM) perforations without the need for conventional surgical therapy. This treatment was performed on patients with cholesteatoma, tumor, or severe calcification of the TM.

Methods: Twenty-five patients (Age: 9–85; M = 10, F = 15) were selected from patients with or without TM perforation. Ten patients had cholesteatomas, 3 had tumors and 12 had severe TM calcification. They were classified into three groups based on TM perforation size: less than 1/3 of the TM as Grade I (n = 4), 1/3 to 2/3 as Grade II (n = 13) and over 2/3 as Grade III (n = 8). Materials for the TM repair included gelatin sponge with b-FGF and fibrin glue. After lesions were removed through the TM perforation, gelatin sponge immersed in b-FGF was placed over the perforation. Fibrin glue was then dripped onto the sponge. Treatment efficacy was evaluated 6 months post-treatment. Treatment was repeated up to 4 times if complete closure of the TM perforation was not achieved after the first treatment.

Results: Complete closure of the TM perforation was achieved in 92% (n = 23/25) of the cases. The average hearing level in all patients with successful TM repair was improved or maintained. No serious sequelae were observed in any patient.

Conclusions: This new regenerative therapy is useful not only for patients with simple TM perforations but also for those with cholesteatoma, tumor, or severe calcification without requiring conventional surgical procedures. This innovative regenerative therapy is an easy, safe, cost-effective and minimally-invasive treatment.

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ID: IP090

Cholesteatoma recurrence after endoscopy assisted tympanoplasty

Presenting Author: **Emilia Karchier**

Emilia Karchier, Kazimierz Niemczyk, Krzysztof Morawski, Robert Bartoszewicz
Medical University of Warsaw

Learning Objectives: The endoscopically assisted surgery of the middle ear is widely used in the world for over 20 years. The aim of the study was to assess the application of this method in comparison to the standard microscopic tympanoplasty in terms of the tendency to recurrence of cholesteatoma.

The endoscopically assisted surgery of the middle ear is widely used in the world for over 20 years. The aim of the study was to compare the use of this method compared to the standard microscopic tympanoplasty in terms of the tendency to recurrence of cholesteatoma.

The study included 45 patients operated in the years 2009 to 2010 due to cholesteatoma. All patients had made canal wall up tympanoplasty with posterior tympanotomy and removing the cholesteatoma from the middle ear. Reconstruction of the tympanic membrane and ossicular chain were performed as needed. Additionally application of endoscope in study group allowed to visualize and removing of the matrix of cholesteatoma from the recesses of the tympanic cavity. We compared the results of treatment of patients five years after the first operation.

To the study group were enrolled twenty-five patients and twenty to the control group. During five years after surgery, again we operated on sixteen subjects in the study group (66%) and ten from control group (50%). The reason of second-look procedure was uncontrollable retraction pocket or apparent recurrence in the pocket in six patients from the study group (24%) and in one case from the control group (5%). The further persons had carried out second-look tympanoplasty to check the tympanic cavity and to perform ossiculoplasty.

The presence of cholesteatoma during reoperation were found in nine individuals in the study group (37.5%) – six recurrences from the retraction pockets (24%) and three residual cholesteatoma in the recesses of tympanic cavity (12%). In the control group the cholesteatoma was found in only two cases (10%). The recurrence from the retraction pocket in one patient (5%) and the residual of cholesteatoma in one person (5%).

We conclude that developed otosurgical technique is the basis of the satisfactory results of treatment. Additional tool is not affected a in crucial way for improving results in terms of score of residual cholesteatoma.

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ID: IP091

The development of a new 3D printed temporal bone model and it's comparison to other training models

Presenting Author: **Anand Kasbekar**

Anand Kasbekar¹, Gopinath Narasimhan², Tristram Lesser²

¹Cambridge University Hospitals NHS Foundation Trust, ²Aintree University Hospitals NHS Foundation Trust, Liverpool, UK

Learning Objectives: To develop a 3D printed temporal bone that can be used as a training model and to compare it against the Pettigrew bone model, the Voxel-Man virtual reality model and a cadaveric temporal bone.

Introduction: There is a need for realistic temporal bone (TB) models for dissection by trainees in otolaryngology. Three

dimensional (3D) printers provide a method of replicating realistic models. We have developed the first UK 3D TB model (3D model) to our knowledge and compared it to a Pettigrew model (PM), Voxel-Man virtual reality model (VMM) and a cadaveric TB model (CM).

Methods: The production of the 3D model will be discussed using an Object 3D printer. Different colours and materials were used to enhance realism. A senior ENT trainee and post CCT fellow separately dissected and rated the 4 models assessing their realism to a live TB dissection using a 5 point rating system.

Results: The cadaveric model was the closest to a living TB in all category ratings. Amongst the other models, the 3D model rated excellently for “anatomical feel” but due to technical difficulties in the manufacturing process anatomical accuracy was poor. Pros and cons of each of the models are discussed including how the 3D model will be improved to an acceptable standard for ENT trainees to dissect.

Conclusions: With improved manufacturing of the 3D model, trainees will have access to relatively cheap, high quality models to dissect. All models evaluated have varying benefits to the trainee dependant on the stage of their training. The 3D model will be utilised in the region's training programme in the future.

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ID: IP092

How to achieve a dry care free mastoidectomy cavity

Presenting Author: **Udi Katzenell**

Udi Katzenell¹, Rona Bourla², Doron Halperin²

¹Kaplan Medical Center, ²Kaplan Medical Centre, The Department of Otolaryngology Head and Neck Surgery, Affiliated to the Faculty of Medicine of the Hebrew University of Jerusalem

Learning Objectives:

Objectives: This study investigates the clinical results of canal wall down mastoidectomy (CWDM).

Methods: The clinical records of patients who had primary or revision canal wall down mastoidectomy between 9/2011 and 12/2015 in Kaplan Medical Center were reviewed. All surgeries were performed in a uniform technique by two experienced surgeons.

Results: 39 patients had CWDM with the average age of 34 years (5–87). 72% (28) were male and 11 (28%) were female. For 51% (20) it was a revision surgery. 46% (18) had a contralateral pathology and 7(18%) had contralateral surgery. 7% (2) had recurrence of the cholesteatoma after surgery. The Nadol cavity grading after surgery was grade 0 (No discharge events and no granulations) in 71% (22) of the patients, grade 1 (one event of discharge which is shorter than two weeks in the past three months or no discharge with a sensation of a wet ear) in 13% (4) and grade 2 (persistent

discharge or granulations in examination or a need for revision surgery) in 16% (5) patients. We did not have enough information to determine the Nadol grading for 5 patients. 35% (14) did not practice water precautions of whom only one experienced a vestibular effect. 10% (4) used a hearing aid, one had a Bone Anchored Hearing Aid and one had a Bonebridge.

Conclusions: CWDM is reserved for aggressive or recurrent cholesteatoma. We believe that the following are essential for the achievement of a dry care free cavity with a low recurrence rate and rare vestibular effect: evacuate all mastoid air cells, avoid overhangs of the tegmen, drill the sinudural angle, amputate the tip, lower the facial ridge, drill down the inferior part of the tympanic bone, smoothen obliterate the mastoid cavity with bone pate, perform an adequate miatoplasty and use an antiseptic dressing like BIPP. Most patients continue to practice water precautions although the cavity is dry and do not accept hearing rehabilitation with a hearing aid or a bone anchored hearing device.

doi:10.1017/S0022215116005892

ID: IP093

The application of surgical simulation system in the middle ear surgery

Presenting Author: **Jia Ke**

Jia Ke¹, Furong Ma², Shaoxing Zhang², Shilong Sun²

¹Peking University Third Hospital,

²Department of Otorhinolarygology Head and Neck Surgery, Third Hospital, Peking University

Learning Objectives:

Objectives: To probe into the characteristics and applications of the Voxel-Man TempoSurg in middle ear surgical procedures.

Methods: 40 middle ear surgical procedures were selected with videos of the routine surgical procedures reserved. Then simulated procedures were done as the real procedures in the operation. Depending on the different viewing angles, the above cases were classified as three methods: A. Different types of middle ear surgery; B. Different types of mastoid pneumatolysis. C. Different surgical methods (canal wall up or canal wall down). The appearances of the important structures were recorded and compared both in the real procedures and the simulated procedures.

Results: 1. For different middle ear surgeries, the simulator can truly reflex the surgical situations in diseases mostly with bone structure lesions; 2 Recognitions of anatomic structures are easier in better pneumatic mastoids. 3. Recognitions of anatomic structures are almost the same in different procedures with different surgical methods.

Conclusion: Otologic simulator can be used in difficult middle ear surgeries mainly with bone lesions and it can be used in pre-operation and path planning to increase the safety of the surgery.

doi:10.1017/S0022215116005909

ID: IP094

Cone-Beam CT compared to Multi-slice CT for the diagnostic analysis of conductive hearing loss, a pilot study

Presenting Author: **Jiska van Stralen**

Pieter Kemp¹, Jiska van Stralen¹, Pim de Graaf¹, Erwin Berkhout², Jan Wolff¹, Pepijn van Horssen¹, Paul Merkus¹

¹VU University Medical Center Amsterdam,

²Academic Center for Dentistry Amsterdam, department of Oral and Maxillofacial Radiology

Learning Objectives: Image quality is largely dependent on the pilot study parameters that have been used during scanning. Additional research will be performed to optimize the parameters for CBCT (and the MSCT) in imaging of the temporal bone. Thereafter, a new comparison in optimal settings between the NewTom 5 G (CBCT) and MSCT will be conducted.

Introduction: Multi-slice CT (MSCT) is commonly used as a diagnostic tool for patients with a conductive hearing loss. Recent studies indicate that Cone-beam CT (CBCT) may be used as a low radiation dose alternative for temporal bone imaging. However, limited data are available on the image quality of CBCT compared to MSCT (Casselmann, 2013; Theunisse, 2015). The aim of this study was to compare image quality and effective radiation dose of CBCT with MSCT.

Methods: Three human cadaver heads (six ears) were imaged on three CBCT scanners (NewTom 5G, Accuitomo 170 3D, PaX-Zenith 3D) and one MSCT scanner (Discovery CT750 HD Freedom Edition). Visibility of sixteen anatomical landmarks of the middle and inner ear were assessed by two observers on a 4-point Likert scale. Total scores of all landmarks, scores of subgroups (such as the ossicular chain) and individual landmarks were compared. Furthermore, effective radiation dose of the protocols was measured and compared.

Results: Image quality of MSCT and the NewTom 5 G were assessed as superior to the Accuitomo 170 3D and Pax-Zenith 3D ($P < 0.05$). No significant differences in image quality were found between the MSCT and the NewTom 5G. Similar results between scanners were found when comparing scores of the ossicular chain.

It seems that optimizing the scan settings could further improve the image quality of the NewTom 5 G CBCT.

Effective radiation dosages of CBCT protocols were around 25 percent of the clinical MSCT dose.

Conclusion: Image quality of the NewTom 5 G seems comparable to MSCT when scanning the temporal bone with special attention to the ossicular chain and conductive hearing loss landmarks. Furthermore, CBCT imaging results in a considerably lower effective radiation dose compared to MSCT.

doi:10.1017/S0022215116005910

ID: IP095**Novel concept of attaching endoscope holder to microscope (Justtatch) for two handed endoscopic tympanoplasty**Presenting Author: **Mubarak Khan**

Mubarak Khan, sapna Parab

*Mimer medical college**Learning Objectives:*

The well established techniques in tympanoplasty are routinely performed with operating microscopes for many decades now. Endoscopic ear surgeries provide minimally invasive approach to the middle ear and evolving new science in the field of otology. The disadvantage of endoscopic ear surgeries is that it is one-handed surgical technique as the non-dominant left hand of the surgeon is utilized for holding and manipulating the endoscope. This necessitated the need for development of the endoscope holder which would allow both hands of surgeon to be free for surgical manipulation and also allow alternate use of microscope during tympanoplasty. To report the preliminary utility of our designed and developed endoscope holder attachment gripping to microscope for two handed technique of endoscopic tympanoplasty. Prospective Non Randomized Clinical Study. Our endoscope holder attachment for microscope was designed and developed to aid in endoscopic ear surgery and to overcome the disadvantage of single handed endoscopic surgery. It was tested for endoscopic Tympanoplasty. The design of the endoscope holder attachment is described in detail along with its manipulation and manoeuvring. A total of 78 endholder assisted type 1 endoscopic cartilage tympanoplasties were operated to evaluate its feasibility for the two handed technique and to evaluate the results of endoscopic type 1 cartilage tympanoplasty. In early follow up period ranging from 6 to 20 months, the graft uptake was seen in 76 ears with one residual perforation and 1 recurrent perforations giving a success rate of 97.435 %. Our endoscope holder attachment for gripping microscope is a good option for two handed technique in endoscopic type 1 cartilage tympanoplasty. The study reports the successful application and use of our endoscope holder attachment for gripping microscope in two handed technique of endoscopic type 1 cartilage tympanoplasty and comparable results with microscopic techniques.

doi:10.1017/S0022215116005922

ID: IP096**Endoscopic cartilage tympanoplasty: A two-handed technique using dr khan's endoscope holder "EndoHold"**Presenting Author: **Mubarak Khan**

Mubarak Khan, sapna Parab

*Mimer medical college**Learning Objectives:*

Objectives/Hypothesis: 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 cartilage tympanoplasty utilizing both hands for surgery.

Study Design: Retrospective nonrandomized clinical study.

Methods: The endoscope holder was designed and developed to aid in endoscopic ear 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 179 endoscope holder-assisted cartilage tympanoplasties were performed to evaluate the feasibility of a two-handed technique and to evaluate the results of surgery.

Results: In an early follow-up period ranging from 6 to 20 months, the graft take was seen in 174 ears, with one residual perforation and four recurrent perforations, giving a success rate of 97%. The endoscope holder eliminates the disadvantages of single-handed surgery and is a good option for those who wish to perform endoscopic ear surgery using both hands.

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

doi:10.1017/S0022215116005934

ID: IP097**Tympanoplasty in children younger than 10 years**Presenting Author: **Riad Khnifies**

Riad Khnifies, Noam Yehudai, Michal Luntz

Bnai Zion Medical Center, Technion – The Bruce Rappaport Faculty of Medicine, Haifa, Israel

Learning objectives: to evaluate success rate of tympanoplasty in children younger than 10 years and to analyze indications for tympanoplasty in this age group

Introduction: Too often, and especially in children, tympanic membrane perforations are left open due to concerns regarding a possible non-optimal outcome related to frequent upper respiratory tract infections, persistent otitis media and ongoing middle ear underaeration syndrome. The aim of the study is to evaluate success rate of tympanoplasty in children younger than 10 years and to analyze indications for tympanoplasty in this age group.

Method: The study includes a group of 30 children who underwent tympanoplasty or tympanoplasty with canaloplasty between 2011 and 2013. All were younger than 10 years at the time of surgery.

Results: In 20 of the children the ear was dry prior to their referral for 6–12 months, in 10 there was a very large or enlarging perforation, and or high tendency to develop otorrhea with organism typical to chronic otitis media and not to acute otitis media and or bone conduction loss. 10 of the perforations were anterior perforations with overhanging anterior canal wall. In a follow up of 6 months -3 years after surgery, in 27 of the children the tympanic membrane was intact; in 3 children a tiny residual perforation was left. None of the children experienced an event of otitis media after surgery.

Conclusion: The success rate of tympanoplasty in children is relatively high, provided cases are properly selected and technic is carefully chosen (addition of canaloplasty whenever needed). The 10–15% of partial success or even failure (need for revision surgery) does not justify postponing tympanoplasty in all young children, exposing them to the consequences of a long standing tympanic membrane perforation.

doi:10.1017/S0022215116005946

ID: IP098

Does the quality of the material in the ventilation tube can affect the extrusion rate?

Presenting Author: **Dongwon Kim**

Dongwon Kim¹, Soo-Keun Kong¹, Il-Woo Lee², Eui-kyung Goh¹, Se-Joon Oh¹

¹Pusan National University Hospital, ²Yang San Pusan National University Hospital

Learning Objectives:

Objective: The aim of this study is to assess relationship between the material of ventilation tubes (VTs) and VTs extrusion time, among various factors affecting the extrusion rate of ventilation tubes.

Study Design: A prospective, clinical trial.

Method: This clinical trial was conducted in 39 patients, 78 ears with VTs insertion. The 1.02 sized VT was placed in one ear, the 1.14 sized VT was placed in contralateral ear. The patients was evaluated about VTs extrusion history following every month. The extrusion time of VTs in the ears was compared with the contralateral ears. Data included ventilation tube type, discharge characters (scanty, serous, mucoid, glue), multiple intubation (first, multiple), comorbidities, passive smoking, early occlusion, otorrhea or inflammation findings, and age. To minimize additional complicating factors, patients undergoing concurrent tonsillitis, adenoid hypertrophy, sinusitis, and allergic rhinitis were excluded from this study.

Result: There were 41 patients in this study, with a median age of 3.5 years. The mean extrusion time of 1.02 sized ventilation type was 7.94 months, whereas 1.14 sized ventilation type was 6.33 months. In the 1.02 sized VTs, average extrusion time was significantly longer ($p = 0.02$). When the mean extrusion rate associated with age, discharge character, multiple intubation, comorbidities, and otorrhea was compared with ventilation tubes respectively, there were no significant differences.

In addition, it seemed early occlusion and passive smoking affected slightly extrusion time, but no statistical significance.

Conclusion: There was a small but statistically significant increase in the extrusion rate of VTs in patients with the 1.02 sized ventilation tube type. Compared with the 1.02 sized VT and the 1.14 sized VT, the quality of material in ventilation tube was significantly related to the VTs extrusion time. Thus, It would need to consider why the nature of the material affected extrusion rate.

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ID: IP099

Identification of novel potential biomarkers and signaling pathways related to otitis media induced by diesel exhaust particle in in vivo system via transcriptomic analysis

Presenting Author: **Moo Kyun Park**

So Young Kim¹, Hyo Jeong Kim², Jee Young Kwon², Yeo Jin Kim², Seung Hun Kang², Chong Sun Kim³, Young Ho Kim⁴, Jae-Jun Song⁵, Young Rok Seo², Moo Kyun Park⁴

¹CHA Bundang Medical Center, CHA University, ²Dongguk University Biomedical Campus, ³Soree Ear Clinic, ⁴Seoul National University College of Medicine, ⁵Korea University College of Medicine

Learning Objectives: The aim of the present study was to discover potential molecular biomarkers and pathways triggered by DEP exposure in rodent model. Here, we conducted transcriptomic analysis to identify novel potential biomarkers in middle ears of DEP-exposed mice.

Introduction: Association between air pollutants and inflammatory diseases such as Otitis Media (OM) has been shown in recent studies. Diesel exhaust particle (DEP), one of major components among diverse air pollutants, is characterized by a carbonic mixture composed of polycyclic aromatic hydrocarbons (PAHs), nitro-PAHs, small amounts of sulfate, nitrate, metals, and other trace elements. The exposure to DEP as a risk factor for inflammatory diseases has been reported in several recent investigations. In line with these, our previous study identified potential biomarkers in *in vitro* system through gene expression microarray and pathway analysis. Although investigations in *in vitro* system have been conducted to elucidate plausible biomarkers and molecular mechanisms related with DEP, it is necessary to carry out *in vivo* study to identify exact biological relevance regarding incidence of OM caused by DEP exposure.

Methods: We conducted transcriptomic analysis to identify novel potential biomarkers in middle ears of DEP-exposed mice.

Results: A total of 697 genes were differentially expressed in the DEP-exposed mice; 424 genes and 273 genes were up- and down-regulated, respectively. In addition, signaling pathways among differentially expressed genes mediated by DEP exposure were predicted from different two point

of view. Subsequently, we identified several key molecular biomarkers, CHRM1, EPO, SOS1, ESRI, CD4, and IFNA1.

Conclusions: In conclusion, our results might ascertain related cell process and signaling interacted genes underlying DEP exposure and its effects. Moreover, the discovered biomarkers can be recognized as potential candidates for developing early diagnosis and effective treatment strategies of DEP-mediated disorders.

Learning Objectives: We discovered potential molecular biomarkers and pathways triggered by DEP exposure in rodent model.

doi:10.1017/S002221511600596X

ID: IP100

Do we always need gelfoam packing in the middle ear cavity during tympanoplasty?

Presenting Author: **Woo Jin Kim**

Woo Jin Kim, Ji Sun Kong, Jamil AL-Swiahb, So Young Park, Chang Yeong Jeong, Dong Kee Kim, Sang Won Yeo, Shi Nae Park

Seoul St. Mary's Hospital The Catholic University of Korea, College of Medicine

Learning Objectives:

Objectives: A modified overlay tympanoplasty, also known as a lift and repositioning tympanoplasty, has been developed to overcome the disadvantages of the conventional technique. Since fascia is placed over the annulus in this technique, a novel hypothesis that a support of gelfoam in the middle ear cavity would not be necessary has been formed.

Methods: We retrospectively analyzed the surgical outcomes of our modified overlay tympanoplasty to prove whether the outcomes depend on middle ear gelfoam packing during the surgery. A total of 227 chronic otitis media patients who underwent modified overlay tympanoplasty (Type I) with sandwich technique by a single surgeon were included in this study.

Results: The mean age was 49.0 years and the male: female ratio was 76:151. The mean follow up period was 26.3 months (6–94 months). Patients were divided into two groups according to whether or not gelfoam packing was performed in the middle ear cavity; the gelfoam (GG, N = 105) and no-gelfoam groups (NG, N = 122). Graft uptake rates, postoperative hearing levels, and complication rates were compared as the measures of surgical outcomes. The graft uptake rates of each group were up to 99.1% in GG (104/105) and 99.2% in NG (121/122). The air-bone gap significantly decreased after surgery without statistical difference between the groups. Postoperative complications such as epithelial cyst and lateralization occurred very rarely in both groups, and the rates showed no significant differences between two groups.

Conclusions: In conclusion, we suggest that gelfoam packing in the middle ear is not a mandatory procedure during a modified overlay tympanoplasty. Further investigation to find the

clinical advantages of no-gelfoam technique during tympanoplasty is needed in a prospectively designed clinical trial.

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ID: IP101

Paediatric transcanal endoscopic ear surgery

Presenting Author: **Taisuke Kobayashi**

Taisuke Kobayashi, Masahiro Komori, Masamitsu Hyodo
Kochi Medical School

Learning Objectives: TEES is safe and effective for treating children with middle ear disease.

Introduction: Recent advances in endoscopy have led to the development of transcanal endoscopic ear surgery (TEES). In the last decade, TEES usage has increased dramatically worldwide as a minimally invasive surgery with excellent middle ear visualisation and optical surgical manipulation. TEES may be suitable for treating children with middle ear disease. In this study, clinical futures and postoperative results in paediatric TEES cases were investigated to understand the feasibility of TEES in children with middle ear disease.

Materials and Methods: Medical records of 28 paediatric patients (age:

Results: of the 16 male and 12 female patients (mean age: 7.3 years; range: 1–17 years), 8 had left ear disease, 19 had right ear disease, and 1 had bilateral congenital cholesteatoma. They included 20 cholesteatoma, 5 ossicular disruptions, 2 chronic otitis media, and 1 perilymphatic fistula. Tympanoplasty types included 18 type I, 3 type III, and 6 type IV. For three cholesteatoma cases, staged-operations were performed. In an ossicular disruption case, re-operation was needed because of remaining air-bone gap. There was no recurrence of cholesteatoma until now. The diameter of narrowest portion of ear canal (anterior-posterior) on the axial computed tomography was 5.6 mm (mean). Postoperative hearing results were acceptable, with no surgical complications.

Conclusions: Our results suggest TEES as a safe, effective treatment for children with middle ear disease, notably, paediatric chronic otitis media without a mastoid lesion, ossicular disruption, or early-stage congenital cholesteatoma.

doi:10.1017/S0022215116005995

ID: IP103

Usefulness of Anterior-Based Periosteal(Palva) Flap for Obliteration of Mastoid Cavity in Canal Wall Down Mastoidectomy

Presenting Author: **Soo-Keun Kong**
Soo-Keun Kong

Pusan National University Hospital

Learning Objectives:

Objectives/Hypothesis: To observe the usefulness of anterior based periosteal (Palva) flap for mastoid cavity obliteration in canal wall down tympanomastoidectomy and review its efficacy in producing a dry, low-maintenance, small mastoid cavity.

Study design: Retrospective study of a consecutive series of procedures from 2012 to 2014.

Methods: Sixty one consecutive procedures for active chronic otitis media with a minimum follow-up of 6 months (mean, 21 mo; range, 6–40 mo).

Results: 45 ears of cholesteatoma and 11 ears of adhesive otitis media were enrolled this study, and others were chronic otitis media (4 ears), adenoma of middle ear (1 ear). 52 ears (85.2 %) maintained a small, dry, healthy mastoid cavity. 3 ears (4.9 %) had intermittent otorrhea easily controlled by topical treatment, 2 ears (3.2 %) had persistent otorrhea. 3 ears (4.9 %) had showed reformation of tympanic membrane. There were 1 ears of residual or recurrent cholesteatomas. Outcomes remained stable over progressively longer follow-up, up to 40 months.

Conclusion: Obliteration of a canal wall down mastoid cavity by a postauricular periosteal flap is a reliable and effective technique that results in a dry, trouble-free mastoid cavity in 85.2 % of patients with active chronic otitis media.

doi:10.1017/S0022215116006009

ID: IP104

Reliability and comparison of gain values with occurrence of saccades in the video head impulse test (vHIT)

Presenting Author: **Leise Hviid Korsager**

Leise Hviid Korsager¹, Jens Hoejberg Wanscher², Jesper Hvass Schmidt³, Christian Faber²

¹Odense University Hospital, ²Department of ENT-Head & Neck Surgery, Odense University Hospital, ³Department of Audiology, Odense University Hospital

Learning Objectives:

Introduction: The vHIT investigates the vestibular function in two ways: a VOR (vestibulo-ocular reflex) gain value and a graphical representation of VOR. Interpreting patient's vestibular function based on vHIT depends on both parameters, but more information about the reliability of the two parameters is needed.

The objective was to investigate the reliability of vHIT by comparing gain values between examiners on the same subjects and to see how differences affected the occurrence of saccades.

Method: Thirty subjects who had undergone cochlear implant (CI) surgery, were tested with video head impulse test (EyeSeeCam from Interacoustics). Four different examiners, all experienced with vHIT, tested the subjects.

Two judges interpreted the graphical representation of VOR according to occurrence of saccades or not.

Results: Differences in gain values amongst examiners varied from 0.2–0.58 with an average of 0.14 (95% CI 0.12–0.16) on the right ear and 0.17 (95% CI 0.15–0.19) on the left ear. Occurrences of saccades on the same patient were reproduced in 93% of the cases by all examiners. Interclass correlation coefficient (ICC) of the gain values between two examiners was 0.62. Kappa's coefficient was calculated upon the interpretation of the graphical outcome to 0.83.

Conclusion: The gain value seems to be less reliable than the graphical occurrence of saccades in the judgement of VOR. Interpretation of vHIT results should therefore not depend on the gain value alone but should depend on both gain value and the occurrence of saccades.

doi:10.1017/S0022215116006010

ID: IP105

Vestibular findings after cochlear implant surgery measured by video head impulse test (vHIT): A double blinded, randomised clinical trial

Presenting Author: **Leise Hviid Korsager**

Leise Hviid Korsager¹, Jens Hoejberg Wanscher², Jesper Hvass Schmidt³, Christian Faber²

¹Odense University Hospital, ²Department of Rhinology, Odense University Hospital, ³Department of Audiology, Odense University Hospital

Learning Objectives:

Introduction: Dizziness is a common side effect to cochlear implant (CI) surgery. Regarding the CI surgical technique, there is no clear evidence if one approach (round window approach) leads to less dizziness than another approach (cochleostomy).

The main objective to this study is to investigate any difference between the two surgical approaches measured by video head impulse test (vHIT). Secondly we compare the objective findings with the subjective dizziness perceived by the patient.

Method: Fifty patients who will undergo CI surgery at OUH will be examined with vHIT prior to their surgery, the day after their surgery and one month after. They will fill out a Dizziness Handicap Inventory (DHI) scheme and VAS score according to their dizziness.

Subjects are randomized to either the round window approach or the cochleostomy approach. Subjects are stratified according to age (+/- 60), hearing rest and gain prior to surgery (+/-0,68). The randomization is blinded for investigator and subject.

Inclusion period ends at 1st of April 2016.

Results: Results will be revealed at the conference.

Conclusion: The results of this study could have influence on the future choice of approach of electrode insertion in cochlear implant surgery.

doi:10.1017/S0022215116006022

ID: IP106**Health-Related Quality of Life Assessment According Comq-12 in The Healthy Population**Presenting Author: **Sergey Kosyakov**Sergey Kosyakov¹, Julia Minavnina², Ksenia Bgantseva²¹Russia Medical Academy for postgraduate Education, ²Russia Medical Academy for Postgraduate Education*Learning Objectives:*

Introduction: The Chronic Otitis Media Questionnaire 12 (COMQ-12) is a 12-item multiple-choice disease-specific health-related quality-of-life (HRQoL) questionnaire. COMQ-12 allows correlation of the patient's expectations from treatment with the need for surgical intervention. We validated the questionnaire and obtained permission by the authors for its use. As a first step, as part of the development and adaptation of the COMQ-12 we must define normal scores, typical for the healthy population.

Methods: The study included healthy volunteers who were asked to complete a COMQ-12. Also the following data were recorded: sex, age, and whether they had a history of ear problems other than that of chronic otitis media (COM); this included symptoms of hearing loss, dizziness, tinnitus, ear discomfort, history of ear infections. Patients with COM were excluded from the study.

Results: The study included 60 people: 23 men (38,3%), 37 women (61,7%). The average age of the respondents was 34 (16–61). 27 people (45%) did not show any complaints. 33 people (55%) noted the presence of some ear problems, namely: tinnitus – 15 (25%), dizziness – 10 (16,7%), hearing loss – 6 (10%), ear discomfort – 12 (20%), history of ear infections – 16 (26,7%). COMQ-12 scores overall ranged from 0 to 14 among all respondents with a mean score of 3,55. Among patients without complaints average score is 2.07 (range 0–8), among patients with complaints – 4,78 (range 0–14). The median COMQ-12 score overall was 2,5 and the modal score was 0 with 19 (31,7%) participants achieving this score. 75% of respondents achieved a score of 5 or less, 95% of respondents achieved a score of 10 or less out of a possible maximum of 60.

Conclusion: We must pay attention to a group of patients with COMQ-12 scores less than 5 and determine carefully the need of surgical intervention due to the patients expectations.

doi:10.1017/S0022215116006034

ID: IP107**Management of temporal bone osteoradionecrosis complicated by osteomyelitis: a case report**Presenting Author: **M Kuet**
M Kuet, MY Yung*The Ipswich Hospital NHS Trust**Learning Objectives:*

- To describe the presentation, investigation and treatment of a severe case of temporal bone ORN.

Introduction:

- Osteoradionecrosis (ORN) of the temporal bone can result from radiotherapy to the ear.
- We describe the strategy utilised to manage a severe case of temporal bone ORN complicated by superimposed infection.

Case report:

- A 75-year old male presented with a 4-month history of severe headache, right otalgia, otorrhea and hearing loss.
- The patient had undergone excision of a right pinna BCC followed by radiotherapy 15 years ago.
- Examination revealed a 5 cm diameter tender fluctuant swelling over his right temple, pus in the ear canal and an eroded posterior canal wall.
- A diagnosis of severe temporal bone ORN was made.
- CT of the temporal bones demonstrated erosions of the mastoid and squamous portions of the temporal bone. The erosion of the squamous portion had created a bony defect with a large abscess overlying the exposed dura.
- The patient underwent urgent abscess drainage, debridement of necrotic periosteum, subtotal petrosectomy and blind pit closure without obliteration using biological material. A titanium plate was used to repair the lytic area of the skull. This was covered by the preserved temporo-parietal fascial flap.
- Pus culture grew *S. anginosus* requiring treatment with 7 days of IV co-amoxiclav followed by 5 weeks of PO amoxicillin.
- 2 months post surgery the patient was completely pain free and follow up CT confirmed radiological resolution.

Conclusions:

- Temporal bone ORN arises from radiation injury causing bone hypovascularity with subsequent cellular death. It may occur many years after radiotherapy to the head and neck.
- Potential sequelae include osteomyelitis, CSF leak, meningitis and fatality.
- Patients may present with severe otalgia, chronic otorrhea and swelling.
- The mainstay of treatment is surgical debridement and abscess drainage. Long-term antibiotics are needed to treat an associated osteomyelitis.

doi:10.1017/S002221511600606X

ID: IP108

Vibrant Soundbridge – Lessons Learnt Over Two Decades

Presenting Author: **Jeyanthi Kulasegarah**

Jeyanthi Kulasegarah, Nina Mistry, Huw Cooper, Stuart Burrell, Christopher Coulson, Konstance Tzifa, Richard Irving

Queen Elizabeth Hospital Birmingham

Learning Objectives: Appropriate patient selection for middle ear implant is important.

Introduction: The Vibrant Soundbridge (VSB) is an active middle ear implant that is currently used in patients with conductive, sensorineural, and mixed hearing loss. Initially it was intended for adults with moderate to severe sensorineural hearing loss with previous experience with conventional hearing aids. Since 2006, it was also used for conductive hearing loss and from 2009 onwards, the indication was extended to children. The first implantation in UK was performed in 1997 in our department.

Objective: Our experience of VSB over a period of almost two decades will be presented.

Method: A retrospective survey of two groups of patients: Group I (VSB inserted 1997–2002) and Group II (VSB inserted 2011–2015) were conducted. We looked at indications, surgical and audiological data between the two groups. Long-term follow-up data presented for Group I.

Results: In total 28 VSB were implanted between 1997 and 2015: 14 patients in Group I and 12 patients in Group II (2 patients with bilateral VSB implants). In Group I, all 14 patients had the VSB coupled to the incus for moderate to severe sensorineural hearing loss. Among them, 6 patients are still VSB users. One patient went on to have a cochlear implant 9 years after VSB surgery due to progressive hearing loss. In Group II, all apart from one patient is a VSB user 12 months post implantation. Two patients had round window placement and one patient had a stapes placement, the remaining 11 VSB were the conventional incus coupler. The indications included conductive and mixed hearing loss for chronic middle ear disease (4 patients) and obliterative otitis externa (2 patients).

Conclusion: The VSB implantable hearing technology has been proven to be safe, effective and highly desirable option for patients with conductive, mixed and sensorineural hearing loss. With improvements in patient selection and technology, patient outcomes have improved over time.

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ID: IP109

Three-dimensional displacement of an endoscope - preliminary result

Presenting Author: **Yasuomi Kunimoto**

Yasuomi Kunimoto, Taihei Fujii, Hiroaki Yazama, Junko Kuya, Hiromi Takeuchi

Tottori University

Learning Objectives:

Introduction: Recently, an endoscopic ear surgery is widely spreading. During the endoscopic surgery, the operator holds an endoscope with one hand and manipulates the instruments with another hand. The fixation of the endoscope could be unstable especially for operators who do not have enough experience of the endoscopic surgery. Unstability of the endoscope can cause the surgical difficulty, furthermore, increases the complication by contacting to the surrounding important structures. Because the intraoperative monitor is 2-dimension, we could not measure how far the endoscope is displaced parallel to the visual axis. In this study, we objectively measured the 3-dimensional displacement of the endoscope in several situations and assessed the appropriate fixation.

Methods: The displacement of the endoscope tip was measured using the 3-dimensional motion capture software. The measurements were performed in several situations such as just holding the endoscope without any manipulation, during the manipulation, and while receiving the instrument from the scrub nurse. In each situation, the endoscope was fixed with or without operator's elbow.

Results: The displacement of the endoscope with elbow fixation tended to be smaller than that of without elbow fixation in each situation.

Conclusions: From our preliminary result, it seemed the most appropriate to fix the endoscope with elbow.

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ID: IP110

The incidence of facial nerve dehiscence at surgery: a report of 224 tympanoplasty for cholesteatoma

Presenting Author: **Charles Edouard Rouf**

Emmanuel Lescanne, Charles Edouard Rouf, David Bakhos, Sylvain Moriniere, Soizick Pondaven, Emmanuel Lescanne

CHU de Tours

Learning Objectives: Facial paralysis can occur after surgery for cholesteatoma. Rate of FND was reported 13% in our serie, suggesting that otologist should be highly vigilant when dissecting near the FN.

Objective: The objective of this retrospective study was to identify the incidence of facial nerve dehiscence (FND) in patients undergoing tympanoplasty for cholesteatoma.

Patients and method: We retrospectively reviewed 224 patients, who underwent tympanoplasty performed by a

single surgeon between 2012 to 2014. We collected following data: kind of surgery (canal wall up (CWU) or canal wall down with mastoid obliteration (CWD), FND and its location after exenteration of disease, labyrinthine fistula, dural exposure and preoperative and postoperative facial function.

Results: The incidence of FND was 13% (29/224 ears) for total surgical procedures, 0.1% for CWU tympanoplasty (23/208), 38% for CWD tympanoplasty (6/16). The most common site of dehiscence (90%, 26/29) was the tympanic segment, posterior to the cochleariform process in 18 cases. We find 11 patients with labyrinthine fistula (5%) and 3 with dural exposure (1%). All but one have normal preoperative FN function, all retained normal function postoperatively.

Conclusion: In our series, incidence of facial nerve dehiscence and labyrinthine fistula was similar to the data reported in the literature. All patient retained normal function postoperatively.

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ID: IP111

Eustachian tube opening measurement by sonotubometry using perfect sequences for patients with chronic secretory otitis

Presenting Author: **Eugenijus Lesinskas**

Eugenijus Lesinskas¹, Vilma Beleskiene²
¹Vilnius University Hospital santariskiu Clinics, ²Vilnius University Hospital Santariskiu Clinisc

Learning Objectives: Most testing methods for evaluation of the Eustachian tube function are subjective and non-specific, likewise objective methods are insufficiently standardised and they poorly correlate with the clinical picture or are non physiological, therefore employed only under certain pathological conditions. Among the many studies, there is no 'golden standard' which could be widely used and serve as a benchmark to all.

The aim of the study: To examine the relationship between ET function and chronic middle ear diseases by applying sonotubometry with perfect sequences (PSEQ).

Methods: In order to objectively assess ET function, PSEQ-based sonotubometry results were assessed in healthy persons and in patients with ET dysfunction. All subjects were performed comprehensive examination which included collection of anamnestic data, otoscopy, rhinoscopy, tympanometry, Valsava test and sonotubometry using PSEQ stimuli, nasal and nasopharyngeal videoendoscopy.

Results: The testing was conducted on 43 OME patients (28 females (65,1%) and 15 males (34,9%)) and 39 healthy individuals (21 females (53,8%) and 18 males (46,2%)). The openings were not detected for 43,9 % of the OME patients and for 6,4 % of healthy individuals ($p < 0,001$). The mean ET opening duration in OME

patients was 261 ± 147 ms, the mean sound wave amplitude $7,41 \pm 4,77$ dB, for healthy- 274 ± 153 ms and $12,26 \pm 5,40$ dB.

Conclusions: Average of the wave sound amplitude was shorter comparing to healthy individuals ($p < 0,001$). Factors, statistically significantly related with not detected openings using sonotubometry were severe hypertrophy of inferior turbinate's, B type tympanogram and the character of the tympanic membrane retraction. More frequent ET dysfunction was found for the patients with retraction of pars tensa of tympanic membrane (0,038).

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ID: IP112

Extensive supporting cell proliferation and mitotic hair cell generation through genetic reprogramming process

Presenting Author: **Wenyan Li**

Wenyan Li, Wenli Ni, Huawei Li
 Affiliated Eye and ENT Hospital of Fudan University

Learning Objectives:

The activation of cochlea progenitor cells is a promising approach for hair cell (HC) regeneration and hearing recovery. The mechanisms underlying the initiation of proliferation of postnatal cochlear progenitor cells and their transdifferentiation to HCs remain to be determined. We show that Notch inhibition initiates proliferation of Wnt-responsive Lgr5 + progenitor cells and mitotic regeneration of HCs in neonatal mouse cochlea *in vivo* and *in vitro*. We demonstrate that Notch inhibition removes the brakes on the canonical Wnt signaling and promotes Lgr5 + progenitor cells to mitotically generate new HCs. While, by down-regulating Notch signaling, the proliferated supporting cells (SCs) and mitotic generated HCs mainly located at the apex region of cochlea, which usually lose less hair cells compared to the base region of cochlea. For pursuing the extensive proliferation and hair cell generation needed for hearing recovery, we genetically reprogrammed the SCs by activating the β -catenin to up-regulate Wnt signaling, deleting the Notch1 to down-regulate Notch signaling and overexpressing the Atoh1 in Sox2⁺ SCs in neonatal mouse cochlea, as we show here that the extensive proliferation of SCs followed by mitotic HC generation is achieved. Our study reveals a new function of Notch signaling in limiting proliferation and regeneration potential of postnatal cochlear progenitor cells, and provides a new strategy to regenerate HCs from progenitor cells by genetically reprogramming SCs with defined genes involved in HCs formation.

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ID: IP113

Middle Ear Adenoma: rare entity, life-long surveillance

Presenting Author: **Shueh Lim**

Shueh Lim¹, John Crowther², Georgios Kontorinis²

¹Royal Hospital Sick Children Glasgow,

²Queen Elizabeth University Hospital, Glasgow

Learning Objectives: Middle ear adenomas are rare benign tumours. Surgery remains the mainstay of treatment. Longterm follow up should be carried out. Middle ear adenoma should be included in the differential diagnosis of middle ear mass in patients with persisting, non-specific symptoms.

Introduction: Middle ear adenoma is a low-grade neoplasm with the potential for recurrence and metastases. Clinical and radiological findings can be misleading and often fail to provide the right diagnosis. Our objective is to present our experience over a 10 year period.

Methods: A retrospective review of all middle ear pathology at our tertiary referral centre with a catchment area of over three million over the last 10 years was carried out.

Results: In total, only three patients were identified (prevalence 1:1,000,000), two male one female. Common symptoms of presentation included conductive hearing loss, aural pressure and autophony. Detailed imaging (computed tomography, magnetic resonance imaging complimented by angiography) was employed to better characterize the lesion and help with surgical planning. All patients underwent middle ear/ lateral skull base surgery. One patient had revision surgery for recurrence. Because of the neuroendocrine nature of ME adenomas, all patients remain under postoperative surveillance.

Conclusion: Our experience is similar to published literature. Adenomas of middle ear are indistinguishable benign tumours; surgical excision should be carried out to ensure complete excision.

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ID: IP114

Intracranial Complications from Chronic Otitis Media

Presenting Author: **Richard Locke**

Richard Locke¹, John Crowther², William Taylor³, Georgios Kontorinis²

¹Queen Elizabeth University Hospital, Glasgow, ²ENT Department, Queen Elizabeth University Hospital, Glasgow, ³Neurosurgery Department, Institute of Neurosciences, Queen Elizabeth University Hospital, Glasgow

Learning Objectives: Intracranial complications from middle ear disease Patterns of presentation Management of intracranial complications

Middle ear disease remains relatively common in the UK population with a previous study revealing the prevalence of inactive chronic otitis media to be 2.6% and active chronic

otitis media to be 1.5% in the adult population. The incidence of intracranial complications from middle ear disease has fallen, however these life threatening complications are often diagnosed late and need to be treated aggressively.

We performed a retrospective analysis of patients referred to a tertiary neurosurgical centre with intracranial complications from both mucosal and squamous middle ear disease. The case notes and imaging were reviewed for comparison. Patient age, symptom duration, type of middle disease, management, complications and outcomes were determined. The results were then compared with a similar analysis performed at the same institution 20 years previously.

The majority of patients had active squamous otitis media. Previous surgical treatment of cholesteatoma did not prevent development of intracranial complications when there was recurrent disease. Meningitis was the predominant intracranial complication with venous sinus thrombosis and abscess rates lower. One patient developed a false aneurysm of the internal carotid artery from active mucosal otitis media.

There has been little change in the range of complications encountered over the past 20 years. For conditions such as false aneurysms, advances in interventional radiology have led to improved outcomes.

We present these cases to highlight the issues regarding diagnosis and management of patients with intracranial complications from chronic middle ear disease. High index of suspicion and aggressive surgical treatment remain essential as delay in diagnosis or treatment can be catastrophic.

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ID: IP115

Cholesteatoma: How it grows and where it goes, and how we should therefore approach its surgery: An analysis of data collected prospectively on 516 cases.

Presenting Author: **James Loock**

James Loock

University of Stellenbosch

Learning Objectives:

Introduction: While all otologists operate on cholesteatoma, little analysis exists of the patterns of disease spread which logically should dictate surgical approaches. Nor has comparison been made between different parts of the world.

Method: A detailed data-base was prospectively collected on every cholesteatoma surgery in Tygerberg Hospital between 2003 and 2016 (n = 516). This included *inter alia* the cholesteatoma's origin from the tympanic membrane, and its presence/not in all parts of the mesotympanum, epitympanum and mastoid. This data is analysed for the various sites and subsites and the site of origin of the cholesteatoma.

Results: Surprisingly, the tympanic membrane origin was: pars flaccida 27%, pars tensa posterior-superior marginal 29%; pars tensa central 30 %; and indeterminate 13% (some had multiple origins).

Cholesteatoma involved the epitympanum in 78%, mesotympanum in 77%, and mastoid in only 52%. Subsite involvement in the epitympanum was: posterior 86%; middle, superficial to ossicles 69%; middle deep to ossicles 54%; anterior 65%, and anterior epitympanic recess 9%.

In the mesotympanum it was central over promontory in 76%; posterior-superior in 72%; in the facial recess and sinus tympani in 48%, anterior in 22% and in the hypotympanum in 12%.

In the mastoid it was restricted to the antrum in 52% and more widely in 26%.

Differences are described in the pattern of spread dependent on the site of origin from tympanic membrane.

Conclusion: This data shows cholesteatoma is primarily a condition of the meso- and epitympanum. One thus needs to be able to remove it from the complex subsites of the middle ear, including retrotympaanum, and rehabilitate the mesotympanum. The frequent involvement of the ossicles in the epitympanum demands techniques to mitigate recidivism here. Our South African data is significantly different from what the literature describes - the question is whether this disease is different in different regions.

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ID: IP116

Meeting Medical Expectations in Pediatric Cholesteatoma Surgery – Revisited

Presenting Author: **Michal Luntz**

Michal Luntz, Riad Khnifies, Noam Yehudai
Bnai Zion Medical Center, Technion – The Bruce Rappaport Faculty of Medicine, Haifa, Israel

Learning Objectives: to establish realistic expectations in pediatric cholesteatoma in the era of non-EPI-diffusion weighted MRI.

Introduction: Cholesteatoma is a struggle for a safe and convenient condition with the least possible surgeries in the presence of a disease that tends to re-create after complete removal due to the compromised ME physiology, as well as the possibility of residual disease.

Methods: Data collected from consecutive pediatric cholesteatoma surgeries performed by a single surgeon (ML) between 2001 and 2005 and between 2011 and 2015. Type and number of surgeries performed in each group over the follow up period before (2001 and 2005) and after (2011 and 2015) the introduction of non-EPI-diffusion weighted MRI were compared. Revision surgery was also performed in both groups at any point when recurrent cholesteatoma is detected by routine follow-up otoscopy (4–6 weeks, 3 m, and every 6 m thereafter).

Results: There were no significant medical or surgical complications in either group. 54.5% of the children operated between 2001–2005 ended with a CWD mastoidectomy condition (radical cavity) after a mean follow up of 5.8 ± 3.8 . None of the children operated during

2011–2015, after the introduction of routine periodic post-operative non-EPI diffusion MRI follow-up ended at this point or expected to have at any point a radical mastoidectomy.

Conclusions: Currently, radical mastoidectomy with meato-plasty should not be used as one of the routine surgical options in pediatric cholesteatoma. Follow up (clinical and imaging) after cholesteatoma is absolutely mandatory, without it, children with cholesteatoma are exposed to a very significant and unnecessary risk. In cases of repeated, de-novo re-creation of cholesteatoma, or repeated infection in an existing radical cavity, a CWD mastoidectomy with blind sac obliteration of the EEC and the ME cleft is also a very practical option in certain cases, as it eliminates de-novo re-creation of cholesteatoma.

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IP117

Hearing in Patients with Cholesteatoma: Facing Reality

Presenting Author: **Michal Luntz**

Michal Luntz, Riad Khnifies, Noam Yehudai
Bnai Zion Medical Center, Technion – The Bruce Rappaport Faculty of Medicine, Haifa, Israel

Learning Objectives: to confront the otologic community with the non-optimal hearing of individuals with controlled cholesteatoma.

Introduction: Goals of management in cholesteatoma are to create a safe ear (avoiding complications), to achieve a dry and convenient ear and to reach the best possible hearing restoration. Although hearing restoration is not defined as the first priority for treatment in cholesteatoma, it may have serious long-term effects on patient's life.

Methods: The study included two study groups. In one group there were 260 consecutive cholesteatoma surgeries, 128 adults and 132 children. The mean group follow-up was 6.6 ± 12.8 yrs. Hearing thresholds were analyzed according to type of surgery performed and age of the patients (children Vs adults). The other group includes 39 ears of children who were operated after the introduction of routine use of none EPI-diffusion weighted MRI and the complete avoidance of traditional radical cavities. In this group follow up was much shorter (Mean 1.4 ± 1.3 yrs.)

Results: Mean group air conduction (AC) PTA after canal wall up procedures were 38 dB in children and 55 dB in adults. Mean group AC-PTA after canal wall down procedures were 70 dB in children and 60 dB in adults. Group AC-PTA after canal wall up procedures were 38 dB in children and 55 dB in adults. In the group with radical mastoidectomy and reconstruction of the EEC and mastoid obliteration mean group AC-PTA was 40 dB as compared to 60 dB in the canal wall down cases which were left as radical cavities.

Conclusions: The mean AC-PTA of ears with controlled cholesteatoma indicates that hearing is unsatisfactory in many of the individuals with controlled cholesteatoma. When it is evident that hearing is not within normal thresholds (whether ossiculoplasty was performed or not) all relevant rehabilitation options should be offered to the patients, including conventional hearing aids, bone conduction systems, middle ear implants or cochlear implants.

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ID: IP118

Middle Fossa approach to Bone Bridge Surgery

Presenting Author: **Manoj M P**

Manoj M P¹, Sumit Agrawal²

¹MESIARC, ²Department of Otolaryngology - Head & Neck Surgery London Health Sciences Centre - University Hospital University of Western Ontario

Learning Objectives: to popularise the middle fossa approach to placement of the receiver stimulator and vibrating mass transducer of the bone bridge implant instead of the mastoid cavity

Introduction: The Bone Bridge is a new bone conduction device that works on the principle of transcutaneous sound transmission and a vibrating mass transducer placed with titanium screws on to the mastoid bone to deliver sound to the cochlea in conductive and mixed hearing losses. Since we use this technique mostly in children and adults with microtia, the placement of the device in the mastoid can compromise future otoplasty surgery for pinna reconstruction. We demonstrate a technique of middle fossa placement of the device that is easier to perform, quicker and leaves the post aural skin free for later reconstruction.

Methods: The bone bridge has a large vibrating mass transducer that needs a well fitting circular cavity so that the titanium screws are placed properly. We chose the area above the mastoid, above the transverse sinus for placement where a small incision can place the implant easily and firmly

Results: Of the cases performed in two centers, London health sciences center has done 19 and Calicut MESIARC 6. All these are middle fossa placements. The age of the patients vary from 4 years to 58. Placement timing was between 30–40 minutes for one side. No post operative immediate or delayed complications were noted. Hearing results were excellent.

Conclusions: The middle fossa technique of bone bridge vibrating mass transducer is a safe, easy and quick technique even in very young children with minimum morbidity

Learning Objectives: It is expected that this technique is more widely followed than the conventional sinodural angle placement method

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ID: IP119

Facial nerve dehiscence and middle ear cholesteatoma: endoscopic vs microscopic approach

Presenting Author: **Giuseppe Magliulo**

Giuseppe Magliulo, Giannicola Iannella, Benedetta Pasquariello, Alessandra Manno, Diletta Angeletti 'Organi di senso' Department, 'Sapienza' University of Rome

Learning Objectives: - Endoscopic approach in cholesteatoma surgery - Endoscopy vs microscopic approach in cholesteatoma surgery - Facial nerve dehiscence evaluation using oto-endoscopy

Introduction: Facial paralysis is one of the most devastating postoperative complications of cholesteatoma surgery, and dehiscence of the Fallopian canal may contribute to this serious complication. In recent years endoscopic approaches to the middle ear have increasingly been used. The aim of this study was to assess the incidence of facial nerve dehiscence in a group of patients with middle ear cholesteatomas who underwent primary exclusive endoscopic surgery (PEES).

Methods: Forty attic cholesteatomas were enrolled in the study. 20 patients underwent PEES were compared with a group of 20 patients that undergone microscopic surgery. Preoperative and postoperative clinical symptoms and disease duration before surgery were evaluated, together with the presence and site of facial nerve dehiscence, the presence and site of labyrinthine fistula, the type of surgery performed and the duration of the operation.

Results: The incidence of intraoperative facial nerve dehiscence in the EES group was 27.1%. Dehiscence was present in 42.3% of the patients who underwent revision surgery. The most common site of dehiscence (92.3%) was the tympanic segment. Similar data were reported in patients treated with microscopic approach without statistical difference between the two groups. No difference regarding post-operative complications was present in the two groups. PEES exhibited shorter surgical time.

Conclusions:

- Primary endoscopic surgery is a minimally invasive approach that circumvented bony work in sclerotic mastoid with antral or periantral cholesteatoma involvement with shorter times compared with mastoidectomy.
- Endoscopy is a 1-hand surgical manipulation and in some situations the need of 2-hand manipulation can oblige the use of microscopic dissection. However its complementary option in dehiscent facial nerve appears essential for evaluating hidden areas as in the area posterior to the geniculate

ganglion focusing the importance of the floor of the anterior epitympanum.

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ID: IP120

Cholesteatoma in children, is it really particular?

Presenting Author: **Benzamit Makhoulouf**

Benzamit Makhoulouf¹, Djarmouni Nabila²,
Benamira Mohamed³, Kehal Youcef³

¹Chawki & Achwak Clinic, SETIF, ²Ent Department,
Ferhat Abbas University, ³Chawki et Achwak Clinic

Learning Objectives:

Introduction: Cholesteatoma is a serious middle ear disease, affecting both adults and children. It is more special in children. Occurred on a pneumatized mastoid, cholesteatoma in children is more aggressive with a great potential of extension and a high tendency to recurrence. Although in literature many authors support this hypothesis, others still disagree with this point of view at the present time. Therefore, the particularity of cholesteatoma in children is a reality or just a myth? Our study aims to emphasize on this issue.

Materials and methods: with a longitudinal-type study on 82 cases of acquired cholesteatoma in children at ENT department of Ferhat Abbas university and Chawki & Achwak clinic between January 2004 and December 2015. The aim of this work is to illustrate the clinical, para clinical and therapeutic features of cholesteatoma in the pediatric population and highlight the main characteristics.

Results: The main reason for consultation is largely driven by the fetid otorrhea (96.5%), hearing loss, however, is well behind (66.7%). It is worth noting that Tubal dysfunction, adaptation disease, allergy are very common and characterize children. CT scan is the imaging method of choice in the pre-operative evaluation. It provides useful details, particularly regarding the pneumatization of the mastoid. Thus, confirming that cholesteatoma in children occurs on a very pneumatized mastoid which usually belongs to younger children. Granulation tissue in the middle ear and the mastoid cavities, denuded facial nerve, very extensive cholesteatoma are the most common difficulties to remove the disease and to prevent the recurrence which is absolutely higher than that observed in adults.

Conclusion: Cholesteatoma of the child is special because the child himself is special. The large clinical latency and the misdiagnoses complicate not only the task of the surgeon but also the prognosis with a high potential of recurrence whatever the technique used.

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ID: IP121

Endaural Approach through Post auricular Incision

Presenting Author: **Bulent Mamikoglu**
Bulent Mamikoglu¹, Bulent Mamikoglu²

¹Chicago Dizziness and Hearing, ²Chicago Dizziness and Hearing, and U of Illinois at Peoria Medical School, Department of Neurosurgery

Learning Objectives: Endaural approach can be performed through postauricular incision. Author has 20 years of experience using endaural approach in cholesteatoma surgery. Author will discuss the surgical technique, patient selection, difference in surgical drilling compared to cortical mastoidectomy, and results. Endaural approach allows minimally invasive surgery for cholesteatoma patients with fast recovery and smaller mastoid cavity for post-operative care. Hearing results are competitive to cortical mastoidectomy results. Case selection is important but also surgery can easily switch into canal down procedure if the pathology is larger than predicted before surgery. Cartilage grafting is an important part of the surgery and graft material is usually obtained from auricular concha rather than tragus.

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ID: IP122

Comparative study on different graft tissues for simple myringoplasty

Presenting Author: **Francesco Mancini**

Francesco Mancini, Tommaso Sorrentino, Nader Nassif,
Luca Oscar Redaelli de Zinis

Spedali Civili di Brescia

Learning Objectives: Comparison of three different autologous graft tissues in simple myringoplasty in terms of effectiveness and hearing gain.

Introduction: In case of chronic otitis media it is possible to reconstruct the defect of the eardrum with different autologous materials: fascia (F), perichondrium (P), or cartilage (C). Last tissue shows greater resistance but might reduce the gain of the auditory canal due to its thickness. Aim of the study is to compare the effectiveness and the success in auditive gain of the 3 different tissues in simple myringoplasty.

Material and Methods: All simple myringoplasty of the last 3 years have been reevaluated. Exclusion criteria were the presence of a cholesteatoma and chronic otitis. An otoscopic picture of both ears was taken for each patient. The site of perforation was classified into anterior, posterior and subtotal. A PTA, according to the guidelines of the AAO-HNS has been performed before and 2 months after surgery.

Results: A total of 123 patients undergoing simple myringoplasty was identified. In 33 patients we used C, in 33 F and in 26 P. The overall failure rate was 10%, divided in: 12.1 % for C (plus a further 12.1 % of microperforation all repaired), 2.7 % for F, 18.2 % for P. The status of the contralateral ear showed it was pathological in 48.5 % of cases of C, 16.6 % F and 18.2 % of P. The site of the perforation was anterior in 48.5 % of C, 41.6 % of F and 40.1 % of P; posterior in 12.1 % of C, 13.8 % of F and 45.4 % of P; subtotal in 39.4 % of C, 44.4 F and 13.6 % of P. The ABG was 26.9 dB for the preoperative C, 20.7 dB for F and 18.6 dB for and P; The postoperative ABG was 17.3 dB for C, 13.1 dB for F and 11.5 dB for P. The auditive gain (difference of ABG pre and postop) was 9.5 dB for C, 7.5 dB for F and 7 dB for P.

Conclusions: The results show an overall success rate in line with the literature. It emerges that F has the best success rate but C is used mostly in cases where the contralateral ear is pathological. The auditory gain is comparable, even if C is chosen in the cases with a worse initial ABG.

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ID: IP123

An evaluation of the NHS Clinical Commissioning Policy on Bone Anchored Hearing Aids

Presenting Author: **Rishi Mandavia**

Rishi Mandavia¹, Samit Unadkat², Anne Schilder¹

¹Ear Institute, University College London,

²London North Thames ENT Registrar

Learning Objectives:

Introduction: The NHS Commissioning Policy on Bone Anchored Hearing Aids (BAHA) identifies the criteria for the commissioning of BAHA services and therefore has a major impact on patient access to care. This paper aims to evaluate the evidence base informing the NHS Commissioning Policy on BAHAs. We also aim to produce recommendations on BAHA policy development.

Methods: This study was conducted in two parts.

- 1) Critical assessment of the evidence based informing the NHS Commissioning Policy on BAHAs. Quality of included articles and the overall strength of the policy were assessed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) System.

- 2) Systematic review of the literature on BAHAs published since the release of NHS Commissioning Policy. Papers were included if they could be used to inform the Commissioning Policy on BAHAs.

Results: All studies referenced by the policy were graded as 'low quality' or 'very low quality' evidence. The strength of the overall policy was graded as weak. The literature cited by the Commissioning Policy contained several areas of disagreement with the Commissioning Policy itself.

Nineteen articles were included following systematic review. These studies identified six areas for development of the NHS Commissioning Policy for BAHAs: 1) BAHA implantation in children with unilateral hearing loss; 2) BAHA as an alternative to other surgical treatments; 3) The minimum number of BAHAs implanted by a centre each year; 4) Unilateral BAHA implantation in patients with less than profound sensorineural hearing loss; 5) Bilateral BAHA implantation in adults; 6) BAHA implantation in patients with osteogenesis imperfecta.

Conclusion: It is important that these areas are reviewed by the commissioning board to help ensure equitable access to BAHA services and that resources are allocated effectively. It is also clear that high quality research is urgently needed in this field to help inform national policy.

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ID: IP124

Couplers for Vibrant Soundbridge® implant vs no-Coupler-Vibrant Soundbridge® implant

Presenting Author: **Manuel Manrique**

Manuel Manrique

NA

Introduction: The middle ear active implant Vibrant Soundbridge® (VSB) is a device designed for the treatment of the sensorineural, mixed and conductive hearing losses. Depending on the type of the hearing loss and the anatomical condition of the different middle ear structures, the placement of its FMT can be carried out in different ossicular chain points or directly on the round or oval window, aimed to obtain a direct stimulation of the inner ear. Recently, new Couplers have been designed to obtain a better coupling of the FMT with these structures.

Objectives: To compare surgical feasibility and auditory performance with VSB traditional system versus the new "Couplers" for the VSB implant

Methods and materials: Thirty eight patients treated with VSB systems are included at the moment. Eleven patients implanted with VSB Coupler versus 27 patients with no-Coupler VSB. Three out of eleven VSB Coupler implants were indicated for sensorineural hearing loss (SNHL) patients and eight of them for conductive and mixed hearing loss patients. Regarding no-Coupler VSB, seven patients were diagnosed of SNHL whereas twenty of conductive and mixed hearing loss patient.

Mean thresholds for 0.5, 1, 2, 3 and 4 KHz frequencies before and after implantation are obtained for r VSB Coupler group and no-coupler VSB group. For SNHL air conduction is analysed whereas bone conduction is considered for conductive and mixed hearing loss.

Besides, functional gain and discrimination of disyllabic words at 65 dB in quiet is analyzed.

Results: Surgeon subjective perception is that Couplers simplify the surgical process, allow a more stable coupling and minimize the risks of post-surgical FMT movement as well. Focusing on SNHL patients, the mean hearing thresholds for the air conduction before and after the surgery were respectively 59.25 dB and 29.75 dB for the no-Coupler VSB group, opposite to 63 dB and 24.75 dB for the VSB-Coupler group; and the mean functional gain was 30.25 dB for the no-Coupler VSB group, opposite to 38.25 dB for the VSB-Coupler group. In the disyllabic words test, difference was 78% for the no-Coupler VSB group and 82% for the VSB-Coupler group. For conductive-mixed hearing loss patients, mean hearing thresholds for the air conduction before and after the surgery were 84.75 dB and 85 dB respectively for the no-Coupler VSB group, opposite to 85 dB and 30.75 dB for the VSB-Coupler group; and mean functional gain was 47.5 dB for the no-Coupler VSB group, opposite to 53 dB for the VSB-Coupler group

Conclusions: Surgical procedure is simpler for coupler VSB for both indications (SNHL and conductive and mixed hearing loss). A greater tendency to improve auditory outcomes is described for VSB Coupler group vs no-Coupler VSB group.

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ID: IP125

Aberrant internal carotid artery in the middle ear: a cause of aural fullness

Presenting Author: **Angels Martinez Arias**

Angels Martinez Arias¹, Mario Prenafeta², Rosa Rosell², Anton Aguila¹, Mariana Campos¹, Laura Samara¹, Yolanda Escamilla¹, Alda Cardesin¹, Juan Jose Diaz¹, Ricard Bargues¹

¹Hospital Parc Tauli Sabadell, Barcelona, Spain, ²Hospital Parc Tauli Sabadell, Barcelona, Spain

Learning Objectives: Otolologists should be aware of vascular malformations of the temporal bone. Aberrant ICA in the middle ear is a very rare finding and its damage during surgical procedures can lead to severe complications. When there is a suspicion of a middle ear vascular anomaly, CT scan of the temporal bone is the standard. It should be performed before any middle ear surgery, to avoid complications related to misdiagnosis. Endoscopic examination improves diagnosis of middle ear pathology.

Introduction: Aberrant internal carotid artery (ICA) in the middle ear is a rare vascular anomaly of the temporal bone and its diagnosis can be difficult because the symptoms and signs are often nonspecific.

Accidental injury during myringotomy or other middle ear surgeries, can lead to severe complications.

Methods: We report a case of a 47-year-old woman who complained of fullness in the right ear for 6 months, without hearing loss or tinnitus. She had no previous otological pathology.

Endoscopic otoscopy revealed a slight white-rosy mass behind the inferior half of the tympanic membrane.

A CT scan of the temporal bone confirmed aberrant ICA passing through the middle ear. A magnetic resonance angiography was also performed.

The patient was informed about the diagnosis and the possible complications of middle ear interventions, and regular follow-up was arranged.

Results: Color changes on otoscopic examination may suggest the presence of a vascular anomaly, as sometimes seen in aberrant ICA, due to its intratympanic course.

These features were seen in the CT scan: the ICA ran more laterally, there was an enhanced mass in the hypotympanum and a deficient bony plate along the tympanic portion of the ICA, bulging into the tympanic cavity.

The magnetic resonance angiography showed a lateralized right ICA with a reduced diameter.

Conclusions: Aberrant ICA in the middle ear should be identified before middle ear surgery, because misdiagnosis could lead to surgical complications: hemorrhage, stroke or death may occur if the vessel is damaged.

Clinical diagnosis is difficult because the symptoms and signs are nonspecific or absent and in some cases it can be discovered during middle ear surgery. However, symptoms such as pulsatile tinnitus or conductive hearing loss may be present.

Most authors recommend a conservative approach. If an asymptomatic aberrant ICA in the middle ear is diagnosed any physician involved in the patient's care should be informed.

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ID: IP126

The impact of postoperative antrum pneumatization on hearing outcome after canal wall-down tympanoplasty with soft-wall reconstruction for cholesteatoma

Presenting Author: **Masatsugu Masuda**

Masatsugu Masuda, Jobe Matsumoto, Tatehiro Nakamura, Takehiro Matsuda, Kohno Naoyuki, Koichiro Saito
Kyorin University

Learning Objectives: It might be enough to concentrated on making the pneumatized cavity in the tympanic cavity alone. Further studies with a larger sample size will be needed to confirm it.

Introduction: It is not completely clear whether the pneumatized antrum is critical for good hearing in patients operated on for acquired cholesteatoma with canal wall-down type III (-c or -i) tympanoplasty with soft-wall reconstruction (CWDT-SWR). We thus investigated the correlation of pneumatization of the antrum with hearing outcome.

Methods: Eligible patients were: (1) CWDT-SWR was performed for the past four years; (2) ossiculoplasty was performed by the present author; (3) > 1 year follow-up. Patients who had a past history of an otologic operation in

another institution were excluded. Twenty-two patients (age, 37 ± 13 yr) fit within the above condition. CT-scan was performed every year after surgery, and antrum pneumatization was evaluated. Pre- and post-operative pure-tone averages (PTA) and average air-bone gaps (ABG) were analyzed. PTA was calculated as the mean of 0.5, 1, 2, and 4 kHz thresholds. ABG was determined from air conduction (AC) and bone conduction (BC) thresholds that were measured at the same time. Average ABG (AABG) was calculated as the mean of 1, 2, and 4 kHz thresholds. Variables were shown in mean \pm SD. Hearing results were compared using Mann Whitney test.

Results: Twelve patients had the pneumatized antrum (P-Group) and 10 did not (non-P-Group). Following results were shown in P-Group and non-P-Group, respectively: (1) pre-operative PTA was 37 ± 8 and 40 ± 24 dB; (2) pre-operative AABG was 20 ± 8 and 18 ± 12 dB; (3) the change in PTA was 7 ± 12 and -1 ± 14 dB; (4) the change in AABG was 4 ± 13 and -2 ± 14 dB. The variables were not statistically different between two groups.

Conclusion: With this sample size, pneumatization of the antrum do not have an impact on hearing outcome statistically in patients operated with CWDT-STR.

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ID: IP127

Analysis of the characteristics of hearing loss of PLF cases

Presenting Author: **Han Matsuda**

Han Matsuda¹, Kei Sakamoto¹, Tomohiro Matsumura², Shiho Saitoh², Ryuichiro Araki¹, Tetsuo Ikezono³

¹Saitama Medical University, ²Nippon Medical School, ³Saitama Medical University

Learning Objectives: Background & Method: Perilymphatic fistula (PLF) is defined as an abnormal communication between the perilymph and middle ear, where there are leaky sites. The clinical manifestation of PLF is widely variable, and there was no physiological or biochemical diagnostic test for PLF that has the proper specificity and sensitivity. Therefore, it is very difficult to make a definite diagnosis of PLF. By the proteomic analysis, we have identified an isoform of Cochlin, CTP (Cochlin tomo-protein). CTP is a perilymph specific protein, which is not expressed in blood, CSF or saliva. We could establish a highly reliable ELISA-kit and again we could confirm this specific expression of CTP. With this background, in 2013, Japanese PLF diagnostic criteria was proposed. In this criteria, a definite diagnosis can be made with one of these basic rules, (1) a fistula is identified between the middle ear and the inner ear by microscope or endoscope, (2) Cochlin tomo-protein (CTP) is detected from the middle ear lavage (MEL). MEL was collected as follows: (1) after myringotomy or during PLF repair surgery, the middle ear was rinsed with 0.3 ml saline, (2) MEL was recovered and blood cells and cell debris were removed, (3) the supernatant was taken and stored frozen. If there is 2 μ l of perilymph in the MEL, the

test is positive. So far, we already have tested about 3000 samples including MEL, perilymph, serum, CSF etc. Between April 2014 and March 2015, 281 PLF suspected cases who had antecedent traumatic events were tested by the standardized CTP detection test protocol. In 281 cases, 61 (22%) were positive with CTP. The characteristics of hearing loss was vary, sudden hearing loss (26 cases), recurrent (8 cases), sudden and progressive (7 cases), progressive (7 cases) and fluctuate (5 cases). Our results indicates PLF is a real clinical entity and should be considered as pathological bases of sensorineural hearing loss.

Background: Perilymphatic fistula (PLF) is defined as an abnormal communication between the perilymph and middle ear, where there are leaky sites. The clinical manifestation of PLF is widely variable, and there was no physiological or biochemical diagnostic test for PLF that has the proper specificity and sensitivity. Therefore, it is very difficult to make a definite diagnosis of PLF.

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MEL was collected as follows: (1) after myringotomy or during PLF repair surgery, the middle ear was rinsed with 0.3 ml saline, (2) MEL was recovered and blood cells and cell debris were removed, (3) the supernatant was taken and stored frozen. If there is 2 μ l of perilymph in the MEL, the test is positive.

Method: So far, we already have tested about 3000 samples including MEL, perilymph, serum, CSF etc. Between April 2014 and March 2015, 281 PLF suspected cases who had antecedent traumatic events were tested by the standardized CTP detection test protocol.

Result and Conclusion: In 281 cases, 61 (22%) were positive with CTP. The characteristics of hearing loss vary, sudden hearing loss (26 cases), recurrent (8 cases), sudden and progressive (7 cases), progressive (7 cases) and fluctuate (5 cases). Our results indicates PLF is a real clinical entity and should be considered as pathological bases of sensorineural hearing loss.

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Tympanoplasty With Canal Wall Reconstruction Using Sliced Auricular Cartilage For Old Radicalized Cavities

Presenting Author: **Shinya Hirahara**

Keiji Matsuda, Shinya Hirahara, Tetsuya Tono
University of Miyazaki

Learning Objectives:

Tympanoplasty with canal wall reconstruction was performed using sliced cartilage, fascia, and inferior based musculoperiosteal flap in 46 patients with open mastoid cavities and hearing loss. All patients were followed for more than two years after the last operation. The mastoid skin was elevated and trimmed, and then the fascia and sliced auricular cartilage were transplanted to the mastoid side of the skin and covered using musculoperiosteal flap. The remaining space in the mastoid cavity was filled with bone chips (42 cases). In the cases involving a normal or shallow eardrum (24 cases, group A), ossicular reconstruction was performed at the same time. Among the cases involving an adhesive eardrum, two-staged surgery was planned in 11 cases (group B). The other 11 patients with adhesive eardrums were treated with one-stage ossiculoplasty where possible (group C). Hearing improvement was achieved in 75% (18/24 cases) of the cases in group A, 45% of the cases in group B (5/11 cases), and 18% of the cases in group C (2/11 cases) at 12 postoperative months. None of the patients developed recurrent discharge, cholesteatoma or granulation tissue, although one patient in group C (2%) suffered re-adhesion. The reconstructed tympanum and posterior canal wall appeared to be thick structures made of skin and sliced cartilage. The boot-shaped reconstructed canal was suited to staged ossiculoplasty because the shape-memory effect provided an adequate combination of stiffness and flexibility for the second stage. The structure remained relatively stable over the long term. This method has advantages for patients with adhesive eardrums that require secondary ossiculoplasty or an active middle ear implant.

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ID: IP129

Practicality Analysis of JOS Staging System for Retraction Pocket Cholesteatoma: Japan Multicenter Study (2009–2011)

Presenting Author: **Keiji Matsuda**

Keiji Matsuda¹, Tetsuya Tono², Hiromi Kojima³, Yutaka Yamamoto³, Masafumi Sakagami⁴, Yasuo Mishiro⁴, Yasuyuki Hinohira⁵, Taeko Okuno⁶

¹University of Miyazaki, ²University of Miyazaki, ³Jikei University School of Medicine, ⁴Hyogo College of Medicine, ⁵Showa University School of Medicine, ⁶Mitsui Memorial Hospital

Learning Objectives:

Objective: To analyze the practicality of staging criteria of acquired cholesteatoma (2010) for standardizing pathological condition in Japan.

Design: A multicenter, retrospective study.

Setting: Six academic tertiary referral centers.

Participants: A total of 446 patients that underwent surgery (for the first time) for acquired retraction pocket cholesteatoma between 2009 and 2010 at 6 institutions in Japan.

Intervention: Cases were managed by trans canal atticotomy (TCA, 42 cases), canal wall down and reconstruction (CWDR, 142 cases), canal wall down (CWD, 29 cases), or canal wall up technique (CWU, 233 cases).

Main Outcome Measures: The extent of cholesteatoma was surgically confirmed, and auditory outcomes and disease recurrence during 3 years after the last operation were assessed.

Results: The cholesteatoma affected the pars flaccida in 325 cases (73%), the pars tensa in 100 cases (22%), and both of these regions in 21 cases (5%). The frequency of postoperative air-bone gaps of < 20 dB was 70% in the pars flaccida group, 54% in the pars tensa group, and 43% in the combined group. These rates decreased as the cholesteatoma stage increased. The frequency of residual disease at the “second look” (10%) peaked at 12 postoperative months, whereas it peaked at 24~36 postoperative months after single-stage procedures (4%). Recurrent sac formation exhibited a similar frequency (4%) from 6 months to 36 months. The frequencies of all types of recurrence increased with the disease stage.

Conclusion: Disease stage was found to be related to hearing outcomes and the recurrence rate. This simple staging system may be particularly useful for standardizing the reporting of acquired cholesteatoma and for adjusting for the severity of the condition during outcome evaluations. It might also provide information that is useful for counseling patients.

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Canal wall down tympanoplasty with soft posterior meatal wall reconstruction in cases of recurrent cholesteatoma

Presenting Author: **Saeko Matsuzaki**

Saeko Matsuzaki, Naoki Oishi, Masato Fujioka, Sho Kanzaki, Yoshihiko Hiraga, Noriomi Suzuki, Makoto Hosoya, Kaoru Ogawa

Keio University School of Medicine

Learning Objectives:

Introduction: Prevention of postoperative recurrent cholesteatoma is one of the important goals in the management of cholesteatoma. Surgery for recurrent cholesteatoma could be rather challenging because of potential tendency towards recurrence. Canal wall down tympanoplasty can be a good surgical option with low rate of recurrence, and soft posterior meatal wall reconstruction has a feature of less formation of a narrow-neck retraction pocket after surgery compared to other hard-tissue reconstruction methods (Yamamoto-Fukuda et al, 2009). In order to achieve disease-free and dry ears after surgery on 13 recurrent cholesteatoma cases which we experienced for 3 years, we adopted a canal wall down technique with soft posterior meatal wall reconstruction. We present

representative cases and short-term results with mean follow-up period of 23 months.

Study design: Retrospective chart review

Patients: Thirteen cases of recurrent cholesteatoma out of consecutive 388 middle ear surgeries in Keio University Hospital between January 2012 and March 2015 were enrolled. The average age of the cases was 48 years old with a range of 25–76 years. The mean follow-up period was 23 months (ranging from 10 months to 33 months). The operation was 2nd time in 8 cases, 3rd time in 4 cases, and 4th time in 1 case.

Results: Dry ear was achieved in all the cases in average 5.5 months after surgery and no further infection was observed. Postoperative air-bone gaps were less than 40 dB in 5 patients and 20 dB in 4 patients. No re-recurrence was observed during the observation period.

Conclusions: A canal wall down tympanoplasty with soft posterior meatal wall reconstruction for recurrent cholesteatoma provides good short-term results. Longer observation period is needed to confirm the effectiveness of the surgical procedure.

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Endoscopic versus Open Surgical Management of Patulous Eustachian Tubes

Presenting Author: **A. E. Louise McMurran**

A. E. Louise McMurran, Ahmad Moinie, Constantinos Mamais, Clive Brewis, Bhaskar Ram
Aberdeen Royal Infirmary

Learning Objectives:

Presenting features of Patulous Eustachian Tubes
Surgical management of Patulous Eustachian Tubes

Introduction: A variety of surgical techniques have been used in the management of Patulous Eustachian Tubes, however the long-term efficacy and safety of these methods remains uncertain. We highlight this issue using the case of an 84 year old man with bilateral Patulous Eustachian Tubes who has had multiple surgical procedures over a two year period.

Methods: The patient presented with bilateral autophony, tinnitus and hearing loss. The diagnosis was confirmed by observation of tympanic membrane movement on respiration at otomicroscopy. Initial surgical management involved endoscopic reduction of the Eustachian tubes, first by injection of calcium hydroxylapatite and cautery to the torus tubarius, and followed by insertion of fat into the Eustachian tube with suturing when symptoms recurred. Further symptoms prompted more invasive surgical

management with transtympanic occlusion of the Eustachian tubes with conchal cartilage.

Results: Endoscopic injection of fillers and cautery to the Eustachian tubes did provide symptomatic benefit in this patient's case, though the effects were short lived. Insertion of fat and suturing endoscopically was difficult practically and did not produce long-term symptom control. Open ear surgery with placement of tragal cartilage into the Eustachian tube performed initially on the right followed by the left four months later has led to complete resolution of symptoms. The patient did, however, develop bilateral middle ear effusions with conductive hearing loss, requiring myringotomy and grommet insertion.

Conclusions: Endoscopic surgical techniques for reducing patulous Eustachian tubes may provide symptomatic benefit with few ill effects, but have limited long-term efficacy. Transtympanic occlusion with cartilage is presented as an alternative approach with an improved outcome.

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ID: IP132

Changing lives of hearing impaired patients in rural north india through concept of trained ear care workers with the vision of hearing for all by 2030

Presenting Author: **Rohit Mehrotra**

Rohit Mehrotra¹, Pankaj Srivastava², Ashutosh Kumar¹
¹Mehrotra ENT Foundation, ²Pankaj ENT Hospital

Learning Objectives: By introducing the concept of **ear care workers** who identify patients having hearing loss by organizing regular ear health camps in rural areas of Kanpur district. If this concept is implemented throughout India, a significant reduction in deafness could be achieved. Those patients who could be benefited from surgery or hearing aids are treated accordingly at low cost with a vision of **hearing for all by 2030**.

Introduction: Hearing loss is the most common sensory deficit in humans today. As per WHO estimates in India, there are approximately 63 million people, who are suffering from Significant Auditory Impairment; this places the estimated prevalence at 6.3% in Indian population.

Materials and Methods: This is an ongoing study. Patients with history of hearing loss were identified by ear care workers through our regular ear health camps in rural areas of Kanpur district. Ear care workers were trained at our base hospital. Patient requiring conserving treatments were treated at the camps. Patients who required surgery or hearing aids were brought to our clinic, subjected to clinical ENT examination, Otoscopy and pure tone audiometry. Surgery was performed, or hearing aids were provided and patients were followed up at regular interval.

Results: 142334 people were screened in the year 2014 in which 10248 suffered from hearing loss. Prevalence of hearing loss was 7.2%. 9310 patients were managed conservatively. Surgery was performed in 506 cases and hearing aid was provided to 432 cases.

Conclusion: This study emphasizes that through the introduction of concept of ear care workers, a large number of unprivileged patients with treatable causes of hearing loss can be provided with appropriate, cost effective and early treatment.

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ID: IP133

Ossicular Implants (Prosthesis) – from Infancy to Maturity

Presenting Author: **Mario Milkov**

Mario Milkov¹, Georgi Marinov¹, Robert Guidoin², Stefan Mirchev³, Hamaputra Vijayendra⁴

¹Prof. Paraskev Stoyanov Medical University of Varna Faculty of Dental Medicine, ²Laval University, Quebec, Canada, ³Medical University of Pleven, Bulgaria, ⁴Vijaya E.N.T. care Centre, Belgaum, India

Learning Objectives: The idea of ossicular chain reconstruction emerges and develops as a result from the creation of Wulstein and Zollner's concept of tympanoplasty. Initially, doing the ossicular reconstruction a transposition of incus mainly is performed. Bone or cartilage material has been used as a material. In 1956 Wulstein reported the use of a vinyl-acrylic device as acoustic transmitter between the mobile footplate and the tympanic membrane graft. However, the results were poor. Shea moved from the concept of a graft to that of a bioprosthesis. Shea first began a successful series of ossicular reconstructions. Shea first implanted Teflon prosthesis on a 48-year-old female patient who had widespread otosclerosis, throughout the oval window rim and footplate. As a result, the patient's hearing improved. Today the implantation of ossicular prostheses to replace non-functional and pathologically altered ossicular chain is a well-accepted surgical technique. The limited graft applications in the reconstructive auditory-chain surgery stimulated the search for new prosthetic medical device. Several questions are of paramount interest for solving this problem: 1. Biomaterial selection for the ossicular implants (prosthesis) construction; 2. Design of the ossicular implants (prosthesis); 3. Validation of the ossicular implants (prosthesis); 4. Monitoring of the patients with implanted ossicular prostheses. In modern otosurgery, a large variety of biomaterials were made use. None of them is, however, useful for any applications. In general, the biomaterials used for ossicular chain reconstruction should possess a good biocompatibility and biostability. They must be well osteointegrated, with

minimal risk of ankylosis. Surface properties, particularly structural characteristics, critically influence the quality of the implant-biological interface. The biomaterials need to be easily processed and retain their shape already acquired. A proper sound transmission requires biomaterials of low mass and high hardness. None of them is, however, useful for any applications. In the literature available, usage of different animals for biomaterial validations has been reported. In experiments on the guinea pigs bulla mastoidea model, introduced in the experimental medical practice from Assoc. Prof. Mario Milkov, MD, Ph.D., gold, Teflon, hydroxyapatite, and ceromer were used convincing us in the good qualities of the guinea pig to serve as a model for testing the ossicular prostheses.

The idea of ossicular chain reconstruction emerges and develops as a result from the creation of Wulstein and Zollner's concept of tympanoplasty. Initially, doing the ossicular reconstruction a transposition of incus mainly is performed. Bone or cartilage material has been used as a material. In 1956 Wulstein reported the use of a vinyl-acrylic device as acoustic transmitter between the mobile footplate and the tympanic membrane graft. Shea first began a successful series of ossicular reconstructions. Today the implantation of ossicular prostheses to replace non-functional and pathologically altered ossicular chain is a well-accepted surgical technique. The limited graft applications in the reconstructive auditory-chain surgery stimulated the search for new prosthetic medical device. Several questions are of paramount interest for solving this problem:

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ID: IP134

Diagnosis and successful surgical treatment of pediatric cholesteatoma: a case report and literature review

Presenting Author: **Stefan Mirchev**

Mario Milkov¹, Stefan Mirchev², Aleksandar Valkov², Georgi Nikolov³, Boris Duhlenki³, Hamaputra Vijayendra⁴

¹Prof. Paraskev Stoyanov Medical University of Varna Faculty of Dental Medicine, ²Medical University, Pleven, Bulgaria, ³Medical University of Pleven, Bulgaria, ⁴Vijaya E.N.T. care Centre, Belgaum, India

Learning Objectives: Although relatively rare in childhood, cholesteatoma deserves a special attention by not only by general practitioners but also by specialists in different mutually related disciplines in the family of neurosciences and, particular, in neurootology.

Introduction. Cholesteatoma in childhood is difficult to diagnose in spite of substantial advances in diagnostic approaches. The delayed detection of this complicated pathology necessitates adequate surgical management.

Methods: We report a child aged eight years presenting with congenital cholesteatoma accompanied by peripheral facial nerve palsy. Management has been initiated by a neurologist and later on, an otorhinolaryngologist has been involved in the therapeutic team because of the failed drug therapy. According to parents' report, three years ago the child complained of gait disturbances attributed mainly to his overweight. A comprehensive physician's examination included preoperative audiometry and computer tomography, intraoperative monitoring system enabling safe cholesteatoma removal in the area of bone destruction at second genu level as well as pre- and postoperative electromyography.

Results: We successfully identified the degree of morphological damage and of the disturbed function. Besides, the prognosis concerning facial nerve restoration was clarified. On the seventeenth day after the surgical intervention, there was convincing electromyographic evidence of significant improvement of the facial nerve function and positive change of facial appearance as documented by pictures in 4-day intervals. A concise review of recent publications dealing with cholesteatoma diagnosis and surgery illustrated the socio-medical importance of this entity in childhood (e.g., A. T. Harris et al., *J Laryngol Otol.* 2016;130:235; M. S. Cohen et al., *Laryngoscope.* 2016;126:732; J. B. Hunter et al., *Otolaryngol Head Neck Surg.* 2016; Mar 1, etc.).

Conclusion: Scanty initial clinical symptoms along with poor otoscopic findings hamper considerably the early exact diagnosis of cholesteatoma. Interdisciplinary collaboration between neurologists, otorhinolaryngologists, radiologists and neurosurgeons could warrant the proper therapeutic behaviour in children with cholesteatoma.

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ID: IP135

Endoscope-i: transforming endoscopic technology and the delivery of patient care in ENT

Presenting Author: **Nina Mistry**

Nina Mistry¹, Jeyanthi Kulasegarah², Ajith George³, Christopher Coulson²

¹University Hospitals Birmingham NHS Foundation Trust, ²University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK, ³University Hospitals of North Midlands NHS Trust, Stoke, UK

Learning Objectives: To raise awareness amongst ENT surgeons of the potential role that digital and mobile device technology such as the endoscope-i can play in enhancing the delivery of healthcare services to patients.

Introduction: Digital and mobile device innovation in healthcare is a growing market. The introduction of the endoscope-i, the world's first endoscopic mobile imaging system, allows the acquisition of high definition images and videos, without the need for expensive and bulky stack systems.

Methods: The endoscope-i system was first developed by the senior authors in conjunction with experts in the engineering and software development fields. The system combines the e-i Pro camera app with a bespoke engineered endoscope-i adaptor which fits securely onto the iPhone. The system is portable and allows high definition endoscopic imaging of the ear, nose and throat, with the facility to capture still images and videos.

Results: The endoscope-i has far-reaching applications but comes into its own in when examining the ear endoscopically. The assessment of a variety of pathology such as tympanic membrane perforations, retraction pockets and cholesteatoma can be undertaken efficiently and relayed immediately to the patient. Not only does this provide instant feedback to the patient during the consultation, thereby improving patient education, it also allows the documentation of findings via a secure app which can be stored as part of the patient's record of care, replacing the need for previous hand-drawn notes.

Conclusions: The use of endoscopic mobile imaging systems has the potential to transform the way that healthcare is delivered in ENT. The endoscope-i system provides a cost effective device that is accessible, easy to use and which makes diagnostics simpler and quicker. Although there are clear applications in the field of otolaryngology, the technology is also being used by other medical specialties such as anaesthetics and urology as well as in veterinary medicine and engineering.

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ID: IP136

The Novel Affordable Telford Temporal Bone Holder

Presenting Author: **Alistair Mitchell-Innes**

Alistair Mitchell-Innes¹, Alistair Mitchell-Innes²,
Andy Senior³, Andrew Scott⁴

¹University Hospital Birmingham Foundation
NHS Trust, ²University Hospital Birmingham,
³University Hospital North Staffordshire,
⁴Princess Royal Hospital, Telford

Learning Objectives: Surgical training is constantly evolving with greater emphasis placed on simulation. In particular, the understanding of complex three-dimensional anatomy in temporal bone dissection necessitates significant additional training outside of the operating theatre. While virtual reality systems have been developed recently, cadaveric dissection remains the gold standard for simulation.

Several variations of temporal bone holder have been developed but all have limitations. The ideal temporal bone holder should remain stable in multiple orientations but also adjust easily. It should not obstruct the surgical view and should simultaneously provide adequate drainage of bony debris.

The temporal bone holders that are currently commercially available for both ENT departments and temporal bone laboratories, are expensive and have scope for refinement. With this in mind we have produced an extremely cheap alternative that allows trainees to maintain a stable surgical position and facilitate excellent surgical orientation.

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ID: IP138

The Management of Petrous Bone Cholesteotoma: A Challenging Clinical Entity

Presenting Author: **Scott Mitchell**

Scott Mitchell, Karamveer Narang, Richard Irving
University Hospitals Birmingham NHS
Foundation Trust

Learning Objectives: 1. To demonstrate that petrous bone cholesteotomas are a complex clinical entity. 2. To show that patients with this condition often present late with significant morbidity present prior to intervention 3. To describe our clinical outcomes following surgical intervention in the context of the current literature.

Introduction: Cholesteotomas occurring or extending medial to the otic capsule and labyrinth are regarded as petrous bone cholesteotomas (PBC). Important anatomical structures within this area makes the management of these cases demanding. We report our experience and outcomes following surgery.

Methods: Case notes of patients who underwent PBC surgery over an 11 year period (2003–2014) were retrospectively analysed.

Results: 23 patients were identified. Median age 50 years (range 19–81). The commonest symptom was hearing loss (78.3%) with facial nerve dysfunction (69.6%) and disequilibrium (26.1%) being experienced by many. 12 (52.2%) patients had a facial nerve palsy prior to operative intervention. 11 (47%) had previously undergone ear surgery with 7 (30.4%) being for cholesteotoma. 1 (4.3%) patient had multiple episodes of meningitis and 1 (4.3%) had developed a cerebellar abscess prior to operative intervention. Preoperatively, 6 (26.1%) had a “dead” ear with 5 (21.7%) having a profound hearing loss.

In our series, 14 (60.9%) patients had a total petrosectomy with closure of the ear canal, eustachian tube and obliteration of the cavity with an abdominal fat graft. The remaining had subtotal petrosectomy (4), revision petrosectomy (3) or a combined middle fossa and trans-mastoid approach (2). Operative findings confirmed extensive disease in most cases with facial nerve (56%), dural (39%), vestibular (26%), cochlear (21%) and carotid (13%) involvement being encountered. 9 patients had post-operative complications including: wound infections (3), post aural fistula (2), facial palsy (2) and dead ear (2). Within an average follow up period of 43 months, there was 1 (4.3%) recurrence.

Conclusion: In our series, PBC had often become advanced prior to intervention, despite advances and increased availability of imaging techniques. Extensive PBCs are difficult to “cure” by surgery but we show good control rates with little increased morbidity from intervention.

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ID: IP139

A Comparison of Operative Time Outcomes in Endoscopic and Open Tympanomastoid Surgery

Presenting Author: **Mohamed Rizny Mohamed Sakkaff**

Mohamed Rizny Mohamed Sakkaff, Duncan Bowyer
Shrewsbury and Telford NHS Trust, Shrewsbury
and Telford NHS Trust

Learning Objectives: Initial concerns regarding increased operative times when developing a novel EES practice are unfounded and should not deter otologists from becoming proficient at this technique.

Introduction: Endoscopic Ear Surgery(EES) has recently developed from being an adjunct to traditional microsurgery to becoming the principle methodology in select cases. Surgical use of the endoscope provides a wider field of view, increased depth of field and the ability to directly visualise ‘hidden’ areas of the middle ear.

Prolonged operative time is often considered a drawback when developing a novel application for minimally invasive surgery. There is limited data on the specific operative time of endoscopic tympanomastoid surgery compared to a conventional open approach.

Methods: Single-surgeon (senior author), retrospective case review of procedure time (retrieved from theatre computer logs) for patients undergoing tympanoplasty, or primary tympanomastoid surgery for cholesteatoma, during a period of transition from conventional open to a principally endoscopic ear surgery practice.

Results: 109 patients (7–85yrs) underwent tympanoplasty/primary cholesteatoma surgery. Entirely endoscopic technique in 22/42 tympanoplasty and 29/67 cholesteatoma procedures. Mean operative time for endoscopic tympanoplasty was 77.7 mins.(range 41–126 mins.), for open procedures 95.3 mins.(range 50–120 mins.). Endoscopic approach was quicker compared to open surgery ($p = 0.031$). In mastoid surgery the mean surgical time was 154 mins.(range 91–205 mins.) for the endoscopic technique and 169 mins. (64–259 mins.) for open surgery. There was no significant difference between these two groups ($p = 0.082$).

Conclusion: Operative time is not a drawback when transitioning from a conventional open to predominately EES otology practice. For tympanoplasty procedures it is significantly faster utilising the endoscopic approach. Endoscopic mastoid surgery has similar time to conventional techniques.

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ID: IP140

Lemierre's syndrome: a difficult diagnosis

Presenting Author: **AE Louise McMurrin**

Ahmad Moinie, Constantinos Mamais,
AE Louise McMurrin, Bhaskar Ram
Aberdeen Royal Infirmary, NHS Grampian

Learning Objectives: We aim to identify early features common to cases of Lemierre's syndrome to facilitate prompt diagnosis and treatment.

Introduction: Lemierre's syndrome is an uncommon, but potentially deadly, complication of common infections of the throat and ear involving thrombophlebitis of the internal jugular vein. Oropharyngeal and auricular infections are some of the most commonly presenting illnesses so physicians must be aware of this diagnosis. However it may be easily missed as early signs are often subtle and non-specific.

Methods: We highlight the difficulty faced in the diagnosis of Lemierre's by presenting the case of a 15 year old boy admitted with sepsis from chronic otitis media, alongside a review of the literature.

Results: As seen with our patient, a common theme in cases of Lemierre's is late diagnosis. He was found to have septic

pulmonary emboli on CT pulmonary angiogram after developing breathlessness. From our literature review, the features that can aid early recognition include; headache, neck ache, tenderness over sternocleidomastoid muscle, trismus, chest crepitations and Fusobacterium grown from blood cultures. Later signs include dyspnoea, desaturations, pleuritic chest pain and other signs of septic pulmonary emboli which prompt chest imaging.

Conclusions: Due to the potentially fatal consequences of Lemierre's syndrome, a high index of suspicion should be applied to patients with oropharyngeal or ear infections where symptoms do not settle with 24 hours of antibiotics or where pain, trismus or chest symptoms and signs are seen. We recommend the use of CT or US to screen for IJV thrombosis earlier in the clinical course of these infections.

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ID: IP141

Endoscope-assisted microsurgery for cholesteatoma removal

Presenting Author: **Hiroko Monobe**

Hiroko Monobe¹, Kazunari Okada², Wakako Nakanishi²,
Amiko Ishii²

¹Japanese Red Cross Medical Center,

²Department of Otolaryngology, Japanese Red Cross Medical Center

Learning Objectives:

Introduction: Endoscopes can facilitate surgery within the facial recess, sinus tympani, and deep part of the round window niche, which are not fully visualized under an operating microscope. We investigated whether using endoscope-assisted dissection of cholesteatoma gave a lower incidence of cholesteatoma recurrence than using microscopic dissection only.

Methods: Four patients with middle ear cholesteatoma were operated on by using intact canal-wall techniques, canal-wall reconstruction techniques, or transcanal approaches assisted by endoscope-guided dissection. Eleven patients were operated on by using the same techniques but under an operating microscope alone. Comparison of group (A) microscopic surgery assisted by endoscope-guided dissection, with group (B) microscopic surgery only.

Main Outcome Measures: Rates of cholesteatoma recurrence, controlling for the site of the initial cholesteatoma and whether the tumor was detected by second-stage surgery or by non-echo-planar-imaging diffusion-weighted MRI.

Results: Five patients in group B (5/11, 45%) had cholesteatoma recurrences in a follow up of 1 year that needed to be surgically removed. No group A patients (0/4, 0%) developed cholesteatoma recurrences in that period.

Conclusions: In those techniques with canal-wall techniques, canal-wall reconstruction techniques, or transcanal approaches, most surgical failures occur within the tympanic cavity and its hard-to-reach extensions, rather than within the mastoid. Using an endoscope enables us to see inside the facial recess, sinus tympani, and deep part of the round window niche, which are not fully visible under an operating microscope, thus leading to lower rates of cholesteatoma recurrence. These areas are minimally accessible even with extensive postauricular mastoidectomy. Microscopic surgery assisted by endoscope-guided dissection is therefore useful in such cases.

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ID: IP142

Use of the apparent diffusion coefficient of conventional echo-planar imaging to differentiate between cholesteatomas and infectious lesions of the temporal bone

Presenting Author: **Hiroko Monobe**

Hiroko Monobe, Chikako Yamada, Kazunari Okada, Wakako Nakanishi, Miyako Ishii

Japanese Red Cross Medical Center

Learning Objectives:

Introduction: As therapeutic alternatives and technologies have advanced, the use of non-invasive modes of therapy to avoid surgery has increased. From this perspective the focus of this study was to evaluate the diagnostic benefit of the ADC in conventional echo-planar magnetic resonance imaging (MRI) as a means of differentiating between cholesteatomas and inflammatory lesions.

Methods: We evaluated three patients with suspected temporal-bone cholesteatomas, one infected cholesteatoma and three with inflammatory lesions by using MRI, including standard T2-weighted spin-echo and echo-planar DW/ADC sequences, and computed tomography (CT) as aligned with regions of interest (ROIs) determined in DW imaging. The ADC values in the selected ROIs were calculated by using a 2-point linear regression method ($b = 0$ and $b = 1000 \text{ s/mm}^2$). To test the reliability, all measurements were performed twice; the coefficient of correlation was 0.94.

Results: Three of the patients with suspected cholesteatoma and one patient with temporal-lobe abscessation due to temporal-bone inflammatory lesions subsequently underwent surgical confirmation and excision or drainage of their lesions. The ADC values were $0.759\text{--}0.915 \times 10^{-3} \text{ mm}^2/\text{s}$ (mean, $0.840 \times 10^{-3} \pm 0.0586 \text{ mm}^2/\text{s}$) for cases of uninfected cholesteatoma, $0.538\text{--}0.573 \times 10^{-3} \text{ mm}^2/\text{s}$ (mean, $0.555 \times 10^{-3} \pm 0.0141 \text{ mm}^2/\text{s}$) for infected cholesteatomas, and $0.905\text{--}1.272 \times 10^{-3} \text{ mm}^2/\text{s}$ (mean, $1.063 \times 10^{-3} \pm 0.123 \text{ mm}^2/\text{s}$) for inflammatory lesions. These ADC

values differed significantly (one-way analysis of variance: $F(2,11) = 18.1, P < 0.05$).

Conclusions: The ADC value can be used preoperatively to differentiate between temporal-bone cholesteatomas compared with infectious lesions. However, T2-weighted, FIESTA, or CISS images must be matched carefully to temporal-bone CT scans to accurately define ROIs.

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ID: IP143

Surgical treatment for markedly advanced petrous apex cholesteatoma via the translabyrinthine and trans-sphenoidal approach

Presenting Author: **Tsunetaro Morino**

Tsunetaro Morino¹, Kazuhisa Yamamoto¹, Yuichiro Yaguchi², Yutaka Yamamoto¹, Hiromi Kojima¹

¹Jikei University School of Medicine,

²St. Marianna University School of Medicine

Learning Objectives:

Introduction: Cholesteatoma is one of the most frequent lesions in the petrous portion of the temporal bone. It is difficult to completely remove the lesions of the petrous apex, specifically cholesteatoma. Selection of a surgical approach is determined by the location of the cholesteatoma in the petrous bone. We report a case of an intractable petrous apex cholesteatoma, which was managed with combined surgery, involving a translabyrinthine approach and trans-sphenoidal approach.

Case report: A 71-year-old Japanese man underwent right tympanoplasty 6 years previously. He visited our hospital because of recurrent cholesteatoma. He could not hear because of obstruction of the right external auditory meatus caused by the previous surgery. Computed tomography (CT) revealed a soft tissue density lesion that extended widely from the petrous portion of the temporal bone to the sphenoid sinus. Cholesteatoma had extensively spread to the nearby carotid artery and posterior cranial fossa. It was considered difficult to completely remove this lesion. Surgery was performed via a translabyrinthine approach to remove most of the cholesteatoma. A trans-sphenoidal approach was used to create a drainage and observation hole. The post-operative course was uneventful, and the remainder of his clinical course was benign. Post-operative CT findings after 10 months revealed that the drainage route leads to the petrous portion of the temporal bone.

Conclusions: We encountered a markedly advanced, intractable petrous apex cholesteatoma. A surgical procedure, including trans-sphenoidal approach can maintain debris drainage and facilitate observation of the lesion from the

sphenoid sinus. This therapy will help prevent complications in the future.

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ID: IP144

Management for temporal bone cancer: A single institution experience

Presenting Author: **Shinya Morita**

Shinya Morita, Akihiro Homma, Yuji Nakamaru, Tomohiro Sakashita, Atsushi Fukuda, Takatsugu Mizumachi, Satoshi Fukuda

Hokkaido University Graduate School of Medicine

Learning Objectives:

Objective: We aimed to evaluate the prognostic factors and efficacy of treatment modalities for patients with temporal bone cancer, and to determine if definitive chemoradiotherapy (CRT) for advanced-stage disease can provide a substitute for highly invasive surgeries.

Methods: We performed a retrospective, single-institution review of 66 patients with previously-untreated squamous cell carcinoma of the temporal bone treated with curative intent between April 1997 and March 2015. Lateral temporal bone resection was selected as the initial choice of treatment for patients with T1–2 tumors. If histologic examination revealed positive surgical margins or more extensive involvement than preoperative imaging suggested, post-operative radiotherapy (RT) or CRT was performed. For patients with T3–4, lateral or subtotal temporal bone resection was performed. Adjuvant RT or CRT for T3–4 disease was systematically proposed after surgical resection. For locally advanced tumors with extension to the pyramidal apex, posterior cranial fossa, middle cranial fossa or internal carotid artery, definitive CRT or RT was also selected.

Results: The 5-year overall survival (OS) rate for each T classification was 100% for T1, 76.2% for T2, 55.6% for T3 and 36.7% for T4. Univariate and multivariate analysis showed that T classification was an independent predictor of the OS rate (hazard ratio 5.64; 95% confidence interval 1.34–23.8; $p = 0.0184$). Analysis by treatment modality revealed that the 5-year OS rate for patients with T1–2 was 100% for surgery and 81.3% for RT alone. The rate for patients with T3–4 was 52.1% for definitive CRT and 55.6% for surgery followed by RT with or without chemotherapy.

Conclusions: Patients with T1–2 benefited from surgical intervention without significant morbidity or mortality. Our findings also suggested that definitive CRT might be

appropriate as the first-line treatment for T3–4, especially in cases with unresectable tumors.

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ID: IP145

Recurrent cases in pediatric congenital cholesteatoma

Presenting Author: **Yuka Morita**

Yuka Morita¹, Kuniyuki Takahashi², Shinsuke Oshima², Shuji Izumi², Yamato Kubota², Yutaka Yamamoto³, Sugata Takahashi², Arata Horii²

¹Niigata university, ²Niigata University, ³Jikei University

Learning Objectives:

Congenital cholesteatoma in children is a challenging condition because complete resections sometimes difficult and it often recurs. There are two types of recurrence: residual cholesteatoma and the retraction cholesteatoma. It is very important to know the risk factors of recurrence for the management of congenital cholesteatoma. For this purpose, we compared various factors between the recurrence (+) group and (-) group.

Medical records of 67 children under 15 years old who underwent surgery for tympanic type of congenital cholesteatoma from 1999 to 2012 were retrospectively reviewed. Not only cholesteatoma found after onestage surgery but also found during or after second-look operation was defined as recurrence. Because pathophysiology of residual cholesteatoma and retraction cholesteatoma may be different, we investigated risk factors of each type of recurrence separately. Factors compared between the recurrence (+) and (-) groups are age, gender, and stage according to the Potosic classification.

Residual cholesteatoma and retraction cholesteatoma was seen in 14 ears (20.8%) and 4 (6%) ears out of 67 ears, respectively, and 49 patients had no recurrence. There was no significant difference in age and gender between the residual recurrence (+) and recurrence (-) group. However, patients with advanced stage of Potosic classification had more residual recurrence than no recurrence group ($p = 0.004$). All cases of retraction cholesteatomas were Potosic stage IV, male and age at surgery was 4 ± 0.8 , which was significantly younger than recurrence (-) patients (6.4 ± 3.6).

Advanced stage was the significant risk factor for residual cholesteatoma. In contrast, younger patients with advanced stage were the risk factors of retraction recurrence. In surgeries for younger patients with advanced stage, extensive removal of mucosa as well as epithelium have to be performed in young patients with developing tubal function, which might result in retraction recurrence.

doi:10.1017/S0022215116006423

doi:10.1017/S0022215116006447

ID: IP146**Middle Ear Adenoma, A Rare and Controversial Diagnosis: Case report and Discussion**Presenting Author: **Mona Mozaffari**Mona Mozaffari¹, Matthew Bull², Olivia Whiteside²¹ENT registrar at Wexham Park Hospital, UK, ²Wexham Park Hospital

Learning Objectives: Learning Objectives Middle ear adenomas are exceedingly rare Pre-operative radiological workup does not always correlate with intraoperative findings and clinicians should keep an open mind Histological classification of middle ear adenomas remains controversial Surgical resection is the treatment of choice.

Introduction: Middle ear adenoma is a rare differential diagnosis for a middle ear mass. Histological classification of middle ear adenomas remains poorly defined. As well as presenting our experience of one such case, this study aims to assimilate findings from previously published cases in order to contribute to our knowledge of a rare diagnosis.

Method: We report the case of a 51 year old male who presented with symmetrical tinnitus and left sided hearing loss. Examination revealed a postero-inferior mass behind the left tympanic membrane. CT and MR imaging was consistent with a tumour arising from the chorda tympani nerve and a pre-operative diagnosis of chorda tympani neuroma was made. However, intra-operative findings revealed a well-defined mass, close to but distinct from the chorda tympani nerve. Histopathology of the tumour was consistent with a middle ear adenoma.

Results: A review of the literature shows 95 previous reported cases of middle ear adenoma with the entity first described in 1976. A common theme is the difficulty of making a correct pre-operative diagnosis when faced with a middle ear mass, despite modern imaging techniques. Histologically, middle ear adenomas continue to defy classification with their cell line of origin posing the main point of controversy: exocrine versus neuroendocrine cell types. This in turn poses controversies regarding treatment and follow up.

Conclusion: Middle ear adenomas are rare. Reported cases highlight the difficulty of interpreting preoperative imaging. The histological classification of these tumours poses a further difficulty. With the natural progression and prognosis if left untreated of these tumours remaining unknown, further studies and reports would be a welcome addition to the literature. A current literature review advocates a radiological workup and surgical excision where there is clinical suspicion of middle ear adenoma

ID: IP148**The cytokeratin pattern of congenital and acquired cholesteatoma, epidermoid, medial and lateral canal wall skin**Presenting Author: **Jef Mulder**Jef Mulder¹, Theo Peters¹, Paul Vennix²¹Radboud University Medical Center, ²Leids Universitair Medisch Centrum

Learning Objectives: In this paper we present a study in which cytokeratins have been used to characterize congenital cholesteatoma and epidermoid (and we compared these patterns with previous data on acquired cholesteatoma and ear canal skin) in order to confirm or invalidate a developmental theory.

Introduction: Histologically ear canal skin, epidermoid, congenital and acquired cholesteatoma are indistinguishable. They all contain keratin, a matrix of keratinizing stratified squamous epithelium and a lamina propria-perimatrix. Nowadays still different theories on the development of congenital cholesteatoma and epidermoid are suggested.

Cytokeratins are intermediate filament proteins that are exclusively present in epithelial cells and can be used to study epithelial differentiation.

In this paper we present a study in which cytokeratins have been used to characterize congenital cholesteatoma and epidermoid (and we compared these patterns with previous data on acquired cholesteatoma and ear canal skin) in order to confirm or invalidate a developmental theory.

Methods: Cytokeratin Antibodies RCK103, RCK105, M20, CK18-2, LP2 K, AE14, RCK107, E3, KA12, LL025, RKSE60, 6B10 en 1C7 were used to characterize the cytokeratin pattern of congenital cholesteatoma and epidermoid of the cerebellopontine angle. These data were compared with previous patterns on acquired cholesteatoma and medial and lateral ear canal skin.

Results: Our results show that the cytokeratin pattern of congenital cholesteatoma and epidermoid differs. The cytokeratin expression of congenital cholesteatoma mimics the pattern of acquired cholesteatoma and medial ear canal skin: slightly positive LP2 K (Ck19), AE14 (Ck5), 6B10(Ck10) and 1C7 (Ck13). The pattern of epidermoid is comparable to that of normal skin: negative LP2 K, 6B10 and 1C7 and positive AE14.

Conclusions: The cytokeratin pattern of congenital cholesteatoma, acquired cholesteatoma and medial ear canal skin coincide. This may support the invasion theory as explanation of its development. Epidermoid and lateral ear canal

skin share the same cytokeratin pattern which may support the ectodermal rest theory.

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ID: IP149

Novel human stem cell-like cells in middle ear cholesteatoma tissue and auditory canal skin

Presenting Author: **Janine Müller**

Janine Müller¹, Johannes Greiner², Julia Nagel², Jörg Ebmeyer², Holger Sudhoff²

¹Klinikum Bielefeld Mitte, ²Klinikum Bielefeld/
Department of Otolaryngology, Head and Neck Surgery

Learning Objectives:

Being a potential life-threatening middle ear disease, cholesteatoma is an abnormal expanding cystic lesion leading to extensive tissue destruction in the temporal bone followed by conductive and sensorineural hearing loss and facial nerve palsy. Facilitating further infections beyond those of the middle ear, cholesteatoma may also result in meningitis or intracranial infections. Since surgical removal of cholesteatoma remains as the only therapeutical option, lack of non-advanced medical care results in increased pediatric morbidity, emphasizing the need of developing new treatment strategies.

Here we show for the first time the presence of a novel stem cell-like cell population in cholesteatoma tissue and auditory canal skin. Immunohistochemical analysis of cholesteatoma tissue revealed the presence of Nestin-expressing cells localized subepithelially within the matrix and perimatrix. Nestin-positive cholesteatoma-derived stem-like cells (CSCs) were successfully isolated and cultivated *in vitro* and showed the capability of neurosphere formation and clonal growth. CSCs were further successfully expanded within a human blood-plasma derived three-dimensional matrix. In accordance to the classification of cholesteatoma, proliferative Ki67-positive CSCs also showed a normal euploid DNA content and karyotype. We further observed no changes in proliferative capability and expression profile between CSCs and Nestin-expressing cells isolated from auditory canal skin (auditory skin derived cells, ASCs). In particular, cultivated CSCs and ACCs expressed epithelial and neural crest-specific stemness markers.

Our findings gain new insights in the complex biology of cholesteatoma and may thus broaden the range of treatment strategies for this severe lesion within the middle ear.

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ID: IP150

The role of preoperative gadolinium enhanced magnetic resonance imaging (MRI) in anticipating postoperative middle ear aeration after canal wall up tympanoplasty for cholesteatoma

Presenting Author: **Noriaki Nagai**

Noriaki Nagai, Tetsuya Tono, Keiji Mtsuda, Shinya Hirahara
University of Miyazaki

Learning Objectives:

Objective: This study was designed to anticipate the post-operative middle ear aeration using preoperative gadolinium enhanced magnetic resonance imaging (MRI) after canal wall up tympanoplasty (CWU) for cholesteatoma.

Materials and methods: Retrospective review was performed on 56 patients with mastoid involvement undergoing CWU tympanomastoidectomy without mastoid obliteration at a single institution from 2010 to 2013. In all patients, the cholesteatoma was removed by a combined approach. The communication between the Eustachian tube and the attic was reestablished with a posterior and anterior tympanotomy. The attic bony wall defect was reconstructed using sliced auricular cartilage and fibrin glue (scutum plasty). Patients were classified into two groups according to the status of enhancement around the cholesteatoma sac using pre-operative MRI: Group A (strongly enhanced) and Group B (weakly or no enhanced). In each group, restoration of the middle ear aeration was assessed with high-resolution computed tomography (CT) before and after operation. Status of aeration was classified into 4 grades (no aeration, mesotympanum, epitympanum, mastoid).

Results: Although the middle ear aeration ameliorated in both groups, the range of re-aeration was much better in Group A (strongly enhanced group) than Group B. Re-aeration to the mastoid was achieved in 68% of the cases in Group A, 36% of the cases in Group B.

Discussion and Conclusion: The enhanced MR image was found to be related to postoperative middle ear aeration. These findings might be particularly useful for predicting re-aeration of acquired cholesteatoma.

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ID: IP151

The results of obliteration technique in canal wall up and wall down tympanomastoidectomy in patients with acquired middle ear cholesteatoma

Presenting Author: **Nune Nahapetyan**

Nune Nahapetyan¹, Artur Shukuryan²,
Hayastan Mesropyan³, Alla Hambardzumyan³

¹Yerevan State Medical University,
"Astghik" Medical Center, ²Yerevan State
Medical University, "Erebuni" Medical Center,
³Yerevan State Medical University, "Astghik"
Medical Center

Learning Objectives:

Introduction: The objective in the surgical management of acquired middle ear cholesteatoma is eradication of disease

and the creation of a dry, safe ear. For reducing of incidence of frequent cleaning need after CWD, as well as for control of reretracted tympanic membrane after CWU tympanomastoidectomy, mastoid obliteration is preferable for many otological surgeons.

Material and Methods: 50 patients (16 to 65 y.o.) with cholesteatoma have been observed in this work. 34 ears have extensive cholesteatoma with erosion of posterior bony wall of ear canal. In 12 patients cholesteatoma involves only epitympanum, in 4-hole tympanic cavity. Posterior canal wall erosion due to cholesteatoma was indentified as the primary indication for radical mastoidectomy. Most patients mentioned periodic, only 7 of them- persistent otorrhea. All patients had conductive to mixed hearing loss with ABG more than 25 dB. 34 patients were undergone CWD, 16 CWU tympanomastoidectomy with mastoid obliteration using of bone pate' from the cortical layer of mastoid. Temporalis fascia has been used for tympanic membrane grafting and for covering of mastoid cavity filling with bone pate'. Tragal cartilage has been used in 27 patients for placement between the head of the stapes and fascia. In cases of cholesteatoma in the oval window area, ossiculoplasty is postponed for second look surgery.

Results: Among the 50 patients 42(84%) grafts healed. In 5(10%) patients cholesteatoma developed during 3 years after the surgery. In 3(6%) patients reperforation occurred without cholesteatoma.

Conclusion: The mastoidectomy with tympanic membrane grafting and mastoid obliteration provides eradication of disease, prevents reretracted of tympanic membrane in patients with middle ear cholesteatoma. The results of surgery are good basis for the second stage- ossiculoplasty with hearing improvement.

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ID: IP152

Quality of life in patients with mastoid cavities dependent on aural care using COMQ12 - a disease specific PROM

Presenting Author: **Codruta Neumann**

Codruta Neumann¹, Alison Liu², Toby Vishom³

¹East Kent Hospitals NHS Foundation Trust,

²Kings College London Medical School,

³William Harvey Hospital, Ashford

Learning Objectives: To ascertain the impact of having a mastoid cavity requiring regular aural care in a nurse led clinic on quality of life. This study highlights the need for using PROM in assessing QOL in this population in order to inform decision making when offering revision surgery.

Introduction: Patients with mastoid cavities dependent on aural care experience a significant disruption of their life. We aimed to assess patient reported health and quality of life (QOL) following surgery for Chronic Otitis Media

(COM) using a disease specific patient related outcome measure questionnaire along with a generic QOL instrument.

Methods: Patients post surgical treatment of chronic otitis media for mucosal disease or cholesteatoma were recruited from nurse led clinics. All patients had mastoid cavities and no procedure to reduce or obliterate the cavity was undertaken at the time of primary or revision surgery. COMQ12 (chronic ear disease disease specific QOL) and Short Form 36 (SF36) questionnaires were administered.

Results: COMQ12 mean score was 14, median 13 (LQ6, UQ21), and range 2–31. SF36 scores were calculated for 8 domains, scored out of 100. Physical Functioning mean = 71 (median = 90, LQ = 35, UQ = 100); Physical role limitation mean = 63 (median = 100, LQ = 25, UQ = 100); Emotional role limitation mean = 79 (median = 100, LQ = 67, UQ = 100); Energy mean = 57 (median = 55, LQ = 50, UQ = 70); Emotional wellbeing mean = 75 (median = 80, LQ = 68, UQ = 92); Social function mean = 80 (median = 100, LQ = 63, UQ = 100); Pain mean = 74 (median = 90, LQ = 33, UQ = 100); General health mean = 51 (median = 62.5, LQ = 33, UQ = 62.5).

Conclusions: On COMQ12 the most troublesome ear specific symptoms were difficulty in hearing in background noise and the TV, discharge and tinnitus. The frequency of symptoms impacted mainly on time of work and need for medication. On SF36 energy showed least variation, with most patients affected to some degree. Patients generally had good emotional wellbeing, social function, and had little pain. Physical functioning and role limitation scored high, with more variability.

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ID: IP153

Petrous Bone Cholesteatoma: The Manchester Experience

Presenting Author: **Hannah North**

Hannah North¹, Simon Freeman², Scott Rutherford², Andrew King², Charlotte Hammerbeck-Ward², Simon Lloyd²

¹Salford Royal Foundation Trust and Central Manchester Foundation Trust, ²Salford Royal Foundation Trust

Learning Objectives: To discuss the surgical management of petrous bone (skull base) cholesteatoma To discuss the difficulty in recurrence in balance with preservation of anatomical structures To discuss the rates of hearing and facial nerve preservation in this disease.

Introduction: Petrous bone cholesteatoma medial to the otic capsule is very rare. Classification has been described by Moffat and Smith. Surgical management of the disease is extremely challenging and is a balance between total clearance of disease and preservation of critical anatomical

structures including jugular bulb, carotid artery, middle and posterior cranial fossa dura. Resection of the disease from the labyrinth and facial nerve may cause devastating long term effects and must be considered in light of patient preference for revision surgery against long term deficits. We present a series of patients from the Manchester Skull Base Unit and the management of their disease.

Methods: A prospective database has been collated with all patients with petrous bone cholesteatoma managed in the unit. Surgery was dependent on site of disease. All patients were monitored with yearly DWI Propeller Sequence MRI to ensure no recurrence of disease.

Results: We present 63 patients who have presented with petrous bone cholesteatoma at a tertiary referral skull base unit, aged 10 to 87. 38 patients (60%) presented with a good functioning facial nerve (House Brackmann equivalent 1–2) and 21 (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. Only 7 (11%) had residual hearing following surgery. 40 (63%) have a good functioning facial nerve (HB 1–2) post operatively at 1 year. 19 patients (30%) had residual or recurrent disease requiring repeated procedures.

Conclusions: Most patients can expect to maintain good facial nerve function despite aggressive surgery. Residual or recurrent disease can be monitored using advanced MRI technique and repeat surgery can be performed as necessary.

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ID: IP154

Clinical outcomes of tympanoplasty without mastoidectomy for chronic otitis media

Presenting Author: **Kyoko Odagiri**

Kyoko Odagiri, Masashi Hamada, Momoko Tsukahara, Motoki Sekine, Hikaru Yamamoto, Taku Atsumi, Masahiro Iid Atsumi, Masahiro Iida
Tokai University, School of Medicine

Learning Objectives:

Introduction: Since 2009, we perform tympanoplasty (TP) without mastoidectomy (w/o M) for chronic otitis media (COM), aiming preservation of the ventilating function in the mastoid air cells. In this paper, clinical outcomes of that surgery were reviewed.

Methods: We analyzed 54 cases with COM, who underwent the first operation of TP w/o M. Age distribution was 8–78 (median 61) and the minimum follow-up period was 12 months. We compared the rate of complete closure, hearing outcome, and preoperative CT findings between type I and type III cases. As for hearing, successful

outcome means meeting one of the following criteria using an average (0.5, 1.0, 2.0 kHz); 1. Air-bone gap is less than 15db. 2. Hearing threshold improved more than 15db. 3. Hearing threshold is less than 30db.

Results: Type I TP was performed in 31 cases and type III TP was done in 23 cases. Autologous bone was used as columella in all cases with type III TP. The TM closure rate of type I and type III at 12 months follow-up was 74.2% and 82.6%, respectively ($p = 0.68$). The successful hearing rates of type I and type III were 80.6% and 78.2%, respectively ($p = 0.82$). Only 1 case with type I TP presented with soft tissue density area in the mastoid in the preoperative CT, whereas 16 cases with type III TP was shown to have such area. There was no statistically significant difference in TM closure rate between cases with and without soft density area in the mastoid (81.2% vs. 85.7%, $p = 0.35$).

Discussion: There was no significant difference in either TM closure rate or hearing outcome between type I and type III. In type III TP, incus and the head of malleus are usually removed to secure the ventilation route from the Eustachian tube through the mastoid. This may be the reason for less disadvantage of TP w/o M even for COM with mastoid granulation. Another factor should be searched on the failure of TP w/o M.

Conclusion-Type III TP w/o M has similar benefit to type I TP even on COM with mastoid granulation.

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ID: IP155

A Clinical Study on 87 Cases of Congenital Cholesteatomas Based on Potsic's Staging System

Presenting Author: **Hideo Ogawa**

Hideo Ogawa, Daiki Takagi, Masahiro Okada, Hiroyuki Yamada, Naohito Hato
Ehime University, School of Medicine, Ehime, Japan

Learning Objectives:

Objectives: We investigated the clinical features and surgical results of congenital cholesteatoma according to Potsic's staging system. Potsic proposed a classification system comprising four stages to evaluate the extent of disease as follows: I, disease confined to a single quadrant; II, cholesteatoma in multiple quadrants, but without ossicular involvement or mastoid extension; III, ossicular involvement without mastoid extension; and IV, mastoid disease.

Methods: A total of 87 patients who had undergone surgery at our hospital were retrospectively analyzed for presenting symptoms, the location of cholesteatoma, and surgical results according to Potsic's staging system.

Results: Of the 87 patients, 25 were classified as Potsic stage I, 13 as stage II, 35 as stage III, and 14 as stage IV. More than half of the patients with early-stage congenital cholesteatoma

(stages I and II) were diagnosed asymptotically by a chance visit to a clinic or on ear screening. Others were diagnosed following a complaint of hearing loss, acute otitis media, or otitis media with effusion. The location of congenital cholesteatoma varied somewhat by stage. In stage I congenital cholesteatoma, the most frequent location was behind the anterior-superior quadrant of the tympanic membrane; however, in stage III congenital cholesteatoma, it was behind the posterior-superior quadrant. All patients were treated surgically. Recurrence was detected in 11 of the 87 patients (12.7%). Recurrent lesions were removed during revision surgery.

Conclusions: Potsic's staging system is a clinically useful procedure for evaluating the extent of congenital cholesteatoma. As the classification is simple, and the stage is easily determined based on otoscopic and CT findings.

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ID: IP156

The application of endoscopes and microscopes to middle ear surgery

Presenting Author: **Hiroshi Ogawa**

Hiroshi Ogawa, Shuji Yokoyama, Tomohiko Ymauchi
Fukushima Medical University Aizu Medical
Center

Learning Objectives: The ratios of microscope and endoscopic use in middle ear surgery in our hospital were investigated, and the effective application of microscopes and endoscopes in middle ear considered.

Objective: The ratios of microscope and endoscopic use in middle ear surgery in our hospital were investigated, and the effective application of microscopes and endoscopes in middle ear considered.

Materials and methods: Middle ear surgery was performed for 63 cases of chronic otitis media with cholesteatoma and 40 cases of chronic otitis media without cholesteatoma in our hospital over a five year period from October, 2011 to September, 2015. The medical records for the 103 patients were reviewed.

Results: Thirty-seven of the 63 cases of chronic otitis media with cholesteatoma underwent surgery with a microscope alone, 15 cases with a combination of microscope and endoscope, and 11 with endoscope alone. Eighteen of the 40 cases of chronic otitis media without cholesteatoma underwent surgery with a microscope alone, 7 cases with a combination of microscope and endoscope, and 15 with endoscope alone. Surgery was performed with an endoscope alone for localized cholesteatoma in the tympanic cavity and for cases in which the edge of the perforation could not be evaluated under microscopic observation. The cases which

were required mastoidectomy or in which the edge of perforation was completely visualized underwent surgery with microscope alone.

Discussion: The endoscope has been used as a tool for improving the visual exposure of hidden structures and deep recesses, obtaining a wider angle of view, and achieving minimally invasive intervention. However, its usage during surgery is limited due to its one-hand operation in comparison with surgery under microscopic observation.

Conclusion: The ratios of microscope and endoscope use during middle ear surgery in our hospital were investigated. Improvement in surgical results can be expected by undertaking interventions with an understanding of the advantages and disadvantages of each instrument.

Ethics Committee Approval: Ethics committee approval was received for this study from the local institutional review board (2015/2556).

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ID: IP157

Marked Hearing Improvement After Surgical Removal of Vestibular Schwannoma With Profound Hearing Loss

Presenting Author: **Sejoon Oh**

Sejoon Oh
Pusan National University Hospital

Learning Objectives: The preoperative hearing status is one of the important factors to determine the method of surgical approach to the vestibular schwannoma. It has been widely recognized that the hearing preservation surgery is not valuable if the patient has no serviceable hearing. The worldwide reported cases of hearing improvement after surgical removal of vestibular schwannoma with profound hearing disturbance are extremely rare so far. The authors have experienced a significant hearing improvement after surgical removal of vestibular schwannoma with preoperative unilateral total deafness but normal otoacoustic emission response, therefore we should consult the OAE response when deciding the approach method of vestibular schwannoma surgery.

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ID: IP158

Endoscopic Autologous Cartilage Injection for the Patulous Eustachian tube

Presenting Author: **Sejoon Oh**

Sejoon Oh, Soo-Keun Kong

Pusan National University Hospital

Learning Objectives:

Patulous eustachian tube (PET) can have a significant negative impact on a patient's quality of life. Several methods of surgical management can be an option to treat PET, and our objective is to evaluate the safety and efficacy of autologous cartilage injection in patients with PET. Thirty-three ears of twenty-five patients with chronic PET refractory to conservative treatment were enrolled to this study. Autologous tragal cartilage was harvested, and chopped into fine pieces to allow its injection using a 1cc Bruening syringe. Endoscopic cartilage injection was performed submucosally into the anterior (0.5 mL) and posterior aspects (0.5 mL) of the nasopharyngeal ET under local anesthesia in an operating room. Patients were evaluated postoperatively by nasal endoscopy and by interview to document symptoms. Successful treatment was defined as complete relief or significant improvement plus satisfaction with treatment. The only complication that occurred was temporary otitis media with effusion in one ear. Inferior turbinate reduction was performed in three ears with accompanying nasal septal deviation or turbinate hypertrophy to allow better nasopharyngeal ET visualization. After autologous cartilage injection, the successful treatment rate, as determined by subjective autophony symptoms, was 69.7% (23/33). The average follow-up period was 25.2 months. Autologous cartilage injection is a minimally invasive technique that has been used by the authors to successfully treat patulous eustachian tube. The described procedure was found to provide a good overall success rate without long-term complications.

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ID: IP159

Surgical results of transcanal endoscopic ear surgery in chronic otitis media.

Presenting Author: **Masafumi Ohki**

Masafumi Ohki, Masatoshi Takashima, Yuka Kitano, Atsushi Tahara, Sunao Tanaka, Tsutomu Nomura, Atsushi Ohata, Shigeru Kikuchi

Saitama Medical Center

Learning Objectives: To endoscopically examine surgical results for chronic otitis media after endoscopic ear surgery comparing with microscopic ear surgery

Introduction: Middle ear surgery has commonly been treated using a surgical microscope. A binocular stereomicroscope has often been used in ear surgery because this instrument offers many advantages including binocular stereoscopic vision of the surgical field; no obstruction of the view by blood, mucus, or bone dust on the lens; high magnification, besides being hands-free. Conversely, the narrow-angle view is a disadvantage of using a microscope for middle ear surgery. Moreover, there are several blind areas behind important structures, such as the facial nerve, that cannot

be avoided. The use of an endoscope can offer several advantages over the use of a microscope during middle ear surgery, particularly the wider field of view. Therefore, endoscopic ear surgery, especially transcanal approach, has been developing recently. The aim of this study is to endoscopically examine surgical results for chronic otitis media after endoscopic ear surgery comparing with microscopic ear surgery.

Methods: Sixty-nine consecutive patients who underwent tympanoplasty for chronic otitis media. Transcanal endoscopic ear surgery was performed in 25 patients, and postauricular incision microscopic ear surgery in 44. Hearing outcome of air conduction threshold, bone conduction threshold, air-bone gap was assessed.

Results: Surgical results of hearing levels after transcanal endoscopic ear surgery was significantly better than postauricular incision microscopic ear surgery. Transcanal endoscopic ear surgery is advantageous to approach to the attic and perform tympanoplasty for sound transmission.

Conclusions: Surgical results of transcanal endoscopic tympanoplasty for chronic otitis media were excellent.

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ID: IP160

Postoperative residual cases in pediatric acquired cholesteatoma

Presenting Author: **Shinsuke Ohshima**

Shinsuke Ohshima¹, Yuka Morita¹, Kuniyuki Takahashi¹, Shuji Izumi¹, Yamato Kubota¹, Yutaka Yamamoto², Sugata Takahashi¹, Arata Horii¹

¹*Niigata University Graduate School of Medical and Dental Sciences,* ²*The Jikei University School of Medicine*

Learning Objectives:

Introduction: Acquired cholesteatoma is more aggressive in children than in adults. Despite the aggressive behaviour, radical treatment such as canal wall down technique was less performed to reduce cavity problem which requires endless care. This results in high rate of residues and recurrence. We focused in this study on reducing residues in pediatric acquired cholesteatoma surgery and explored risk factors of residual lesions.

Methods: Medical charts of 39 children under 15 years old with acquired cholesteatoma were retrospectively reviewed. Various factors were compared between the residual cholesteatoma (+) and (-) groups: surgical procedures, type of cholesteatoma, number of primary sites of cholesteatoma at surgery (P, protympanum; T, tympanic cavity; A, attic; M, mastoid), development of mastoid air cells, and the status of stapes. Residue (+) was defined if residual lesion was found after one-stage surgery or planned two-stage surgery, but not during second-look operation.

Results: Residual cholesteatoma was found ten out of 39 ears (25.6%). Residual sites including overlaps were mastoid cavity (n = 7) followed by tympanic cavity (n = 6) and attic (n = 4), which is different from adult acquired cholesteatoma where the tympanic cavity such as tympanic sinus is the most likely area of residues. Among the various factors examined, significant differences were found between the residue (+) and (−) groups: multiple primary sites such as TAM and PTAM diseases and poor status of stapes were more seen in residue (+) group.

Conclusions: Residual cholesteatoma was mostly seen in mastoid cavity, probably because small piece of epithelium remains in honeycomb structure of well-developing mastoid cavity, which is a characteristic feature of mastoid in children. In order to minimize the residual lesion, surgeons should take care of complete removal of mastoid cholesteatoma especially in patients with advanced case such as multiple primary sites and with invasion to stapes.

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ID: IP161

Hearing results in stapes surgery

Presenting Author: **Yumi Ohta**

Yumi Ohta¹, Tetsuo Morihana¹, Kazuya Ohta¹, Takao Imai¹, Takashi Sato¹, Suzuyo Okazaki¹, Atsuhiko Uno², Tadashi Kitahara³, Katsumi Doi⁴, Hidenori Inohara¹

¹Osaka University Graduate School of Medicine, ²Osaka General Medical Center, ³Nara Medical University, ⁴Kinki University

Learning Objectives:

In Asia, otosclerosis is not so common as in Europe and North America. The reports about stapes surgery is not many in Japan. So we report the hearing results in stapes surgery performed in our institution.

We analyzed the hearing results of 101 ears which were performed stapes surgery at Osaka University Hospital from April 2007 to December 2014. We evaluated the hearing results by criteria of AAO-HNS at 6 months after surgery and at 2 years after surgery. Furthermore, we analyzed hearing gain, air-bone gap and air conduction threshold by each frequency.

Small fenestration stapedotomy was performed in 63 ears. Partial stapedectomy was performed in 23 ears and total stapedectomy was performed in 12 ears. The CO2 laser was used to fenestrate the foot plate of stapes in 40 ears. The manual perforator was used in 56 ears. The details of prostheses are as follows: Teflon wire piston; 64 ears, Teflon piston; 20 ears and titanium clip piston; 14 ears. The total success rate (i.e. the air-bone gap is smaller than 10 dB) is 70%. Concerning the success rate by A-B gap (AAO-HNS criteria), there was no statistical difference in fenestration methods, fenestration devices or prostheses. To see by each frequency, the hearing gains at high frequencies (2k, 3k and 4k) are better in stapedotomy than in stapedectomy at 6 months after surgery. But there is no significant difference at 2 years after surgery. The air conduction threshold at high frequencies in stapedotomy at 2 years after surgery worsened than at 6 months after surgery.

The hearing results are substantially equal to other reports. The A-B gap after surgery does not depend on either fenestration methods, fenestration devices or prostheses in our report. The reason why the air conduction threshold at high frequencies in stapedotomy worsened at 2 years after surgery seems re-calcification around the piston.

doi:10.1017/S0022215116006587

ID: IP162

A case of presigmoid retrolabyrinthine approach to vestibular schwannoma by use of continuous direct neurophysiological monitoring of facial nerve and cochlear nerve

Presenting Author: **Naoki Oishi**

Naoki Oishi¹, Hidemi Miyazaki², Noriomi Suzuki¹, Kaoru Ogawa¹

¹Keio University School of Medicine, ²Tokyo Women's Medical University Medical Center East

Learning Objectives:

Intraoperative monitoring of the facial nerve and the cochlear nerve is essential to achieve preservation of function after surgery to vestibular schwannomas. Recently two novel monitoring methods have been reported to improve preservation of function: continuous direct auditory evoked dorsal cochlear nucleus action potential (AEDNAP) monitoring and facial nerve root exit zone-elicited compound muscle action potential (FREMAPP) monitoring (Nakatomi and Miyazaki, et al. 2015). A presigmoid retrolabyrinthine approach is considered to have the advantages of the two major approaches, the retrosigmoid suboccipital and presigmoid translabyrinthine approaches, as a minimally invasive surgical option to vestibular schwannomas, allowing direct access to the cerebello-pontine angle and preservation of hearing function (Iacoangeli et al. 2013). Here, we report a case of presigmoid retrolabyrinthine approach to medium vestibular schwannoma by use of continuous monitoring of the facial nerve and the cochlear nerve, as a novel surgical method to achieve a minimally invasive surgery with preservation of function.

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ID: IP163

Surgical success and complications of tympanoplasty using composite tragal cartilage in chronic otitis media

Presenting Author: **Kadir Serkan Orhan**

Kadir Serkan Orhan, Mehmet Melih Çiçek, Beldan Polat, Hakan Avcı, Bayram Sahin, Yahya Guldiken
Istanbul University

Learning Objectives: To evaluate the success rate and result of tragal composite cartilage tympanoplasty.

Objective: This study intends to present the success of the membrane closure and audiological earnings of tympanoplasty operations using composite tragal cartilage, in our clinic.

Materials and Methods: One hundred and seventy one patients with diagnosis of chronic otitis media without cholesteatoma (classified in accordance with types of perforation) who treated with tympanoplasty using tragal cartilage graft between the years 2006–2014 was included to the study.

Results: The study included 171 patients, 73 were men and 98 were women. The range of the age was 13–71. Mean age was $31,7 \pm 12,5$. Follow-up period ranged from 99 months to 8 months, and the average was 34 months. There was central, attic, marginal and total perforations in 147 (85,9%), 13 (7,3%), 9 (5,3%) and 2 (1,2%) patients, respectively. Preoperative retraction was found in 12 (7%) of patients. In preoperative examination tympanosclerosis was observed in 26 (11,1%) patients. Patients' preoperative air-bone gap values were between 6–80 dB and, mean was 34 ± 13 dB. In 26 patients tympanosclerosis (11,1%) was observed in accordance with the preoperative examination. The Standard surgical technique applied in this study and in the postoperative examination complete and incomplete closure was seen in 145 (84,8%) and 26 (15,2%) patients, respectively. In the postoperative audiological evaluation, statistically significant increase was seen in air-bone gap values at 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz ($p < 0.01$).

Conclusions: The success of membrane closure at tympanoplasty operations using cartilage graftmaterial is superior to other grafts which are physically thinner and more flexible compared to cartilage. In terms of hearing values, the results are similar with the operations carried out with other graft materials.

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ID: IP164

Endoscopic Assisted Petrosectomy via Middle Fossa Approach for Isolated Petrous Bone Cholesteatoma

Presenting Author: **Kadir Serkan Orhan**

Kadir Serkan Orhan, Mehmet Çelik, Beldan Polat, Yahya Guldiken

Istanbul University

Learning Objectives: Endoscopic assisted surgery for petrous bone cholesteatoma can be used safely.

Objective: The petrous bone cholesteatoma (PBC) is used to describe an epidermoid cyst of the petrous portion of the temporal bone. Sanna et al have classified PBCs into five groups: supralabyrinthine, infralabyrinthine, infralabyrinthine-apical, massive, and apical. Besides, these terms describe both the extent of the lesion and the location.

The appropriate surgical procedure for PBC is frequently radical surgical removal such as the labyrinthectomy and/or rerouting of the facial nerve. However, it may

have to be modified, depending on the status of the contralateral ear. Therefore, location and extend of the pathology is defined to adequate surgical approach with modification. Recently, some studies have described to “minimally invasive cholesteatoma removal” which were aimed to preserve hearing and facial nerve functions for treatment of the PBC.

Methods: We performed standard middle fossa craniotomy to access to petrous apex. Otomicroscope was used to remove the most part of the cholesteatoma, but in some hidden area such as infralabyrinthine area, medial part of the carotid artery, endoscope (4 mm 0 or 45 degree) was used.

Results: Here we present 4 cases with infralabyrinthine-apical cholesteatoma who underwent endoscopic assisted surgery via middle fossa approach. We were able to preserve hearing in 2 patients. In another 2 patients, labyrinth was already invaded by cholesteatoma and the hearing was not able to preserved.

Conclusion: Endoscopic assisted surgery via middle fossa approach can be help removal of infralabyrinthine-apical or massive without cochlear resection, labyrinthectomy and facial nerve injury. Moreover, it may help to reduce the residual cholesteatoma mostly in hidden recess.

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ID: IP165

Surgical Intervention of Early Stage Primary Acquired Cholesteatoma

Presenting Author: **Tao Pan**

Tao Pan, Furong Ma, Yu Wang, Ke Zhang, Jia Ke
peking university third hospital

Learning Objectives:

Objective: The purpose of this study was to investigate the surgical intervention and hearing preservation of early primary acquired cholesteatoma.

Methods: A case of bilateral early primary acquired middle ear cholesteatoma was reported. The different operative management of each ear was reviewed. Postoperative effect and hearing outcome were followed up.

Result: A 27-year-old male complained of intermittent bilateral otorrhea for seven years. The pure tone audiometry was 22 dB for the right ear and 28 dB for the left. Based on clinical history combining with CT imaging, the patient was diagnosed with bilateral primary acquired cholesteatoma. The two ears were operated separately in 1-year interval.

At surgery of left side, the ossicular chain was wrapped around by cholesteatoma which involved the region inside the ossicular chain. Hence the incus and head of malleus was removed. Then partial ossicular replacement prosthesis (PORP) were used to reconstruct the left ossicular chain and the epitympanum was reconstructed with cartilages.

For the right side, cholesteatoma was confined to the regions outside the ossicular chain. The incus and stapes were intact with good movement although the head of malleus was partly eroded. Therefore, the right ossicular chain was reserved and the epitympanum was reconstructed. The patient was followed up until 9 months after the last operation. No recurrence was found in either ear and the PTA was improved to 13 dB for the right side and 20 dB for the left.

Conclusion: For primary acquired cholesteatoma at early stage, there is possibility that hearing impairment was slight even though the lesions of middle ear already covered and eroded the ossicular chain. For these cases, surgical procedure to remove the cholesteatoma may result in further hearing loss, which lead to a dilemma for both doctors and patients.

doi:10.1017/S0022215116006629

ID: IP166

Cholesteatoma treated by mastoid obliteration, recommendations from a personal follow-up of surgical results

Presenting Author: **Ronald Pennings**

Ronald Pennings

Radboudumc

Learning Objectives:

Introduction: Despite declining prevalence, cholesteatoma remains the most devastating type of chronic otitis media that can affect hearing, balance and facial nerve function. In order to prevent such complications, cholesteatoma requires surgical removal. This study presents the lessons learned from an overview of personal results of a single otologic surgeon after starting in a staff position.

Methods: 183 patients that were operated for cholesteatoma between September 2009 and November 2015 by a single otologist were included in this retrospective evaluation. All patients underwent surgery for cholesteatoma and were followed-up by either MRI DWI (>95%) or a mandatory second look procedure (<5%). In general, a canal wall-up technique with ossicular chain reconstruction was used and in selected cases this was followed by mastoid obliteration with bone dust.

Results: Personal results will be presented on recurrent and residual disease after cholesteatoma surgery. A significant otologic learning curve was seen after evaluation of all cases and this was entirely related to a significant reduction of the percentage recurrent and not residual cholesteatoma. Additional mastoid obliteration leads to a significant reduction of recurrent but not residual disease. No difference was seen in results between pediatric and adult patients.

Conclusion: A strict personal follow-up of surgical results on cholesteatoma surgery identified mastoid obliteration as a key factor to reduce recurrent cholesteatoma.

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ID: IP167

Indications and techniques in Canal Wall Up Mastoidectomy

Presenting Author: **Enrico Piccirillo**

Enrico Piccirillo, Sampath Chandra Prasad Rao, Flavia D'Orazio, Mario Sanna

Gruppo Otologico

Learning Objectives:

Objective: The aim of this study is to retrospectively analyse the functional and hearing outcomes of canal wall up mastoidectomy for cholesteatoma.

Materials & Methods: 252 patients who underwent canal wall up mastoidectomy for cholesteatoma were analysed. Charts were analysed for age of the patient, type of cholesteatoma, surgical procedures, hearing results, recurrence and follow up.

Results: 64% of the patients belonged to the pediatric population. 38% of the patients had a follow-up of at least five years. Of the patients who underwent two staged surgery, 46.1% had a residual lesion that was identified and excised during the second surgery. Over a five year follow-up period, there were 12.5% patients with recurrences, all belonging to the group in whom a residual cholesteatoma was identified during the second staged surgery. The rate of residual cholesteatoma tended to decrease as age increases. The type of cholesteatoma, acquired or congenital middle ear, were not statistically related to the incidence of residual cholesteatoma. Hearing analysis showed that hearing recovery was excellent with canal wall up procedures and remained stable over five years.

Conclusion: Surgery for cholesteatoma is especially challenging in a pediatric population because of the need for hearing preservation. Hence canal wall up mastoidectomy in a single or two stages should be the approach of choice in the pediatric population. Radiological follow-up by DWI is mandatory for more than 5 years as recurrences can be seen even after 5 years.

doi:10.1017/S0022215116006642

ID: IP168

Reconstruction of the incudostapedial joint

Presenting Author: **Marek Porowski**

Marek Porowski¹, Henryk Skarzynski², Maciej Mrówka², Piotr Skarzynski²

¹*Institute of Physiology and Pathology of Hearing, ²World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany | Warsaw, Poland*

Learning Objectives:

Introduction: The most common place of damage of the conductive apparatus of the middle ear in cases of chronic otitis media is the area of the incudostapedial joint. The incudostapedial joint may be disconnected also in congenital deformations or after head and ear injuries.

Aim: The aim of the study was to analyze the results of hearing improving surgeries in ears with hearing loss caused by damages of the ear's conductive apparatus in the area of the incudostapedial joint.

Material and Methods: Analysis was performed in the group of patients operated in years 1999–2015. Reconstruction surgeries were performed using autogenous (incus interposition) or allogenuous (glassionomer cement or various types of prostheses) materials. The results were assessed, following the standard adopted by the Institute, after 1 month, 3 months, 6 months, one year and then after 2 and 3 years.

Results and conclusions: The results confirm that an isolated damage of the auditory ossicles within the incudostapedial joint allows, in most cases, to achieve stable reconstruction or connection of the damaged chain, resulting in improvement of hearing, measured as decrease or total closing of the air-bone gap. Good and very good results achieved in the large percent of ears after surgery confirm that the technique and materials applied may be a correct approach in this type of damages of the conductive apparatus of the middle ear.

doi:10.1017/S0022215116006654

ID: IP169**The treatment of cholesteatoma with intact ossicular chain**

Presenting Author: **Nicola Quaranta**

Nicola Quaranta¹, Francesco Barbara², Vito Pontillo¹, Valentina De Robertis²

¹University of Bari, ²University of Bari

Learning Objectives: To discuss the surgical treatment of cholesteatoma with intact ossicular chain.

Introduction: The primary goal of cholesteatoma surgery is complete eradication of the disease. The objective of this study is to compare the results obtained in patients affected by cholesteatoma with intact ossicular chain and submitted to Bondy Modified radical Mastoidectomy (BMRM) and canal wall up tympanoplasty (CWUT).

Methods: 65 patients were treated: 30 with BMRM (group A) and 35 with CWUT (group B). Of these last, 27 have undergone single stage technique (20 transcanal approach, with mastoidectomy 7) and 8 second look technique (2 transcanal approaches, with mastoidectomy 6). The location and the extension of the cholesteatoma was considered. The anatomical and functional postoperative complications were recorded. Functional analysis was conducted by comparing the Air Bone Gap (ABG) pre- and postoperatively.

Results: As for the group A, 2 patients (6.66%) presented post-operative complications (3,33% vertigo, 3,33% tinnitus); 5 patients (16.67%) had late anatomical complications (3,33% retraction pocket, 3,33% epidermal cyst, 10% otorrhea). As for the B group, 2 patients (5.9%) had post-operative complications (2,85% vertigo, 2,85% tinnitus); 7 patients (20%) had anatomical complications (8,75% recurrent cholesteatoma, 8,75% retraction pocket, 2,86% otorrhea). Group A had a preoperative ABG of $11,79 \pm 6,48$ dB and post operative of $13,86 \pm 9,03$ dB; group B had a pre-operative ABG of $17,45 \pm 9,18$ dB and a postoperative of $19,53 \pm 13,62$ dB. One patient of the group A and one of the B presented a significant decline of bone conduction (>30 dB).

Conclusion: Both techniques lead to good anatomical and functional results. In case of cholesteatoma with intact chain, RMB is indicated in cholesteatoma spreading posteriorly, in antrum and mastoid, while CWUT in case of cholesteatoma located in epitympanum and mesotympanum.

doi:10.1017/S0022215116006666

ID: IP170**Study of Biocompatibility Between Bone Pâté with Fibrin Glue and Human Osteoblast in Vitro**

Presenting Author: **Nicola Quaranta**

Nicola Quaranta¹, Anna Eugenia Salzo², Concetta De Luca², Cinzia Buccoliero², Graziana Colaianni², Giorgio Mori³, Giacomina Brunetti², Silvia Colucci², Maria Grano²

¹University of Bari, ²University of Bari,

³University of Foggia

Learning Objectives: To describe the fate of bone patè when in contact with osteoblast cultures.

Hypothesis: The aim of the present study was to evaluate the effect of bone patè (BP) on human osteoblast differentiation by measuring cellular viability, expression of the transcription factors and the major components of extracellular matrix.

Background: Although BP has been used in ear for many years and it has been reported that after surgery BP become viable bone, the cellular mechanisms that lead to BP osteointegration have never been described.

Methods: BP obtained from 4 patients subjected to mastoidectomy and affected by middle ear and mastoid cholesteatoma was placed in contact with osteoblast-like cell (OB) cultures obtained by mastoid bone. Cell culture were treated with BP, BP with fibrin glue (BPG) and with fibrin glue alone. Cells viability was evaluated after 24 hours; After one week of treatment OBs cultured in the different conditions were subjected to the evaluation of alkaline phosphatase expression, the expression of transcription factors and bone matrix proteins by qPCR.

Results: The MTT assay revealed that, after 24 hours, OBs have increased viability when treated with BP (19% increase)

and BPG (34% increase), while the treatment with fibrin glue alone did not influence this parameter. BP with and without fibrin glue increased of 97% and 94% respectively the number of alkaline phosphatase (ALP) positive cells compared to the control. Finally BP determined the upregulation of transcription factors and component of the extracellular matrix.

Conclusion: The present data show that BP has a high osteoinductive potential on human OBs, enhancing their activity.

doi:10.1017/S0022215116006678

ID: IP171

Clinical analysis on surgery of middle ear cholesteatoma and chronic otitis media

Presenting Author: **Nilipaer Alimu**

Ayiheng Qukuerhan, Nilipaer Alimu, Halimulati Muertiza, Pildong Kuyaxi

First affiliated hospital of Xinjiang Medical University

Learning Objectives:

Objective: To evaluate the choice of microsurgical treatment modalities and its clinical effect on middle ear cholesteatoma and chronic suppurative otitis media.

Methods: 110 cases with middle ear and mastoid lesions including middle ear cholesteatoma and chronic suppurative otitis media were analysed which performed canal wall up mastoidectomy or at the same time tympanoplasty and canal wall down mastoidotomy depending on lesion extent and followed-up, observed the ear recovery, complications, recurrence and postoperative hearing improvement.

Results: 110 cases including 66 cases of middle ear cholesteatoma, 44 cases of chronic suppurative otitis media, 51 canal wall up mastoidotomy, 46 cases simultaneously followed by tympanoplasty, 59 canal wall down mastoidectomy, Intraoperative finding as followed auditory absence of bone destruction 36 cases including 7 cases of chronic suppurative otitis media, 29 cases of middle ear cholesteatoma; 7 cases of complete auditory ossicles including 4 cases of chronic suppurative otitis media, 3 cases of middle ear cholesteatoma; facial nerve canal bone destruction 22 cases, brain palate damaged and meningitis exposed in 13 cases.

Conclusion: According to different lesions of middle ear and mastoid the specific disease in intraoperative, different operative methods can be used to obtain the corresponding clinical curative effect, the canal wall up mastoidectomy plus tympanoplasty, if indications mastered properly, the technical conditions permitted, can effectively keep the original middle ear mastoid anatomical structure and improve

hearing skill, and this surgery is feasible; if tympanoplasty cannot be used to a wide range of middle ear cholesteatoma, canal wall down mastoidectomy should be preferred in order to avoid recurrence and affect the efficacy.

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ID: IP172

Analysis of Clinical characteristic of Simple congenital ossicular malformation and Ossicular chain reconstruction

Presenting Author: **Dongdong Ren**

Dongdong Ren, Xiaoyu Yang, Jing Yu, Xinwei Wang, Fanglu Chi

Eye & ENT Hospital of Fudan University

Learning Objectives:

Object: To study of simple congenital ossicular malformation clinical and audiological characteristics, and to discuss options to different auditory ossicles in ossicular chain reconstruction.

Methods: Ossicular chain malformations in 75 cases (79 ears) were studied involving 43 males and 32 females, aged from 6 to 57 years old (average 23.5 ± 14.5 years old). There are four cases of bilateral conductive deafness and 71 cases of unilateral conductive deafness (39 left ears and 32 right ears). Results of preoperative audiometry showed that air-bone gap was 38.7 ± 14.5 dB of speech frequency. We operated exploratory tympanotomy in 79 ears (4 cases of bilateral). Among them, ossicular chain reconstruction was performed in 71 cases, while in six cases not done because of facial deformity, and in two cases ossicle joints'activities were good after incudostapedial joint release.

Results: According to Teunissen classification (1993), we divided 79 ears into four groups, including 5 (6.3%, 5/79) ears of type I, 11(14%, 11/79) ears of type II, 47(59.5%, 47/79) ears of type III, 16(20.3%, 16/79) ears of type IV. 0.5 cases of type I were implanted with Piston. 11 cases of type II were implanted with Piston, including Kurz(3), Spiggle(5), Xomed(3). For type III, 23 cases were implanted with partial ossicular replacement prosthesis (PORP), including Kurz(6), TTP(5), Xomed(12); 2 cases were implanted with autologous incus; 20 cases were implanted with total ossicular replacement prosthesis (TORP), including TTP(7), Spiggle(2), Xomed(10), autologous incus(1); and 2 cases were performed with incudostapedial joint release. 10 cases of type IV had done oval window drill-out ossicular reconstruction, including 8 cases with Piston, 2 cases with TORP. The average air-bone gap was 21.5 dB in two weeks post-surgery.

Conclusion: Ossicular chain reconstruction with selection of different types of artificial ossicular is an effective method to improve hearing and decrease air-bone gap.

doi:10.1017/S0022215116006691

ID: IP173**Can the softband BAHA indicate the prospective improvement in hearing with middle ear implants?**Presenting Author: **Rujuta Roplekar**Rujuta Roplekar¹, Spielmann Patrick², Stephen Jones²¹NHS Scotland, ²Department of ENT, Ninewells Hospital and Medical School, NHS Tayside

Learning Objectives: Middle ear implant surgery has a significant role in those who have suffered hearing loss due to cholesteatoma, either through the disease process or as a result of surgical clearance. Pre-operative planning is a key component in patient selection for middle ear implant surgery in hearing impairment. The objective of this study is to assess whether softband B.A.H.A. testing pre-operatively indicates the improvement achieved post-operatively. If so, we propose this is as an additional tool in pre-operative planning.

Method: The pre-operative aided half optimum speech recognition threshold (HOSRT) and post-operative aided results were compared for each ear that had undergone either Bonebridge (BB) or Vibrant SoundBridge (VSB) surgery in our centre. Pearson's correlation coefficient was calculated.

Results: Twenty-three implanted ears' (in twenty-two patients) data was assessed. The mean difference between pre-operative (assessment) and post-op (implanted) HOSRT was 8.27 dB. In 16/22 ears (72%) the difference was Pearson's correlation coefficient was 0.52, confirming moderate correlation.

Conclusion: These preliminary data assessment suggests that a BAHA softband is a potential tool to guide expectation of hearing augmentation outcomes with middle ear implant surgery. This data also suggests that results with the softband are not as good as final results with the implant, indicating patients may be counselled to expect equal, if not better, results with implant.

We propose that use of the BAHA softband has a 'predictive' role for pre-operative simulation of expected results, which is useful for patient selection, counselling and operative planning.

doi:10.1017/S0022215116006708

ID: IP174**Is there a Quality of Life (QOL) benefit from Bonebridge © or Vibrant Soundbridge © implants?**Presenting Author: **Rujuta Roplekar**Rujuta Roplekar¹, Irfan Khan², Patrick Spielmann², Stephen Jones²¹NHS Scotland, ²Department of ENT, Ninewells Hospital and Medical School, NHS Tayside

Learning Objectives: Persistent conductive hearing loss in adults can occur for various reasons. It is a recognised consequence of cholesteatoma, and has a significant quality of life impact. Middle ear implantable hearing devices are a relatively novel aid for conductive hearing loss; the first Vibrant Soundbridge © (VSB) surgery was in 2006 and Bonebridge © (BB) in 2013. The objective benefit of improved hearing thresholds is well documented in the literature. This study assesses the more subjective quality of life (QOL) benefit of middle ear implants.

Method: All patients who have undergone VSB or BB surgery were requested to complete Glasgow Benefit Inventory (GBI) questionnaire after the device had been switched on.

The questionnaires were scored as per the GBI inventory scoring system.

Results: 15 out of 25 patients operated on (25 ears) completed the request, giving a return rate of 60%. Eight patients had Bonebridge © and seven had Vibrant Soundbridge © surgery.

The average calculated GBI total sub-score was 32.4, the average social GBI sub-score was 53.5, physical sub-score average was 57.2, and general sub-score was 70.8.

Conclusions: The authors propose that use of QOL assessment is an important component to be included in post-operative assessment alongside audiology assessment.

This case series has shown good QOL outcomes. The scores are equivalent to or better than published GBI scores for other comparable surgical hearing devices[i]. The benefit of middle ear implants is well supported by a combination of audiological and QOL improvement for patients.

[i] Arunachalam PS, Kilby D, Meikle D, Davison T, et al. (2001). Bone-anchored hearing aid quality of life assessed by Glasgow Benefit Inventory. *Laryngoscope* 111(7): 1260–3

doi:10.1017/S002221511600671X

ID: IP175**Evaluation of the Labyrinthine Operation Function in Ears with Acquired Cholesteatoma**Presenting Author: **Leticia Rosito**Leticia Rosito¹, Bruna Seimetz², Cristiane Affeld², Adriane Teixeira², Francisco Zuma e Maia², Sady Selaimen da Costa²¹Hospital de Clínicas de Porto Alegre,²Universidade Federal do Rio Grande do Sul

Learning Objectives: To evaluate the labyrinthine function of ears with cholesteatoma and observe differences between children and adults.

Introduction: Acquired cholesteatoma is an inflammatory condition of the middle ear that causes hearing loss and otorrhea. In our previous study, we had demonstrated that cholesteatoma may be associated to sensorineural hearing loss.

Because of the inner ear damage, we hypothesize that cholesteatoma may be also associated to posterior labyrinth alterations.

Methods: Transversal, descriptive and comparative study. We included consecutive patients with cholesteatoma and no previous ear surgery. As control group, we included patients with ears without any alterations and normal audiometric thresholds. The patients were submitted to an ENT evaluation, digital videotoscopy and a video Head Impulse Test (v-HIT), to detect peripheral vestibular deficits through an objective measure of the vestibular ocular reflex (VOR) gains.

Results: The research group was constituted by 72 ears and the control group by 62 ears. When we analyzed the semi-circular canals (SCC) through the v-HIT, we observed that the average gain of the lateral SCC of the research group was significantly lower than the average of the control group ($p = 0,050$). Regarding the age of the research group, we found in pediatric population a gain of VOR in the anterior SCC significantly lower when compared to the average of ears with cholesteatoma in adults ($p = 0.037$). When we analyzed only the pediatric group, we observed that ears with cholesteatoma had VOR gain significantly lower than normal ears in posterior SCC ($p = 0,026$).

Conclusions: Ears with cholesteatoma demonstrated a lower average gain of VOR than the control group in the three SCC. Considering the age, pediatric patients with cholesteatoma had more alterations in the labyrinthine evaluation than those over 18 years.

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ID: IP176

Tympanic membrane retraction and cholesteatoma: study of the pathogenesis through an analysis of the contralateral ear

Presenting Author: **Leticia Rosito**

Leticia Rosito, Inesangela Canali, Sady Selaimen da Costa, Fábio Selaimen, Jady W. Xavier, Ricardo Brandão Kliemann, Andressa Bernardi

Hospital de Clínicas de Porto Alegre

Learning Objectives: To investigate the cholesteatoma growth pattern and location of TM retraction in the CLE of patients with acquired middle ear cholesteatoma.

Introduction: Theories of acquired cholesteatoma pathogenesis involving previous tympanic membrane (TM) retraction are the most widely accepted. Since prospective studies are very difficult to perform, the study of the contralateral ear (CLE) in patients with cholesteatoma seems to be a good alternative to understand its pathogenesis. Our previous studies had demonstrated that TM retraction is the main alteration in the CLE of patients with cholesteatoma. We now propose to analyze these alterations in greater detail and correlate the observations with the cholesteatoma growth pattern in the main ear.

Methods: Our cross-sectional study included 242 consecutive patients diagnosed with posterior epitympanic (PEC) or posterior mesotympanic cholesteatoma (PMC) in at least one ear between August 2000 and March 2013. The patients had no surgical history. We performed videotoscopy in both ears and analyzed the videos independently in a blind manner. The prevalence of PEC and PMC and moderate-to-severe *pars tensa* and *flaccida* retractions in the CLE was evaluated. The observed alterations in the CLE were compared with the cholesteatoma growth patterns in the main ear.

Results: Cholesteatoma and TM retraction were observed in 17.8% and 42.6% of the CLEs, respectively. In instances where the primary ears displayed PEC or PMC, identical cholesteatoma growth pattern was observed in 89.5% and 64% of the CLEs, respectively ($p < 0.0001$). A similar phenomenon was observed in cases of *pars tensa* and *flaccida* retraction ($p < 0.0001$).

Conclusion: Patients with cholesteatoma have a greater probability of having both cholesteatoma and TM retraction at the same site in the CLE. Our findings validate the hypothesis that cholesteatoma pathogenesis is associated to previous TM retraction, with a high prevalence of bilaterality.

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ID: IP177

Age-based differences in cholesteatoma in children

Presenting Author: **Leticia Rosito**

Leticia Rosito, Inesangela Canali, Sady Selaimen da Costa, Jady Wroblewski Xavier, Andressa Bernardi, Mauricio Noschang Lopes da Silva

Hospital de Clínicas de Porto Alegre

Learning Objectives: To analyze the differences in the prevalence of cholesteatoma growth patterns between children below and over 12 years of age. We also aim to study the effect of age on the observed alterations in the CLE.

Introduction: Some controversy still exists about the pathogenesis of cholesteatoma in children. Classical definitions of congenital cholesteatoma are being debated and the study of cholesteatoma based on age can be useful in improving our knowledge of this disease.

Methods: In a cross-sectional study, videotoscopy data of 148 pediatric patients were analyzed for cholesteatoma growth patterns and contralateral ear (CLE) alterations. The children were divided into two groups: 1) Group 1 comprising 67 patients, under 12 years of age and 2) Group 2 comprising 81 patients, 12 years or older.

Results: We found that 6 out of the 7 patients with anterior epitympanic cholesteatoma (AEC) belonged to group 1. In group 1, 43.3% of the patients were posterior mesotympanic (PMC), 19.4% were posterior epitympanic (PEC), 17.9% had two patterns of cholesteatomas and in 19.7% patients

the growth pattern was undetermined. In group 2, 42% were PMC, 28.4% PEC, 18.5% both, and 11.1% of the patients had an undetermined growth pattern. There was no difference in the diagnosis of the principal ear between the two groups ($p = 0.40$). In the analysis of the CLE, in group 1, 35.7% of ears had *pars tensa* (PT) tympanic membrane (TM) retraction, 28.6% *pars flaccida* (PF) TM retraction, and 35.7% had both abnormalities. PT and PF retractions were present in 50% of children from group 2, and PT retraction only in 9.5% of this group. The differences between the two groups were statistically significant ($p = 0.03$). The CLEs of patients with AEC were normal.

Conclusion: The majority of AEC was found in children younger than 12 years of age and all displayed a normal CLE, suggesting a probable congenital origin. PMC was the most prevalent in both the study groups. The most prevalent CLE abnormalities in children over 12 years of age were PT and PF TM retraction together, suggesting that the PT retractions could evolve and block epitympanum aeration resulting in a PF retraction.

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ID: IP178

Acquired middle ear cholesteatoma in children

Presenting Author: **Leticia Rosito**

Leticia Rosito, Inesangela Canali, Sady Selaimen da Costa, Adriane Teixeira, Fabio Selaimen, Gabriel Albuquerque Silva, Livia Morsch, Larissa Petermann Jung
Hospital de Clínicas de Porto Alegre

Learning Objectives: To describe in children: 1. prevalence of cholesteatoma growth patterns; 2. hearing impairment; 3. contralateral ear alterations.

Introduction: Acquired middle ear cholesteatoma in children is a rare event. Over the years, many studies have elaborated the differences between cholesteatoma in children and adults. The clinical findings and the cholesteatoma growth patterns are known to be distinctive in children.

Methods: In a cross-sectional study, videotoscopy data of 155 pediatric patients were analyzed for cholesteatoma growth patterns. They were subjected to an audiological evaluation. We also analyzed the contralateral ear (CLE), classifying it as normal, TM perforation, outside-in TM perforation (in instances with signs of previous TM retraction), moderate and severe TM retraction, and cholesteatoma.

Results: Cholesteatoma growth patterns were posterior epitympanic in 23.2% patients, posterior mesotympanic in 40.6% and both in 17.4% of the patients. Anterior epitympanic growth pattern was observed in 4.5%. In 14.2% the growth pattern was undetermined. The observed pure tone average for bone conduction was 8.8 dB (SD 13.4), for air conduction was 39.7 dB (SD 21.79) and for air-bone gap was 32 dB (SD 15.61). There was no difference between

the cholesteatoma growth patterns and the pure tone average for bone conduction ($p = 0.6$), for air conduction ($p = 0.42$) and for air-bone gap ($p = 0.32$).

A normal CLE was observed in 34.8% of the patients. Moderate or severe TM retractions were observed in 45.2%, TM perforation in 7.1%, and cholesteatoma in 12.9%. Of all the TM perforations, *outside-in* pattern was observed in 63.6%.

Conclusion: Posterior mesotympanic cholesteatoma was the most prevalent in the study population. Most patients had a conductive hearing loss irrespective of the cholesteatoma growth pattern. The most prevalent CLE abnormalities were moderate or severe TM retraction and cholesteatoma.

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ID: IP179

The prevalence and implications of marginal tympanic membrane perforations in cholesteatoma pathogenesis

Presenting Author: **Leticia Rosito**

Leticia Rosito, Inesangela Canali, Sady Selaimen da Costa, Fabio Selaimen, Gabriel A. Silva, Livia Morsch, Larissa Petermann Jung
Hospital de Clínicas de Porto Alegre

Learning Objectives: (1) To evaluate the prevalence of marginal perforations in patients with chronic otitis media. (2) To evaluate the marginal perforations searching for signs of previous TM retraction and (3) To study the alterations in the contralateral ear.

Introduction: The pathogenesis of acquired cholesteatoma is still not completely understood. Currently, theories involving previous tympanic membrane (TM) retractions are the most accepted. Migration of the squamous epithelium across a marginal perforation of the TM has also been implicated in the development of cholesteatoma. Marginal perforations are rare events and prospective studies are also very difficult to perform since cholesteatoma is a rare disease and takes many years to develop. The study of marginal perforations and the contralateral ear (CLE) can help us to determine their implications in cholesteatoma pathogenesis.

Methods: Videotoscopy data of 1781 patients diagnosed with chronic otitis media (COM) between August 2000 and December 2015 were analyzed to determine the prevalence of marginal perforations. Signs of previous TM retraction associated to the marginal perforations were evaluated for the following: 1. medialization of the manubrium of the malleus, 2. remnant tympanum adhered to the ossicular chain, 3. remnant tympanum adhered to the promontory, and 4. ossicular chain erosion. Videotoscopy data of the CLE were also analyzed.

Results: Of the 1781 patients evaluated, 45 (2.52%) demonstrated marginal TM perforation. One thousand five hundred eighty-three patients (88.9%) showed two or more signs of

previous TM retraction, while only 78 patients (4.4%) had no evidence of previous retraction. Moderate or severe TM retractions were observed in the CLE of 871 (48.9%) patients, perforation/retraction in 8.9%, cholesteatoma in 13.3%, and TM perforation in 6.7% of patients. The CLE in 395 patients (22.2%) was found to be normal.

Conclusion: A low prevalence of marginal TM perforation (2.52%) was observed. The vast majority of ears with marginal perforation bore evidence of previous TM retraction. In addition, TM retraction or cholesteatoma occurred in 71.1% of the CLEs.

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ID: IP180

Isolated Facial Nerve Anomaly Presenting as Conductive Hearing Loss

Presenting Author: **Vrunda Rotte**

Vrunda Rotte, Sherif Habashi, Daniel Gjoni
Royal Free London NHS Foundation Trust

Learning Objectives: Patient's history should always be listened carefully. The otologic surgeon should always be prepared for the unexpected. We should always listen carefully to the patient's history. The otologic surgeon should always be prepared for the unexpected.

Introduction: Anatomical anomalies of the facial nerve range from common minor bony dehiscence of the tympanic segment to much rarer abnormalities in the course of the nerve. Normally their only relevance is that they may pose an increased risk of injury during tympanomastoid surgery.

Method: We report the case of a 60 year old female who presented to the general ENT clinic with right-sided conductive hearing loss. Eventually a grommet was inserted under LA. The hearing did not improve. She was referred to the senior author for tympanotomy. On the day of surgery the patient was asked again about the history of her symptoms and she admitted that she could not be sure if the hearing in her right ear had ever been normal. A permeal tympanotomy was performed under GA. The ossicular chain was found to be intact and mobile. However, the appearance of the promontory was noted to be unusual. The facial nerve was seen to be dehiscent and passing **both above and below** the stapes (intra-operative photograph). This was confirmed by the use of the nerve stimulator. The operation was abandoned and the patient was subsequently informed of the findings.

Result: Post-operative recovery was uncomplicated. Post-operative audiometry showed no change in hearing. Preoperative imaging had not been requested as the diagnosis had not been suspected. However, review of the patient's records showed that the patient has had a previous CT scan of the sinuses. On close review of these images, an anomalous course of the facial nerve could be seen (CT images).

Conclusion: A facial nerve bifurcating and encircling the stapes is extremely rare and would never have been suspected as the cause of conductive hearing loss. Very few reports of such an anomaly appear in the literature.

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ID: IP181

Tinnitus due to pulmonary disease

Presenting Author: **Michalina Rusiecka**

Michalina Rusiecka, Maria Martel Martin
Hospital de Sant Joan Despi Moisès Broggi

Learning Objectives: Present a case of atypical presentation of middle ear tuberculosis.

Introduction: A 47 yo woman, with no medical history, presents to A&E with a tinnitus and blocked left ear for 2 weeks.

On physical examination there is inflammation and whitish exudate on the back wall of the pharynx. Left ear has opaque eardrum with hyperemic annulus.

Nasal endoscopy shows inflamed adenoids with abundant exudate and PTA conductive hearing loss in the left ear. Tympanometry is type B curve in the left ear.

Evolution: The patient is given deflazacort, cefuroxime and nasal irrigation but 2 weeks later she reports no improvement.

CT scan is ordered to rule out neoplasm. It shows hyperplasia in the left side of nasopharynx that doesn't capture contrast. Left middle ear cleft is opacified with no signs of osteolysis. The neck scan reveals irregular consolidation in the right upper lobe so a thorax CT is performed. It shows scarring, tree-in-bud pattern in right lung, all suggestive of tuberculosis.

PPD test is positive and so are acid-fast staining and culture of the sputum. The patient is diagnosed with pulmonary tuberculosis and 4-drug regimen is initiated (ethambutol, isoniazid, pyrazinamide, rifampin). A month later (so she is no longer contagious) the patient has an adenoidal biopsy and left myringotomy. There is no effusion in the middle ear. The microbiology (swabs) confirms adenoidal and middle ear tuberculosis.

The patient's otic symptoms resolves but 6 months later she reports tinnitus and blocked left ear. Otoscopy is normal but PTA shows small conductive hearing loss. Wait and see attitude is proposed and the patient agrees. 5 months later the patient is free from pulmonary tuberculosis but her left ear remains blocked. Myringotomy reveals very thick transparent fluid and a grommet is inserted. The microbiology is negative for tuberculosis. The patient's symptoms get better.

If the problem recurs once the grommet falls out should we think about scarring of the Eustachian tube? Would a balloon dilatation of the tube be feasible?

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ID: IP182

A Case Report of Keratosis obturans - often misdiagnosed

Presenting Author: **Chinnala Sai Chaitanya**

Chinnala Sai Chaitanya
DY Patil University

Learning Objectives:

A Case Report of Keratosis obturans - often misdiagnosed

Introduction: A case report of Keratosis Obturans in a 32 year female patient. The condition is often misdiagnosed and requires careful history taking and clinical examination to diagnose and rule out the disease. It should be differentiated from external auditory canal cholesteatoma, presence of osteonecrosis and focal overlying epithelial loss are the most reliable features favouring the diagnosis of external ear canal cholesteatoma over keratosis obturans

Materials and Methods: All the necessary investigations viz. routine Blood investigations, serological profile, imaging studies i.e HRCT Temporal bone both sides along with orthopantogram to rule out (TM)Temporo-mandibular joint involvement was done, Pure tone Audiometry was done which showed moderate to severe conductive hearing loss on the affected side.

Patient was planned for surgery under GA.

Result: While operating large keratotic mass was seen extending superiorly into tegmen, posteriorly into mastoid extending upto tip cells, anteriorly involving TM joint, the entire keratotic mass was removed and bone was drilled, wide canal meatoplasty was done, excised mass was sent for HPR and was confirmed as keratosis obturans, post operative CT scans were done to recheck.

Conclusion: Keratosis obturans is a rare disease and often misdiagnosed, proper diagnosis with help of imaging modalities is essential to plan for surgery and eradicate disease.

Trauma and anatomical deformity of TM joint and EAC might be a precipitating factor.

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ID: IP183

A Case of Extensive Cholesteatoma with Bezold's Abscess

Presenting Author: **Chinnala Sai Chaitanya**

Chinnala Sai Chaitanya
DY Patil University

Learning Objectives: A rare case of Extensive cholesteatoma with Bezold's abscess.

Introduction: A case of 19 year female patient with complains of continuous foul smelling discharge and swelling behind ear in mastoid region extending to upper neck region came to our OPD. On examination it was diagnosed as attico antral type of COM with Bezold's abscess diagnosis confirmed by CT imaging.

Materials and Methods: All the necessary investigations viz. Routine Blood investigations, serological profile, imaging

studies i.e HRCT Face including Temporal bone and neck, Pure tone Audiometry was done which showed severe conductive hearing loss on the affected side. Patient was planned for I and D of abscess further planned for Radical mastoidectomy under GA.

Result: Following I & D we saw large amounts pus draining from abscess and erosion of cortical bone with huge extensive cholesteatoma debris, hence planned for mastoidectomy extending the incision further planned for radical mastoidectomy, we saw huge extensive cholesteatoma filled in mastoid cavity with multiple fistulae was noted, steps of radical mastoidectomy followed, adequate post op care was taken.

Conclusion: Cholesteatoma has been known to be associated with multiple complications either extracranially or intracranially. Among the extracranial complications, mastoiditis and mastoid abscess are the most common. Bezold's abscess formation with cholesteatoma is a rare occurrence but when present can lead to sinister sequelae if not properly managed. The treatment of cholesteatoma is mainly by surgical exploration namely mastoidectomy. The aim of treatment is to eradicate the diseased mastoid and to prevent subsequent complications. Beside surgical intervention, the patient will also require intensive systemic and topical antibiotic therapy. With proper treatment patient will be rescued from experiencing further life-threatening complications.

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ID: IP184

Use of a thinly sliced cartilage technique in a canal wall up procedures

Presenting Author: **Kazuya Saito**

Kazuya Saito, Michio Isono, Takaaki Kobayashi,
Toshizou Koizumi, Katumi Doi
Kindai University

Learning Objectives: We have performed canal-wall-down tympanoplasty reconstruction with soft posterior meatal wall for cholesteatoma as a single-stage operation from 1998 to 2009. Although this method designed to prevent a cholesteatoma recurrence, posterior meatal wall often retracts like balloon similar to that of conventional open method operation and it has sometimes caused cavity problems, in long-term follow-up.

As you know, in approximately 80% of an anterior attic bony plate of pars flaccida is closed in cholesteatoma cases. As results ventilation routes from Eustachian tube to epitympanum and mastoid antrum are hard to be formed by the single staged operation.

Therefore, after 2010, we decided to perform thinly sliced cartilage technique in a canal-wall-up procedure with planned staged tympanoplasty in many cases.

Cartilage is used as perichondrium-cartilage island flap, and it includes treatment and prevention of attic retraction, reconstruction of scutum and reconstruction of tympanic membrane. This cartilage is the size enough to reconstruct scutum and an eardrum by one. The island flap is simple to use more than a way using both of a cartilage and a

fascia. Because it's possible to reconstruct superior and posterior wall of EAM by one operative procedure.

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ID: IP185

An analysis of Staging-based Surgical Results in primary acquired cholesteatoma

Presenting Author: **Masaharu Sakagami**

Masaharu Sakagami, Kazuhiko Nario, Akinori Yamashita, Tadashi Nishimura, Toshiaki Yamanaka, Tadashi Kitahara
Nara Medical University

Learning Objectives: JOS staging system is efficient for understanding the pathogenesis of cholesteatoma. In general, regular follow-up is required for at least 10 years post-operatively to identify the formation of cholesteatoma recurrence.

Introduction: Japan Otological Society (JOS) proposed the original staging system for the intra-operative extension of cholesteatoma around the tympano-mastoid cavity at this meeting. In the present study, first we defined the types of cholesteatoma as follows: pars flaccida, pars tensa, congenital and secondary. Using JOS staging system, then we reviewed our cases with primary acquired cholesteatoma recently experienced in Nara Medical University Hospital.

Patients and methods: A prospective study of patients with primary acquired cholesteatoma was conducted from January 2011 to September 2014. One hundred and two cases were enrolled and followed-up for a median period of 30 months (range: 12–67 months). We examined the relationship between extension of cholesteatoma according to JOS staging system and surgical results of hearing outcomes and recurrence rates.

Results and conclusion: Hearing improvement in all the subjects with pars flaccida cholesteatoma was 60.6 % (n = 71) and that with pars tensa 44.4% (n = 9). Two cases of recurrence were seen in pars flaccida and also two in unclassifiable cases (range: 18–42 months).

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ID: IP186

Effect of Speaking Rate on Recognition of Natural fast Speech by Cochlear Implant Users

Presenting Author: **Kei Sakamoto**

Kei Sakamoto¹, Chie Obuchi², Han Matsuda¹, Ryuichiro Araki³, Masae Shiroma², Tetsuo Ikezono¹

¹Saitama Medical University Hospital,

²International University of Health and

Welfare, ³Saitama Medical University

Learning Objectives:

Objective: The advanced technology in cochlear implantation has contributed on improving hearing performance in profound hearing loss patients. However, most CI users (CIs) have difficulties in understanding fast speech. It is thought that the difficulties may be associated to either temporal and/or spectral resolution for CI users (CIs), but uncertainty still remains. In this study, we investigated the differences in sentence recognition between natural fast speech for CIs and normal hearing subjects (NHs). In addition, whether context affects the performance at various speed of speech.

Methods: Our subjects comprised 14 CI subjects and 6 age-matched NHs served as control. As for the experimental stimuli, sentence test materials were natural fast speech to ration of normal (350–400 characters /1minute) and two fast speaking rate (525–600 characters /1minute, 700–800 characters /1minute) with two different types of speech materials, contextual and non-contextual. Furthermore determined the relation with the individual factors such as temporal resolution, syllable intelligibility, age and so on. Natural fast speech was produced by one female talker.

Results and Discussion: Results showed that contextual and non-contextual speech perception scores for both CIs and NHs were declined in accordance with speech rate increased, and this tendency was more significant in CIs than those for the NHs. The differences in sentence recognition between CI individuals were not significant. We have not identified significant correlation between temporal resolution, syllable intelligibility and age.

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ID: IP187

Two cases of malleus ankylosis

Presenting Author: **Naoko Sakuma**

Naoko Sakuma¹, Masahiro Takahashi², Maki Inoue³, Takae Yamamoto³, Yasuhiro Arai², Takahide Taguchi¹, Nobuhiko Oridate²

¹Yokohama City Minato Red Cross Hospital,

²Yokohama City University School of Medicine,

³Kanagawa Children's Medical Center

Learning Objectives: We reveal the appropriate surgical approach for a malleus ankylosis.

Introduction: The malleus ankylosis is known as a cause of congenital hearing loss. The limitation of the motion of malleus is due to the attachment of the head of malleus to the wall of epitympanum. In this reported, we presented two cases of malleus ankylosis who underwent the tympanoplasty.

Case1: The case was 18-year-old male. He noticed left hearing loss at the age of 4. He had been referred to our department for hearing examinations at the age of

8. Audiometry showed left conductive hearing loss. CT showed the fusion of the head of malleus and the wall of epitympanum in left side. He underwent left type I tympanoplasty, and got an effective hearing level. However, after 6 months, the hearing level in the left ear was the same as pre-operative one. The recurrence of fixation of the malleus head was suspected.

Case2: The case was 9-year-old girl. She had recurrent otitis media at the age of 3. Though her otitis media was improved, she had still left conductive hearing loss. Thus, she had been referred to our department at the age of 6. CT showed the fusion of the head of malleus and the wall of epitympanum in left side. She underwent left type IIIc tympanoplasty, and got an effective hearing level.

Conclusion: It was suggested that type IIIc tympanoplasty is more appropriate approach for a malleus ankylosis than type I tympanoplasty.

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ID: IP188

The improvement of the bone hearing thresholds after removing cholesteatoma from the round window: our experience Salii O. V. 1, Verchovtseva L. I. 1, Tarasevich T. N. 2

Presenting Author: **Olga Salii**

Olga Salii¹, Tatyana Tarasevich²
¹Regional Clinical Hospital №1, Yekaterinburg, ²Institute of Immunology and Physiology, Ural Branch of the Russian Academy of Sciences, Yekaterinburg

Learning Objectives:

Background: 30% of all patients treated in our ENT-department are patients with the pathology of middle ear. Out of all our patients with chronic otitis media 54% have cholesteatoma. Hearing function recovering is considered as impotent as complete cholesteatoma removing.

In some cases of cholesteatoma it was observed that after surgery there is an improvement not only of sound conduction but also of sound perception.

Objective: The investigation of possible reasons of sound perception improvement of patients after removing cholesteatoma with tympanoplasty.

Materials and methods: An assessment of 256 patients hearing results was carried out retrospectively. The patients underwent surgery on account of chronic otitis media with cholesteatoma from 2009 to 2015. Hearing assessment was analyzed by data mean value for 4 frequencies: 500 ;Hz, 1000 ;Hz, 2000 ;Hz, 4000 ;Hz before surgery and 3 and 6 months after surgery. Moreover, air-bone interval, air-conductive thresholds and bone-conductive thresholds were assessed before and after surgery, and the absolute increase of air conduction was measured after surgery.

Carefully recoded surgery protocols were analyzed.

Results and discussion: According to the analysis of data it was found that an improvement of hearing thresholds mean value occurs not only for air conduction but also for bone conduction in 32 % of the cases. All patients were divided in 2 groups: with increasing bone conduction and without increasing bone conduction. Several points in these groups were analyzed.

According to the analysis of surgeries' protocols, in 87% of cases there was sound perception improvement of those patients who had cholesteatoma localized in the round window area and had it completely removed during surgery.

Conclusions: Removing cholesteatoma from the round window region promotes sound perception improvement due to the free movement of the round window membrane that, in its turn, improves the movement of perilymph.

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ID: IP189

Sigmoid sinus thrombosis and facial paralysis associated to mastoiditis: A case report

Presenting Author: **Oana Alexandra Sandu**

Oana Alexandra Sandu¹, Codrut Saraforanu²
¹"Carol Davila" University of Medicine and Pharmacy, ²"Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania, ²ENT&HNS Department, "Sfanta Maria" Hospital, Bucharest, Romania

Learning Objectives: Initial surgical approach (antromastoidectomy) was not appropriate for this case. Right mastoidectomy, broad-spectrum antibiotics and anticoagulants has been the treatment of choice.

Introduction: Otogenic sigmoid sinus thrombosis is a rare complication of mastoiditis. This paper aims to offer clinical manifestation and management of sigmoid sinus thrombosis and facial palsy secondary to mastoiditis.

Methods: A 72-year-old patient known with right antromastoidectomy in other ENT Clinic, was referred to our ENT Department with right-sided otalgia, headache and with right facial paralysis (loss of forehead wrinkles and inability to frown, inability to close the right eye, the corner of the mouth pulls down). Computed tomography with contrast administration indicated parafloide accumulations at right mastoid cells and thrombophlebitis modifications in sigmoid right sinus.

Results: This case demonstrates rare but serious sequel of mastoiditis: sigmoid sinus thrombosis and right facial paralysis. Middle ear secretion culture was positive with growth of *Pseudomonas aeruginosa*. In this case, a right mastoidectomy was associated with large spectrum antibiotics prolonged for 3 months. The anticoagulant therapy was established also.

Conclusions: The particularity of this case lies in that neurological symptoms had a slow recovery and also the difficulty

of eradicating infection with *Pseudomonas aeruginosa*. The patient will be re-evaluated periodically and also it requires long term follow-up using IRM examination.

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ID: IP190

Hearing Results of Type III Tympanoplasty

Presenting Author: **Shin-ichi Sato**

Shin-ichi Sato, Takashi Fujiwara, Hisanobu Tamaki, Atsuhiko Yoshida, Takuya Miyazaki, Shinji Kaba, Keisuke Kojima, Yasuharu Haku
Kurashiki Central Hospital

Learning Objectives: to analyze the prognostic factors in type III tympanoplasty.

Hearing Results of Type III Tympanoplasty.

Objective: We report the hearing results of type III tympanoplasty to analyze the prognostic factors in type III tympanoplasty.

Methods: Patients who had been performed type III tympanoplasty in our department between October 2004 and February 2015 were retrospectively analyzed. Almost patients underwent tympanoplasty with postauricular incision and canal wall up procedure.

Results: 317 patients underwent type III tympanoplasty in our department. The mean age was 47 years (range, 3 to 82 years). 87.4% of patients had an air-bone gap (ABG) of less than 20 dB. The average postoperative ABG is 12.8 dB. Hearing results were successful in 93.4% based on criteria proposed by the Otological Society of Japan. The hearing results of canal wall up Type III tympanoplasty were significantly more favorable than canal wall down. On comparison of columella, ceramic bone showed significantly poorer than autograft.

Conclusion: Canal wall up Type III tympanoplasty yields relatively good hearing results.

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ID: IP191

Cochlear Implantation in Chronic Otitis Media

Presenting Author: **Clark Bartlett**

David Schramm¹, Clark Bartlett², Nader Aldajani²
¹University of Ottawa, ²Department of Otolaryngology - Head and Neck Surgery, University of Ottawa

Learning Objectives: 1. Understand the necessity of initial management of chronic otitis media prior to cochlear implantation 2. Be aware of the advantages and limitations of

simultaneous and staged surgical management of chronic otitis media and cochlear implantation 3. Appreciate the necessity of long-term follow-up of patients with chronic otitis media undergoing cochlear implantation.

Introduction: Cochlear implantation in patients with a history of chronic otitis media may present substantial surgical challenges. The purpose of this study was to review the management and surgical outcomes of adults at the University of Ottawa Auditory Implant Program undergoing cochlear implantation who have a history of chronic otitis media.

Methods: A retrospective chart review of adults undergoing cochlear implantation since 1992 was performed to identify those patients who had required surgical management of chronic otitis media with or without cholesteatoma prior to implantation. Medical records were reviewed to identify surgical procedures required for chronic otitis media management and ascertain long term outcomes after cochlear implantation.

Results: Seven patients (3 male, 4 female) were identified who required surgical management of chronic otitis media prior to cochlear implantation. The mean age at cochlear implantation was 66.4 years (39–80). Five patients required an intact wall mastoidectomy for management of chronic otitis media. Of these, two underwent a tympanoplasty for management of a tympanic membrane perforation and two required placement of a ventilation tube for chronic middle ear effusion. Two patients required mastoid obliteration and blind sac closure of the external auditory canal (subtotal petrosectomy). Cochlear implantation was performed approximately 6 months later. The mean length of follow-up is 3.7 years (11 months – 7 years). All patients derived substantial benefit from their cochlear implant without long-term complications.

Conclusions: All patients successfully first underwent surgery for chronic otitis media and subsequent cochlear implantation approximately 6 months later without long-term complications. Although simultaneous surgical management of chronic otitis media and cochlear implantation may be considered in selected cases, staged surgical management is a consistently effective option for this difficult condition.

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ID: IP192

Narrow Facial Recess

Presenting Author: **Emel Tahir**

Levent Sennaroglu¹, Emel Tahir²
¹Hacettepe University School of Medicine,
²Ankara Dışkapı Yıldırım Beyazıt Research and Training Hospital Otolaryngology Department

Learning Objectives: To make otologic surgeons must be familiar with facial recess anatomy on temporal bone CT images. To interpret radiological abnormalities preoperatively to minimize complications during CI surgery. To estimate the width of the facial recess by measuring the distance between the external auditory canal and vertical segment of the facial nerve. To discuss alternative approaches to CI in case of narrow facial recess.

Introduction: Cochlear implantation (CI) is typically performed through a mastoidectomy and posterior tympanotomy approach. Successful implantation via this approach depends upon accurate identification of the round window niche (RWN), which can be difficult in patients with limited RWN visibility.

The facial recess (FR) is defined as the mastoid air cells between the chorda tympani nerve and the vertical segment of the facial nerve (FN). If the space between the external auditory canal (EAC) and the FN is more than 2–3 mm, the width of the facial recess can be considered as normal. We present a case with a narrow FR diagnosed on preoperative CT and provide a description of the surgical technique used for CI.

Case Presentation: A 50-year-old female with bilateral profound sensorineural hearing loss (SNHL) presented for CI evaluation. CT demonstrated the space between the vertical segment of the FN and EAC in her right ear to be normal whereas in the left ear the space was narrow; the vertical segment of the FN was positioned nearly beneath the EAC. Therefore, the bony part of the EAC (approximately 0.5 cm in diameter) adjacent to the FN was removed while preserving the integrity of the overlying skin. This permitted greater access to the middle ear. The electrode array was placed via RW approach uneventfully through this technique. The defect in the EAC was reconstructed with a cartilage graft obtained from the concha and the EAC skin was returned to its original position.

Conclusion: When HRCT images indicate limited RWN visibility, surgeons must be prepared to use alternative procedures rather than the posterior tympanotomy approach alone. Removal of a part the posterior EAC wall can increase RWN exposure instead of further enlargement of the FR. The borders and width of the FR can be estimated by measuring the distance between the EAC and vertical segment of the FN. The optimal surgical method can be chosen intraoperatively by an experienced CI surgeon.

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ID: IP193

Congenital cholesteatoma of the mastoid: case report and literature review

Presenting Author: **Elnaz Sepehri**

Elnaz Sepehri, Magnus von Unge

Västerås hospital, sweden

Learning Objectives: Congenital cholesteatoma located in the posterior portion of the mastoid is very slowly growing and some may be treated conservatively.

Introduction: Congenital cholesteatoma of the temporal bone is a relatively rare disease. Most of them occur in the middle ear causing hearing impairment and thereby early detection. Congenital mastoidal cholesteatoma, on the other hand, prevalent in the posterior portion of the mastoid, causes no or few, mostly non-specific symptoms and therefore the diagnosis is delayed. In all previously reported cases eradicating surgery was performed.

We present the so far oldest case of congenital mastoidal cholesteatoma, a 87- year old woman. The process was found incidentally on radiology when admitted for dizziness.

The symptoms, radiological and intraoperative findings, and treatment is discussed in the light of previously reported cases.

Methods: We assessed the patient's medical history retrospectively. A conservative approach was applied with clinical follow-ups and radiology to evaluate any progress or new symptoms correlated to the cholesteatoma.

The Pub Med database was used to search for previously reported cases of congenital mastoidal cholesteatoma.

Results: There was no aural history and the tympanic membrane as well as audiometry were normal at admission. The initial high resolution CT and MRI with cholesteatoma protocol were conclusive. Large bone destructions were present. A one year follow-up with watchful waiting including aural examination and radiology will be presented. Previously, around 30 cases were reported, all being operated at ages ranging between 7 and 77.

Conclusions: This case shows the very slow progress of congenital mastoidal cholesteatoma as it had obviously prevailed during her 87 years of life. The case raises the question should congenital mastoidal cholesteatomas not be treated surgically but instead be handled conservatively, with watchful waiting, in the absence of disabling symptoms?

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ID: IP194

Quality of Life After Mastoid Cavity Obliteration: The Blackburn Experience

Presenting Author: **Arpana Shekhar**

Arpana Shekhar, Surya Narayan

Royal Blackburn Hospital

Learning Objectives:

1. Use of cartilage in MCO and PCR.
2. Effect on QOL of patients after using cartilage for MCO/PCR.

Introduction: Otolologists have tried indigenous alterations in mastoidectomy technique to improve outcomes of chronically discharging ear(CDE). Currently, the surgical management of CDE entails modified radical mastoidectomy(MRM). However it leaves cavity open & prone for discharge along with problems such as wax formation & giddiness.Literature review suggests that mastoid cavity obliteration(MCO)/posterior wall reconstruction(PWR) has low complication rates. Various materials such as cartilage,bone cement & soft tissue are commonly used.

Objective: Pts with MCO require less cavity care and thus decreased dr dependence. Our study was aimed at finding

pt satisfaction and QOL after MCO using cartilage. It was also directed to find out post-op dry ear, wax problems, dizziness & recurrence.

Methods: In our cohort study, 29pts with CDE underwent revision mastoidectomy with MCO/PCR during Jul'11-Jun'15. They were followed at 6wks, 4, 6 & 12mths post-op. Symptoms were noted in pt files during followup visits & collated on excel chart. QOL was assessed using Glasgow Benefit Inventory Score. Response was obtained by posting proformas to pts. Ethical approval was obtained from trust R&D.

Results: The procedure was successful in improving QOL in majority. 26/29 pts reported dry ears. 2 pts continued to have discharge & 1 underwent repeat surgery. Frequency of clinic visits has reduced significantly. >90%pts reported significant improvement in QOL & less visits to GP surgery.

Conclusion: The outcome and QOL improvement after MRM/PCR using cartilage is satisfactory. Frequently encountered problems of chronically discharging ear, wax and dizziness are reduced.

Keywords: Chronic otitis media, mastoid cavity obliteration, cartilage graft, QOL, Glasgow Benefit Inventory Score.

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ID: IP195

Delayed presentation of a giant congenital cholesteatoma with cerebrospinal fluid fistula

Presenting Author: **Sherif Habashi**

Noshin Siddiqi¹, Sherif Habashi¹, Michael Gleeson²

¹Royal Free London NHS Foundation Trust,

²National Hospital for Neurology and Neurosurgery, UCLH

Learning Objectives: Cholesteatoma can exist for many years with little or no symptoms before presentation with life-threatening complications. Patients with persisting ear discharge should undergo CT scanning of the temporal bones.

Introduction: Cholesteatoma is usually acquired. Congenital cholesteatoma is rare and occurs at three important sites: the middle ear, the Petrous apex, and CPA. For the diagnosis to be made the following three conditions should normally apply: there should be a mass medial to the tympanic membrane; the tympanic membrane should be normal and intact and there should be no previous history of ear discharge, perforation or ear surgery. Presentation of congenital middle ear cholesteatoma is normally as a conductive hearing loss in childhood. Petrous apex and cerebellopontine cholesteatomas may present with CPA symptoms or be picked up as incidental radiological finding in early adult life.

Method: A 54 year old man presented with a short history of hearing loss and ear discharge. He was treated for otitis externa and wax. Microsuction was performed several times

before a CT scan of the temporal bones was requested which showed a massive erosive lesion consistent with a giant cholesteatoma (images). As he was leaving the consultation he asked for further micro suction. This provoked a profuse CSF leak. Urgent tertiary referral was made and the patient underwent craniotomy and petrosectomy (operative photographs).

Results: The patient recovered well with no cranial nerve deficits or other complications and is managing well a CROS hearing aid. Four years on he remains well with no sign of recurrence on two diffusion weighted MRI scans (images). He remains under lifelong surveillance.

Conclusion: Congenital cholesteatoma can remain silent for many years presenting late in life as a giant cholesteatoma with bony erosion and extension into the cranial cavity. CT and diffusion weighted MRI imaging can help in diagnosis and pre-operative planning.

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ID: IP196

External ear canal cholesteatoma: Two in a day!

Presenting Author: **Sherif Habashi**

Noshin Siddiqi, Sherif Habashi

Royal Free London NHS Foundation Trust

Learning Objectives: External Ear Canal Cholesteatoma, even when very extensive, can be successfully treated with excellent hearing outcomes.

Introduction: The aetiology of external ear canal cholesteatoma (EECC) may be traumatic, iatrogenic or spontaneous. It is a rare entity with an estimated incidence of around 1 in 1000 patients requiring otologic surgery. Remarkably, we present two cases operated on same the day by the senior author!

Methods: 2 cases are presented including pre-operative imaging. An 80 year old female who presented with a 3 month history of left-side hearing loss. Microsuction for "hard wax" was performed several times before CT scan was requested. A 61 year old female with a short history of left-sided hearing loss and pain. Hard "wax" was removed by microsuction several times. The tympanic membrane was seen to be normal and she was discharged before representing with the same symptoms. Eventually a CT scan was requested. Both patients underwent modified radical mastoidectomy. In the first case the cholesteatoma sac was seen to be originating from the anteroinferior wall of the ear canal and extending into the mastoid. The tympanic membrane was intact and middle ear uninvolved. The second patient was found to have cholesteatoma arising from the postero-inferior wall of the ear canal with extension into the mastoid and petrous bones. Middle fossa dura was widely exposed by the disease. The lateral SCC was dehiscent. The tympanic membrane was normal and the middle ear uninvolved.

Results: Post-operatively, both patients recovered well with no complications and audiometry showed no conductive hearing loss and no worsening of bone conduction. Both patients remain under long-term follow-up.

Conclusion: EECC can present with minimal clinical findings and hearing loss but can be very extensive which could lead to serious complications if left undetected for a long time. CT scanning is extremely helpful in assessing the extent of the disease and for assisting in pre-operative planning.

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ID: IP197

Role of mastoid pneumatisation in paediatric cholesteatoma

Presenting Author: **Gautam Singh**

Gautam Singh

Lady Hardinge Medical College & Associated Hospitals, New Delhi

Learning Objectives: Study evaluates the factor of mastoid pneumatisation w.r.t paediatric cholesteatoma in accordance with "Evidence based medicine". Pneumatisation of mastoid in children was found to be associated with extensive and recurrent cholesteatoma in our study.

Objectives: To study the correlation between mastoid pneumatisation and cholesteatoma in paediatric patients.

Materials & Methods: In a retrospective study design, the medical records of all the paediatric patients which underwent mastoid surgery for chronic suppurative otitis media-cholesteatoma disease were examined in the specific time period of: Jan 2010 to Jan 2016. The surgical pathology was correlated with the CT scan of the mastoid. Further, recurrence of cholesteatoma was also studied. Data was tabulated and statistically analysed.

Results: A total of 56 paediatric patients were evaluated, out of which 6 had sclerotic mastoid, 17 had diploic mastoid and 33 had pneumatic mastoid. Statistical evaluation of this data was found to be significant thereby implying that cholesteatoma development is more in pneumatic mastoid. Further sinus tympani and facial recess involvement was also significantly more in a pneumatised mastoid. Evaluation of our records further revealed that recurrence of paediatric cholesteatoma is also more in pneumatic mastoid.

Conclusions: It is thus hypothesised that a well pneumatised mastoid may lead to cholesteatoma. In addition, cholesteatoma is more extensive and might recur in a pneumatised mastoid in children.

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ID: IP198

Role of "Paediatric Tympanoplasty" in modern otology

Presenting Author: **Gautam Singh**

Gautam Singh

Lady Hardinge Medical College & Associated Hospitals, New Delhi

Learning Objectives: Paediatric tympanoplasty is a controversial subject with no consensus among otologists regarding the minimum age for the surgery. Moreover the subject does not find mention in standard text. There is a general tendency across the world to delay the said surgery on account of various factors like: eustachian tube maturity, size and site of perforation & age etc. I would be examining the concept of "Paediatric Tympanoplasty" in accordance with evidence based medicine: two prospective studies carried out at LHMC & Associated Hospitals, New Delhi. Our results indicate that the graft uptake in children is equal to adults and addresses the issue of deafness in children.

Objective: To evaluate the success rate of tympanoplasty type I in a select pediatric age group of 5 to 8 years, and thereby analyse the factors suggested to influence the outcome of the said surgery.

Study Design: A prospective study with control. 60 patients of chronic suppurative otitis media-inactive mucosal disease of either sex were divided into two groups of 30 each; Group A [paediatrics, 5–8years] and Group B [adults, >14 years]. All the patients underwent tympanoplasty type I by underlay technique using temporalis fascia graft. Pre-operative tympanometric volume was recorded in all the cases and analysed with the graft uptake results post-operatively. The data pertaining to surgical and audiological success was tabulated and statistically analysed.

Results: We recorded an impressive surgical success rate of 87% in Group A compared to a 90% success rate for group B. Also, an audiological success of 69% and 78% was recorded in the pediatric and adult group, respectively. Statistical analysis of the data revealed that age, status of the contralateral ear (taken as a measure of function of the Eustachian tube) and size of the perforation are not significant factors which might influence the outcome of paediatric tympanoplasty, but the site of the perforation was found to be a significant factor for the said surgery with anterior perforations recording a poor success rate. On the basis of mean tympanometric volume of 1.6cm³ the patients were divided into two groups: in Group A (tympanometric volume <1.6cm³), and group B (tympanometric volume >1.6cm³). A graft uptake of 95% and 77% was recorded in Group A & B

respectively. However, the statistical evaluation of the data revealed no significant effect of this factor.

Conclusions: Tympanoplasty type I with underlay grafting using temporalis fascia in children aged between 5 to 8 years, gives good anatomical and functional results.

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ID: IP199

Tympanic impedance measurement with standardised nasopharyngeal air pressures – a new test of Eustachian tube function

Presenting Author: **Matthew E. Smith**

Matthew E. Smith, James R. Tysome
Cambridge University Hospitals NHS
Foundation Trust

Learning Objectives: To understand a novel method of measuring ET dysfunction.

Introduction: Eustachian tube (ET) dysfunction is a common and varied condition with significant associated morbidity. In most cases it is caused by a failure of the ET to adequately open, however there is currently no reliable method of assessing this opening. Tubomanometry is a test that has recently shown good inter-individual repeatability as a measure of ET opening and function, by measuring middle ear pressure after the application of regulated nasopharyngeal pressures during swallowing. We present the first reports of a novel test: middle ear impedance measurements during standardised nasopharyngeal positive pressure bursts (tuboimpedance). We assess repeatability in healthy ears, and whether this new assessment provides any advantages over tubomanometry.

Methods: Ethical approval was obtained. Tubomanometry and tuboimpedance assessments were performed in 20 screened, healthy ears (10 volunteers). Each ear underwent tests while the patient swallowed a water bolus during applied nasopharyngeal pressures of 20, 30, 40 and 50mbar. Immediate and delayed repeats were performed at each pressure.

Results: ET opening was detected more frequently with the tuboimpedance method, with a 100% detection rate using a nasopharyngeal pressure of 30mbar or more. ET opening at 20mbar was detected more frequently with tuboimpedance. Repeatability of both tests, as measured by Intraclass Correlation Coefficient, was very good for both immediate and delayed repeats. Repeatability for the tubomanometry R value was mixed.

Conclusions: Tuboimpedance may provide a repeatable measure of ET opening that is easier to perform, due to lower required nasopharyngeal pressures and fewer issues with poor ear-probe sealing. Further assessment in patients with different forms of ET dysfunction is required.

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ID: IP200

Petrous bone cholesteatoma: our recent experience

Presenting Author: **Tommaso Sorrentino**

Tommaso Sorrentino, Nader Nassif, Francesco Mancini,
Luca Oscar Redaelli DeZinis
Spedali Civili Brescia

Learning Objectives:

Introduction: Petrous bone cholesteatoma is a rare condition affecting the temporal bone. It can be congenital or an evolution of a middle ear cholesteatoma. Usually at clinical presentation it involves labyrinth, facial nerve or vascular structures. We presented 7 cases of petrous bone cholesteatoma treated in our department in the last 4 years.

Methods: We retrospectively review 7 cases of temporal bone cholesteatoma recently treated in our department.

Results: Three patients presented a previous history of middle ear surgery neglected and they presented at the consultation for pain in ear region. Two had already total hearing loss on that side. In the other 4 cases the cholesteatoma was congenital and the diagnosis was made by magnetic resonance for facial palsy in three cases and paralysis of the VI nerve in one case. The surgical approach was transcochlear in 2 cases, translabyrinthine in 4 cases and 1 patient was treated by supralabyrinthine approach. Facial nerve was interrupted in one case and an end to end anastomosis was performed. We were able to preserve hearing in only 1 case. Facial nerve function improve but normalized only in 1 case.

Conclusions: Facial nerve function is the challenging problem in case of petrous bone cholesteatoma. Hearing can be preserved only in case of supralabyrinthine extension.

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ID: IP201

Summarising cholesteatoma surgery and A new method of closing the mastoid cavity

Presenting Author: **Pankaj Srivastava**

Pankaj Srivastava¹, Rohit Mehrotra²
¹Pankaj ENT hospital, ²mehrotra ENT hospital

Learning Objectives:

Anatomically there are two separate layers in ear, first middle ear cleft comprising mastoid air cells, antrum, aditus, middle ear and Eustachian tube all lined by contiguous mucosa which secretes mucus and is drained finally to

Nasopharynx. Second being Canal skin and Tympanic membrane epithelium which exfoliates epithelium and is exteriorised. After surgery if this natural cavities loose their anatomy, operated cavity will no longer be dry or healthy in long term.

After complete canal down mastoidectomy two types of mastoid cavities can be found - First -completely sclerosed – means there remains no visible mastoid cells at the floor-here a large and thin fascia is lined to cover all the cavity and it epithelises and Second - cellular cavity (it is always not possible to exenterate all the air cells or at least impractical) – in which after complete Mastoidectomy, there still remain some cells at the floor. If this cavity is lined by fascia or cavity filling is done, the remaining air cells will keep on secreting mucus and granulate and the cavity will no longer be dry. A new method of solving this problem is - Conchal cartilage which is harvested at the time of meatoplasty is thinned out and laid down in cavity with convexity upwards so that it creates a small cavity communicating to aditus and then to middle ear and large fascia is lined over it.

Out of 102 canal down mastoidectomies we found primary healed cavity in 64 which never had cavity problem, 33 cavities were showing minor granulations and were cured with Trichloroacetic acid,steroid packing or drops.3 came to be tubercular and 3 never became dry in 15 months follow up.

The benefit of this procedure is that the cartilage needed is already harvested by meatoplasty, time saving as no cartilage fixation is needed to create a separate wall, time saving, reduces the size of cavity, primary healing occurs as full cavity is lined by fascia and no raw bone is exposed.

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ID: IP202

Vestibular schwannoma growth after stereotactic radiosurgery

Presenting Author: **Emma Stapleton**

Emma Stapleton¹, John Crowther², Georgios Kontorinis²

¹Scottish Cochlear Implant Centre, ²Institute of Neurosciences, Queen Elizabeth University Hospital, Glasgow

Learning Objectives: 1) To clarify the natural history of vestibular schwannoma and outline treatment options 2) To present two cases of abnormal vestibular schwannoma growth following STRS 3) To discuss potential reasons for tumour growth after STRS 4) To confirm the need for life-long radiological and clinical surveillance following STRS.

Introduction: Vestibular schwannomas, are benign tumours of Schwann cell origin that occur on the eighth cranial nerve. Commonly presenting symptoms include hearing loss, tinnitus and balance disturbance. Tumour progression can lead to brainstem compression, cranial neuropathies and hydrocephalus. Smaller, slow-growing tumours can be safely observed, but larger tumours necessitate treatment in the form of either surgery or STRS. The literature states that tumours up to 3 cm in diameter can be successfully controlled in the majority of patients with STRS, and a recent Cochrane review concludes that the treatment method for large vestibular schwannomas should be chosen on an

individual basis, taking into consideration the patient's preferences, clinician experience and the availability of radiotherapeutic equipment.

Methods: We present two cases of vestibular schwannoma which were treated with STRS, and decreased in size during the two years following treatment, following which they began to exhibit further growth.

Discussion: Pseudoprogression of vestibular schwannomas for up to two years following STRS is a well-documented phenomenon, following which the oedematous tumour regresses in response to the STRS.

Potential reasons for tumour growth over two years after STRS are malignant transformation of the tumour, and late failure of STRS. Although rare, there is a documented risk of malignant change following exposure to radiation. Late failure of STRS is possible if, despite an early response to STRS, living cells within the tumour develop an adequate blood supply for growth.

Conclusions: Vestibular schwannoma patients warrant life-long radiological and clinical surveillance following STRS, as there is a small chance of initial regression followed by further growth. These cases therefore require surgery, for tumour removal and histological diagnosis.

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ID: IP203

Management of the intact, mobile stapes: a 12 year experience

Presenting Author: **Emma Stapleton**

Emma Stapleton¹, Peter Wardrop²

¹Scottish Cochlear Implant Centre, ²Crosshouse Hospital, Kilmarnock

Learning Objectives: 1) To clarify the goals of tympanomastoid surgery 2) To present a single surgeon's 12 year cohort of patients 3) To determine hearing outcomes in patients with an isolated, intact, mobile stapes and aerated tympanum following tympanomastoid surgery 4) To compare the outcomes of Type III cartilage tympanoplasty with published results of various ossicular prostheses in similar patient groups. 5) To recommend management guidelines for hearing preservation in patients with an isolated, intact, mobile stapes

Introduction: The goals of tympanomastoid surgery are the elimination of disease and the preservation of good hearing function. There is much literature on this topic, and it is understood that a mobile stapes and aerated tympanum are essential for a successful type III tympanoplasty, and that the interposition of a cartilage disc between stapes and tympanic membrane graft can improve audiometric results. However, there is heterogeneity amongst reported case series, and conflicting reports regarding the use of ossiculoplasty materials. The aims of this paper were to analyse hearing outcomes from a 12 year cohort of patients with an isolated, intact, mobile stapes following tympanomastoid surgery; to compare primary cartilage reconstruction with

no primary reconstruction, and to compare the outcomes of Type III cartilage tympanoplasty with published results of other reconstruction methods.

Methods: The records of 160 patients from a single surgeon's 12-year cohort were retrospectively analysed. Postoperative changes in air conduction thresholds (0.5, 1, 2 and 4kHz and average gains) and air-bone gap were calculated for each operated ear 2 years after surgery according to AAO-HHS guidelines. Revision surgery and other complications were documented.

Results: Audiometric and other outcomes are presented in detail

Conclusions:

1. The vast majority of patients in whom primary reconstruction was not performed did not require further surgery, as the development of a natural Type III tympanoplasty preserved or improved hearing thresholds following primary disease elimination.
2. Type III cartilage tympanoplasty is an effective technique for hearing improvement in patients with an intact, mobile stapes. Results are similar to those obtained with partial ossicular replacement prosthesis and autologous bone ossiculoplasty, and have the added benefits of lower cost and a lower complication rate.
3. Our recommendations for management of isolated stapes are based on these results.

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ID: IP204

Otological aspects of undergraduate otolaryngology education in the United Kingdom

Presenting Author: **Richard Steven**

Richard Steven¹, Gary Mires¹, Simon Lloyd², Stephen Jones³, Patrick Spielmann³, Sean McAleer⁴

¹University of Dundee, ²Department of ENT, Manchester Royal Infirmary, ³Department of Otolaryngology, Ninewells Hospital, Dundee, ⁴Centre for Medical Education, University of Dundee

Learning Objectives:

Introduction: Studies show that not all UK medical schools have a formal otolaryngology attachment, that the time dedicated to teaching in those which do is comparatively small and that qualified doctors feel that their training was inadequate.

Avoiding curriculum overload is a challenge in the ever expanding field of medicine. It would therefore be advantageous to identify and include key aspects of a subject within a curriculum. Here we report the otological findings from a national curriculum development project.

Methods: A longitudinal transformation approach to mixed methods research was utilised. The undergraduate curricula from UK medical schools were evaluated. Results from this comparison were used to devise a questionnaire. This was

distributed nationally via email to establish what doctors felt a newly qualified doctor should know about otolaryngology.

Results: A curriculum comparison of 19 medical schools revealed a high degree of variability between undergraduate otolaryngology curricula.

308 survey responses were received. Doctors felt that graduates should be able to perform otoscopy (93%) and tuning fork tests (78%). Respondents indicated that graduates should understand indications for common audiological investigations but not to interpret the results.

Respondents felt graduates should be able to assess a patient with chronic otitis media. Results indicate graduates should know more about conditions which present acutely.

Doctors felt that graduates should understand indications for otological procedures but few felt that they should have observed these. Respondents also felt that it was important for graduates to learn about the implications of hearing loss and communication with hearing impaired individuals.

Conclusions: This method of curriculum development allows the end users, the doctor, to influence the content of the curriculum. The study shows the variability in otolaryngology teaching in the UK and highlights key areas for student learning.

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ID: IP205

The effects of saccular endolymphatic hydrops on hearing

Presenting Author: **Satofumi Sugimoto**

Satofumi Sugimoto, Tadao Yoshida, Hironao Otake, Masaaki Teranishi, Michihiko Sone

Department of Otolaryngology, Nagoya University Graduate School of Medicine

Learning Objectives:

Introduction: Patients with significant endolymphatic hydrops (EH) sometimes show a connection between the footplate and the dilated saccule. It was supposed that this connection might cause the low-frequency air-bone gap in Menière's disease. The purpose of this study was to investigate the effects of significant EH showing a footplate-saccule connection on hearing, particularly for low-frequency air-bone gaps.

Methods: Evaluations were conducted using 1996 ears, evaluated by 3-T MRI performed 4 h after intravenous injection of Gd. The degree of EH in the vestibule and cochlea was classified into three grades: none; mild; or significant. Findings of the connection were checked. Ninety-one ears showed the connection. After elimination of ears with middle or inner ear abnormalities and severe hearing loss, 60 ears with the connection were evaluated. We selected those patients who had one ear with the connection and the other with significant EH of the vestibule and/or cochlea

without the connection. Hearing between each ear was then compared using the t test.

Results: Significant differences between ears with the connection and ears with significant EH of the vestibule and/or cochlea without the connection were seen for air-bone gap at 250 Hz and 3 pure-tone averages (500-, 1000- and 2000-Hz thresholds). Low-frequency air-bone gaps improved after EH medication in some patients.

Conclusions: Ears with significant EH that show a footplate-sacculle connection are associated with not only sensorineural hearing impairment, but also low-frequency air-bone gap. Changes in low-frequency air-bone gaps might reflect this aspect of EH.

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ID: IP206

Expression pattern of WOLFRAMIN, the Wolfram syndrome 1 (WFS1) gene product, in the Common Marmoset (*Callithrix jacchus*), a non-human primate, cochlea

Presenting Author: **Noriomi Suzuki**

Noriomi Suzuki¹, Masato Fujioka¹, Makoto Hosoya¹, Naoki Oishi¹, Seiji Shiozawa¹, Takahiro Kondo¹, Reona Kobayashi¹, Takashi Inoue², Hideyuki Okano¹, Kaoru Ogawa¹

¹Keio University, ²Central Institute for Experimental Animals

Learning Objectives:

Introduction: Wolfram syndrome is an autosomal recessive disorder, known as DIDMOAD (Diabetes Insipidus, Diabetes Mellitus, Optic Atrophy, and Deafness) syndrome. Its causative gene, WFS1, encodes an 890 amino acid protein, called WOLFRAMIN, which maintains calcium homeostasis and unfolded protein responses in the endoplasmic reticulum (ER). Limited literatures describing temporal bone pathology display loss of hair cells in the basal turn and atrophy of stria vascularis in the apical turn. However, the expression of Wolfram in mice was distributed widely and uniformly in the sensory epithelium and was absent in the stria vascularis. Moreover, WFS1 knockout mice did not suffer deafness.

Learning objectives: In order to elucidate the discrepancy of the phenotype among species, and to explore the pathophysiology of deafness associated with WFS1 mutations, we examined expression of WOLFRAMIN in a non-human primate, common marmoset (*Callithrix jacchus*), cochlea.

Methods: We examined the expression pattern of WOLFRAMIN with double staining of WFS1 with other markers. The primary antibodies used are as follows: anti-WFS1 (rabbit IgG), anti-MYOSIN7a (mouse IgG), anti-CALDESMON (mouse IgG), and anti-CONNEXIN26 (CX26) (mouse IgG).

Results: In marmoset cochlea, WFS1 immunoreactivity was observed in basal cells of stria vascularis, type I fibrocytes, outer hair cells, outer sulcus cells, Claudius cells, Hensen cells, and spiral ganglion. Immunostaining for WFS1 was co-labeled with type I fibrocytes markers, CX26 and CALDESMON. In stria vascularis, immunoreactivity for WFS1 was co-labeled with a basal cell marker, CX26.

Conclusions: The expression pattern of WFS1 in common marmoset cochlea was different from that of mouse. The pattern suggests basal cells may play essential roles in the maintenance of stria vascularis. Clarifying the function of basal cells of primates, including human, may elucidate pathogenesis of hearing loss in Wolfram syndrome patients.

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ID: IP207

The canal wall down procedure with soft posterior meatal wall reconstruction in acquired cholesteatoma. Focus on recurrence and postoperative middle ear status

Presenting Author: **Tomoyasu Tachibana**

Tomoyasu Tachibana¹, Michihiro Nakada², Yori-hisa Orita³, Kazunori Nishizaki³

¹Himeji Red Cross Hospital, ²Nakada ENT Clinic, ³Okayama University

Learning Objectives:

Introduction: The aim of procedures performed for acquired cholesteatoma (AC) is the complete removal of lesions, the prevention of disease recidivism, and the restoration of hearing loss. Although two main surgical procedures are canal wall up and canal wall down tympanoplasty (CWDT), it remains controversial which procedure would be appropriate for AC.

Objectives: To review surgical results of CWDT with soft posterior meatal wall reconstruction (SWR) for AC and to identify factors associated with surgical outcomes.

Methods: A retrospective review was made of 119 (flaccida, 99; tensa, 20) ears with AC who underwent CWDT with SWR at Himeji Red Cross Hospital between 2002 and 2015. The mean age was 45 years. The mean postoperative follow-up was 65 months (range, 12 to 156 months). Analyzed factors included sex, age, the type and extent of AC, the type of ossiculoplasty, and so on. We defined postoperative balloon-like retraction (PBR) with web formation, which needed reoperation to clean accumulated earwax, as 'nearly' recurrence. We classified all cholesteatomas according to JOS staging system for middle ear cholesteatoma (2015).

Results: Stage I and II were 24 and 95 ears, respectively. Residual was found in 11 ears (9.2%). Of 44 ears with PBR with web formation, 7 ears (5.9%) showed nearly recurrence. Seven residual and 4 nearly recurrent ears underwent

outpatient operation, and the other 7 were operated on under general anesthesia. No significant factors associated with residual or nearly recurrence were evident. In multivariate analysis, the proportion of postoperative mastoid aeration was significantly higher among cases with age

Conclusions: CWDT with SWR showed a low recurrence rate. More than half of residual and nearly recurrent ears could be easily treated with outpatient intervention. This procedure seems to be fully acceptable for surgical treatment of AC.

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ID: IP208

Pneumolabyrinth and Perilymphatic Fistula After 27 Years of Head Trauma

Presenting Author: **Emel Tahir**

Emel Tahir¹, Münir Demir Bajin², Shamkhal Jafarov², Levent Sennaroğlu²

¹Ankara Dışkapı Yıldırım Beyazıt Research and Training Hospital, ²Hacettepe University Department of Otolaryngology

Learning Objectives: To discuss possible problematic situations in cochlear implantation following temporal bone fractures such as pneumolabyrinth. To emphasize the importance of careful evaluation of repeated imaging studies to rule out perilymphatic fistula after temporal bone trauma. To discuss timing of cochlear implantation after temporal bone fracture. To interpret temporal bone CT in case of pneumolabyrinth.

Introduction: Pneumolabyrinth is usually associated with a temporal bone trauma or stapes footplate fracture and a part of perilymphatic fistula. In this presentation, a case with footplate fracture results in pneumolabyrinth which is still perpetual 27 years after the trauma and its management is discussed with his radiological data and intraoperative video.

Case: A 56 year old male patient who had a bilateral profound sensorineural hearing loss (SNHL) admitted to our clinic. He experienced a head trauma results in transverse temporal bone fracture 27 years ago. CT demonstrated a fracture line was passing from cochlea and vestibule and pneumolabyrinth on the left side. MRI revealed labyrinthine ossification (LO) on semicircular canals which is characterized by diminished fluid intensity on T2 weighted images. Exploratory tympanotomy was performed and the ossicular chain was mobile. At stapes footplate level there was a fracture line accompanied by perilymph leakage. By the help of a pick a small fenestra was created at the footplate and it was obliterated by packing temporalis fascia. It was so unlikely to encounter a perilymphatic fistula after 27 years from trauma. The patient had no meningitis or encephalitis during that period. Postoperative CT scan verified the resorption of pneumolabyrinth and Weber test was localized to the operation side. He has been discharged the day after the operation without any complication.

Results: On the basis of this case, exploratory tympanotomy should be performed in patients with SNHL in

association with radiologically detectable pneumolabyrinth. If cochlear implantation was performed to this ear without notification of the fistula, the patient would suffer from meningitis because of the electrode and the implantation would not be beneficial. When there is a significant time delay between the temporal bone trauma and the cochlear implantation, LO or other structural abnormalities such as fistula should be ruled out prior to surgery.

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ID: IP209

Development of the mastoid air cell system in children with congenital cholesteatoma

Presenting Author: **Masahiro Takahashi**

Masahiro Takahashi¹, Kazuhisa Yamamoto¹, Tsunetaro Morino¹, Manabu Komori¹, Yuitiro Yaguti², Yutaka Yamamoto¹, Nobuyoshi Otori¹, Hiromi Kojima¹

¹Jikei University School of Medicine, ²St. Marianna School of Medicine

Learning Objectives:

Introduction: Development of the mastoid air cell system in children with congenital cholesteatoma is said to be relatively good. However we sometimes encounter cases with poorly developed mastoid air cell system, but there have been few quantitative studies about the matter. The present study was undertaken in order to clarify the relationship between development of the mastoid air cell system in children with congenital cholesteatoma and various clinical factors.

Methods: Development of the mastoid air cell system of 53 children with congenital cholesteatoma was evaluated. The size of mastoid cells were measured from 0.5 mm sliced sectioned computed tomography scan of the temporal bone.

The sum of two areas, one showing the lateral semicircular canal and the other, 3 mm below it, was defined as the cross-section area of the pneumatized mastoid cells. Age, episode of otitis media, extension stage and location of the cholesteatoma, and size of the pneumatized mastoid cells were evaluated. Stage of the cholesteatoma was estimated with the grading system described by Potsic et al.

Results: The cross-section area of the affected side was significantly smaller than that of the unaffected side and this tendency was remarkable especially in the elder cases. The group with episode of otitis media was smaller in area than that without it. Cases with severe invasion of the cholesteatoma had smaller in area than that of others. Whether cholesteatoma present close to auditory tube or not made no difference in the development of the mastoid.

Conclusions: The mastoid cells in the ear of children with congenital cholesteatoma were poorly pneumatized compared with those of the unaffected side, and our data indicate that the suppression factor of pneumatization may be episode of otitis media, high age, and cholesteatoma presented in the mastoid portion.

doi:10.1017/S0022215116007064

ID: IP210**Cartilage versus the rest in Type I Tympanoplasty – who wins?**Presenting Author: **Hsern Ern Tan**Hsern Ern Tan¹, Peter Santa Maria²¹*Sir Charles Gairdner Hospital*, ²*Ear Science Institute of Australia*, ²*Sir Charles Gairdner Hospital*

Learning Objectives: To determine the efficacy of different graft materials in Type I tympanoplasty through systematic review.

Introduction: In Type I Tympanoplasty, the most commonly used graft materials are temporalis fascia, cartilage and fat, which are all readily accessible at the surgical site. Over the years many other natural and synthetic materials have been trialled, but there are few published studies on outcomes. There has been a renewed interest in cartilage grafting due to its rigidity and resistance to retraction.

Aims: To determine the efficacy of different graft materials in Type I tympanoplasty through systematic review.

Methods: Using a search of the MEDLINE and PubMed databases from 1970 to 2014, all RCTs and retrospective studies reporting the outcomes of Type I tympanoplasty in primary chronic tympanic membrane perforations were identified. The studies were then analysed in a single variable analysis to compare the success rate of tympanic perforation closure between four major graft materials (cartilage, fascia, fat and other).

Results: 214 studies were identified from a total of 4704 abstracts. Cartilage had the greatest success rate of the four groups with 90.80%, across 33 studies (1746 patients) compared to fascia with a success rate of 88.00%, across 121 studies (14806 patients) and significant *p* value of 0.048. Fat had a success rate of 86.52% (across 22 studies and 1507 patients) and the last category of 'other' had a success rate of 85.39% (across 36 studies, 4217 patients) but the difference was not significant.

Conclusions: Cartilage has a superior graft closure rate compared to fascia in Type I tympanoplasty. Though this is consistent with the findings in recent literature, cartilage is also often used as a graft material for smaller sized perforations, which innately have higher healing rates, and this may account for the increased closure rate with cartilage compared to other graft materials.

doi:10.1017/S0022215116007076

ID: IP211**Does perforation size matter in myringoplasty?**Presenting Author: **Hsern Ern Tan**Hsern Ern Tan¹, Peter Santa Maria²¹*Sir Charles Gairdner Hospital*, ²*Ear Science Institute of Australia*, ²*Sir Charles Gairdner Hospital*

Learning Objectives: The impact of perforation size on tympanic membrane closure in myringoplasty has been well reported in literature. We attempt to summarise the literature findings in a single variable analysis.

Introduction: Graft failure in larger perforations are thought to occur due to increased technical difficulty, reduced visibility, reduced graft overlap with the residual tympanic membrane (TM) and a poor vascular bed for graft uptake. However, smaller perforation sizes fail for similar reasons and literature is not conclusive on the significance of perforation size in myringoplasty success.

Aims: The impact of perforation size on tympanic membrane closure in myringoplasty has been well reported in literature. We attempt to summarise the literature findings in a single variable analysis.

Methods: A literature search of all myringoplasty studies from 1966 to 2014 was conducted using PubMed. Retrospective and prospective papers reporting the impact of perforation size and perforation location on graft closure were extracted. A single variable analysis was then performed.

Results: Perforation size greater than 50% surface area of TM had significantly worse graft closure compared to perforation size less than 50%. Data for perforation size >50% came from 58 studies (3374 patients) showing a graft closure rate of 79.44%, compared data for perforation size ≤50% perforation size from 74 studies (5859 patients) showing a closure rate of 85.56% and a *p* value of 0.019. Perforation location (central, anterior or posterior) was not significant though anterior perforations had the least success.

Conclusions: This single variable analysis indicates that in Type I tympanoplasty, perforations greater than 50% have a lower success rate, while the location of the perforation had no significant effect on success rate.

doi:10.1017/S0022215116007088

ID: IP212**Combined Endoscopic and Microscopic Approach to cholesteatoma Surgery**Presenting Author: **Jabin Thaj**Jabin Thaj¹, Praneta Kullo², Chitta Chowdhury², Gaurav Kumar²¹*Queens hospital*, ²*TBC*

Learning Objectives: i Multidisciplinary pre-operative planning. ii Modern day Otologist should be proficient in both microscopic and otoendoscopic technique.

Introduction: The aim of cholesteatoma surgery is to eradicate the disease process with minimal morbidity and preservation of hearing. The use of the oto-endoscope as a surgical tool is becoming increasingly popular for safe cholesteatoma surgery. We believe that the combined use of the oto-endoscope and microscope helps in achieving the above goals and reduce the need for second look procedures or revision surgery.

Methods: We did a retrospective review of 43 cases of mastoidectomy performed between January 2011 and January 2016 in our otology unit in East London.

Results: We reviewed cases of combined approach tympano-mastoidectomy, atticotomy, revision mastoid surgery and cholesteatoma eradication from antrum in anteriorly lying sigmoid sinus. Our study group involved both adults and paediatric population. After the full microscopic work all cases were assessed using oto-endoscope for any residual diseased epithelium particularly on the on the lateral wall of epitympanum, anterior attic and sinus tympani. Residual disease was dealt with micro-instruments and/or KTP LASER. In 21 cases, residual diseased epithelial remnant was still present.

Conclusion: A combined oto-endoscopic and microscopic approach in the management of cholesteatoma cases helps to achieve a good outcome without any additional morbidity. This has reduced the need for revision surgery and second look procedures.

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ID: IP213

Training in revision mastoid Surgery: Challenges, Pitfalls and Tips

Presenting Author: **Jabin Thaj**
Jabin Thaj¹, Praneta Kulloo², Chitta Chowdhury²,
Gaurav Kumar²

¹Queens hospital, ²BHR Trust

Learning Objectives: i Meticulous pre-operative planning and discussion with multidisciplinary team. ii Availability of appropriate instruments and experienced theater staff. iii Proficiency in lateral skull base anatomy and surgery

Introduction: Surgical management of recurrent complex cholesteatomas can be highly challenging. Our busy otology service in northeast London caters to a unique mixed racial demographic group where there is a high preponderance of such cases. In this study we would like to share the challenges we faced and our subsequent learning journey.

Methods: We undertook a retrospective review of 156 cases of revision mastoid surgeries done between January 2009 and December 2015 in our otology unit in East London.

Results: Following a review of our cases, we found that the pathologies that made surgical management challenging included dehiscent sigmoid sinus, tegmen erosion, eroded bony facial canal and lateral semicircular canal. We hereby

present our pre-operative management planning, operative techniques and post-operative outcome of these complex ear cases. We also share our experience of the individualised care of these complex patients using a multidisciplinary team approach.

Conclusions: Revision mastoid surgery is challenging. A multidisciplinary team consisting of the ENT surgeon, radiologist, neurosurgeon and senior anaesthetist is helpful for pre-operative planning of complex ear cases. Moreover, intra-operative use of oto-endoscope, KTP LASER, facial nerve monitor and post-operative availability of high dependency unit are important aspects to consider for safe and appropriate management of revision mastoid surgery.

doi:10.1017/S0022215116007106

ID: IP214

Depth of the Sinus Tympani is Unrelated to Mastoid Pneumatization: A Cartesian Coordinate Study

Presenting Author: **N Wendell Todd**

N Wendell Todd
Emory University

Learning Objectives: To learn from a study of minimally and maximally pneumatized temporal bones, the depth of the sinus tympani relative to the adjacent facial nerve and to the round window.

Background: Cholesteatoma involving the sinus tympani is notoriously difficult to assess and control. Otolologists would be happy for every sinus tympani to be shallow. Correlates of sinus tympani depth are unknown, although some suggest that increased depth correlates with large mastoid pneumatization.

Objective: To describe the depth of the sinus tympani, relative to both the adjacent facial nerve and distance from the round window, and how depth correlates with mastoid size.

Methods: Ten clinically ear-normal crania underwent computed tomography in a custom non-metallic positioning device that referenced the Frankfort horizontal plane. The crania, from a series of 41, were the five with the largest mastoids, and the five with the smallest mastoids, as assessed by plain lateral radiograph. Each landmark (midst of round window [RW], apex of sinus tympani [ST] and midst of facial nerve [FN] is that slice) was twice independently identified in xyz Cartesian space. The midst of the facial nerve was chosen even though not surgically accurate, so as to better consistently landmark the facial nerve for this study.

Results: The mean direct distance from RW to ST ranged from 3.4 to 7.7 mm, median 6.1 mm for right ears; 4.1–8.0, 5.0 left. For FN to ST, the range was 1.6–4.0 mm, median 3.2 right; 1.8–3.2, median 2.5 left. Neither bilateral symmetry nor relationship with mastoid size was found.

Discussion: Using a technique free of proximity bias, the depth of the sinus tympani is variable and unpredictable.

Conclusion: From one ear to another ear, the depth of the sinus tympani varies and is not predicatable.

doi:10.1017/S0022215116007118

ID: IP215

Preparatory operations for safe middle ear implantation

Presenting Author: **Tetsuya Tono**

Tetsuya Tono, Keiji Matsuda
Miyazaki University

Learning Objectives:

Introduction: The range of candidates for middle implants, either the Rion middle ear implant (Rion MEI) or the Vibrant Sound Bridge (VSB), has been restricted to patients with conductive or mixed hearing loss in Japan and most of the candidates had received previous middle ear surgeries without favorable functional results. Some of the patients have chronic middle ear pathologies which should be controlled before middle ear implantation.

Patients and methods: The Rion MEIs were implanted between 1994 and 2000 in 6 patients. Five of them had had radical mastoidectomy and one had previous canal-wall up surgery. Four patients with a dry mastoid cavity were implanted in one stage with closure of the external ear canal, whereas one patient having an infected mastoid cavity required a two-stage procedure for implantation. The round window vibroplasty technique was employed for VSB between 2012 and 2013 in 6 patients. Among six patients, two patients having a radical mastoidectomy cavity with a retroauricular opening, one patient with failed atresia surgery and one patient following canal wall up tympanoplasty needed preparatory operations before VSB implantation.

Results: All middle ear devices implanted in a two-stage procedure tolerated well in patients who had had severe middle ear diseases and/or eustachian tube dysfunction at the time of the preparatory operations.

Discussion: More than thirty years' experience with the Rion MEI in Japan had shown that postoperative retraction of the tympanic membrane occurred in a fairly high proportion of the patients with eustachian tube dysfunction, potentially causing mechanical interactions and/or protrusion of the vibrator. In order to avoid such uncomfortable situations, we prefer to prepare for a sufficient middle ear space before implantation with lateralization of the tympanic membrane or canal closure supplemented with a pedicled temporalis muscle flap or with a temporo-parietal fascia flap.

doi:10.1017/S002221511600712X

ID: IP216

Nationwide Survey of middle ear cholesteatoma surgery cases in Japan: Results from the Japan Otological Society Registry using 2015 JOS Staging and Classification System

Presenting Author: **Tetsuya Tono**

Tetsuya Tono¹, Manabu Komori², Masafumi Sakagami³, Hiromi Kojima⁴, Naohito Hato⁵, Yutaka Yamamoto⁴, Keiji Matsuda¹, Yuka Morita⁶, Sho Hashimoto⁷

¹Miyazaki University, ²National Center for Child Health and Development, ³Hyogo College of Medicine, ⁴Jikei University School of Medicine, ⁵Ehime University, ⁶Niigata University, ⁷National Sendai Medical Center

Learning Objectives: The committee on Nomenclature of the Japan Otological Society (JOS) was appointed in 2004 to create a cholesteatoma staging system widely applicable in Japan and as simple as possible to use in a clinical practice. After the initial proposal of the principal staging system for attic cholesteatoma in 2008, we proposed 2010 staging system for two main types of acquired cholesteatoma, pars flaccida and pars tensa types. Since then, this system has been widely used in Japan, allowing for more meaningful communication between outcome studies based on surgical methods used for a respective type and stage of cholesteatoma. We have recently added two more types, congenital cholesteatoma and cholesteatoma secondary to a pars tensa perforation, as 2015 JOS cholesteatoma staging and classification system. Briefly, the principal JOS staging system defines four stages: stage I, cholesteatoma confined to the primary site; stage II, involving two or more sites; stage III, with intratemporal complications; stage IV, with intracranial complications. This system is applicable to pars flaccida, pars tensa, congenital cholesteatomas and cholesteatoma secondary to a tensa perforation.

A nationwide survey was conducted by the Committee of JOS in order to promote the use of this system and to capture the prevalence of cholesteatoma types and stages in Japan in 2015. The operative methods employed in each case were also included. Medical information of the patients were anonymized and registered through the JOS website voluntarily between 1 January and 29 February 2016.

As of 2016/02/27, 1480 cases from 59 hospitals have been registered, with stage I 25%, stage II 57%, stage III 14% and stage IV 0.5%. 64% of the cases were assigned to pars flaccida type, 13% to pars tensa type, 12% to congenital cholesteatoma and 5% to cholesteatoma secondary to a tensa perforation. The final registry data and the detailed breakdowns of cholesteatoma classification and staging will be presented.

doi:10.1017/S0022215116007131

ID: IP217**Comparison between different donor sites of grafts to tympanoplasty**Presenting Author: **Chang-Yu Tsai**Chang-Yu Tsai, Chin-Kuo Chen, Wu-Po Chao
Chang Gung Memorial Hospital

Learning Objectives: To review the literatures, it is still a controversy about different materials to take rate in tympanoplasty. This study aims to investigate the anatomical and outcomes of Transcanal Endoscopic tympanoplasty with different donor sites of grafts.

Objective: To review the literatures, it is still a controversy about different materials to take rate in tympanoplasty. This study aims to investigate the anatomical and outcomes of Transcanal Endoscopic tympanoplasty with different donor sites of grafts.

Materials and Methods: We retrospectively reviewed the charts of patients who underwent Transcanal Endoscopic tympanoplasty with different donor sites of grafts at the Chang Gung Memorial Hospital. All calculations were performed with a commercial statistical software package (SPSS 12.0 for windows)

Results: As a result, the take rate of transcanal endoscopic tympanoplasty and audiological outcomes was not related to different donor site. We will present our further outcome and discussion on the future conference.

Conclusion: In our study, there is no significant difference in the take rate of transcanal endoscopic tympanoplasty and various dorsal grafts. The results conclude the outcome of tympanoplasty with Transcanal Endoscopic Ear Surgery is similar as conventional microscopic technique.

doi:10.1017/S0022215116007143

ID: IP218**Mastoidectomy reconstruction with Sofradex®/bone pâté: is there a hearing effect?**Presenting Author: **Nitesh Patel**Jagdeep Virk¹, Nitesh Patel²¹Whipps Cross Hospital, Barts Health, ²Whipps Cross Hospital

Learning Objectives:

Background: The primary goal of cholesteatoma surgery is complete eradication of the disease and to produce a dry, healthy ear. A mastoid cavity following canal wall down

surgery can result in major morbidity due to chronic otorrhea and infection, difficulty with hearing aids, and vertigo with temperature changes, particularly when concomitant meatoplasty is performed. Mastoid obliteration with reconstruction of the bony external ear recreates normal anatomy to avoid such morbidity (and obviates the need for soft tissue meatoplasty). Bone pâté reconstruction is one of the surgical options but some controversy persists in its admixture with Sofradex®, with suggestions that this may induce a sensorineural hearing loss.

Aim: To examine the curative and hearing effect of the use of Sofradex®/autologous bone pâté for posterior canal wall and attic reconstruction following mastoidectomy in consecutive patients.

Method: Retrospective case series; autologous bone pâté was used in conjunction with Sofradex® in all cases.

Results: 28 patients were identified. Mean preoperative and postoperative bone conduction thresholds were 15.5 and 18.3 dB respectively (paired t test, p = 0.12, non-significant). Mean preoperative and postoperative air conduction thresholds were 44.6 and 44.8 dB respectively. Follow up ranged from 6–36 months, with a median of 12 months. All patients had a dry, healthy ear at long term follow up. There have been no cases of recurrent or residual cholesteatoma thus far.

Conclusion: Mastoid and epitympanic obliteration with autologous bone pâté and Sofradex® is a safe and effective technique. There is no current evidence that demonstrates sensorineural hearing loss with the concomitant use of Sofradex®.

doi:10.1017/S0022215116007155

ID: IP219**Relationship of Tympanogram Width (Tw) with Adenoid Hypertrophy: Predictor of Otitis Media with Effusion Occurrence in Adenoid Hypertrophy**Presenting Author: **Ahmad Dian Wahyudiono**Ahmad Dian Wahyudiono¹, Andrew Halim²¹Faculty Medicine of Brawijaya University,²Department of Otorhinolaryngology-Head and Neck surgery Faculty Medicine of Brawijaya University

Learning Objectives:

Abstract: Otitis media with effusion (OME) is difficult to detect because the symptoms and signs are not typical or even asymptomatic. Adenoid hypertrophy is an important cause of OME in children. There are many researches about relationship of adenoid hypertrophy and OME in children. *Tympanogram width* (Tw) has been known to be a sensitive parameter for diagnosis of OME.

Purpose: To understand the relationship of Tw and adenoid hypertrophy.

Method: This is an observational analytic study involving subjects with adenoid hypertrophy without OME who had undergone adenoid skull lateral X-Ray, nasoendoscopy, and tympanometry. Relationship of tympanometry parameters (Gr, Tw, Ytm, TPP, and Jerger type) with degree of adenoid hypertrophy measured with adenoid skull lateral X-Ray and nasoendoscopy was analyzed with Pearson and Spearman correlation test.

Result: There was significant correlation ($p > 0,01$) between Tw and degree of adenoid hypertrophy according to 3 adenoid skull lateral X-Ray measuring methods. There was no significant correlation between Ytm and Gr with degree of adenoid hypertrophy according to 3 adenoid skull lateral X-Ray measuring methods. There was also significant correlation ($p > 0,05$) between Tw and degree of adenoid hypertrophy measured with nasoendoscopy according to Parikh. There was no significant correlation between Gr, Ytm, TPP, and Jerger type with degree of adenoid hypertrophy measured with nasoendoscopy according to Parikh.

Conclusion: Tympanogram width correlates significantly with adenoid hypertrophy and has the potential to predict occurrence of OME.

doi:10.1017/S0022215116007167

ID: IP220

Diagnostic algorithm for patients presenting with tinnitus

Presenting Author: **Hussein Walijee**

Hussein Walijee¹, Rebeeca Leach²

¹Taunton and Somerset NHS Trust,

²Eglwysback Surgery, Pontypridd

Learning Objectives:

Tinnitus is a common and potentially debilitating global health problem. Rarely, it may be the presenting symptom of a serious underlying condition such as vestibular schwannoma, thereby necessitating a thorough assessment. Causes of tinnitus are described and divided into two main categories: subjective (heard by the patient only) and objective (heard by the examiner also). History and examination is key to differentiating between aetiologies however in many cases there is no identifiable underlying cause. The authors provide an approach to tinnitus by means of a diagnostic algorithm. Management in primary care is discussed as well as Department of Health guidance on when patients are to be referred to secondary care.

doi:10.1017/S0022215116007179

ID: IP221

Long-term hearing results following retrograde tympanomastoidectomy with canal reconstruction by using mastoid isolation/obliteration

Presenting Author: **Chih-Hung Wang**

Chih-Hung Wang, Chao-Yin Kuo

Department of Otolaryngology-Head and Neck Surgery, Tri-Service General Hospital, National Defense Medical Center, Taipei, Taiwan

Learning Objectives:

Introduction: Besides mastoid obliteration as enrolled in this study, we offered another surgical technique—mastoid isolation by using several pieces of bony plates and bone chips placed on the preserved canal wall and tegmen tympani to complete the reconstruction of the EAC defect in a one-stage surgical procedure.

Methods: A total of 99 patients resulted in 102 ears underwent retrograde tympanomastoidectomy in a single stage procedure, 6 of them underwent two-stage ossiculoplasty. The main outcome measures included surgical procedures of reconstruction, types of tympanoplasty, complications, and hearing outcomes.

Results: In $>71\%$ of ears, the audiometric tests were monitored more than 2 years. The results of hearing assessments indicated a significant improvement in hearing gain after surgery in view of the postoperative change of air-conduction (AC) thresholds and air-bone gaps (ABGs) ($p < 0.001$). Linear regression analysis of pure-tone average (PTA) before and after surgery at different frequency showed patients benefit postoperative hearing gain largely at low and middle frequencies but may deteriorate their hearing at frequency of 8000 Hz. Among 72 cases with non-serviceable hearing preoperatively, 25 of them (34.7%) would achieve serviceable hearing outcomes postoperatively ($p < 0.001$). The postoperative improvement of hearing degree for patients with moderate, severe or profound hearing loss showed statistically significant difference ($p = 0.04$). Tympanoplasty of type III-i increased the hearing gain markedly, followed by type III-c, I, and IV-c. Two-stage ossiculoplasty can provide a better air gain at 500, 1000, and 2000 Hz. The overall rate of complication was 8.8% (9 of 102).

Conclusions: We conclude that reconstruction of the EAC and mastoid via mastoid isolation/obliteration using bone chips/paté can be considered as an alternative procedure following retrograde tympanomastoidectomy. It gives excellent surgical results and has fewer complications.

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ID: IP222

Advanced stage of cholesteatoma presenting to medical services in Cambodia

Presenting Author: **Mahmood Bhutta**

Elinor Warner¹, T Sokdavy², C Sothea², Huins Charlie³, Matthew Clark⁴, Jim Gollogly², Mahmood Bhutta²

¹Royal National Throat Nose and Ear Hospital,

²Children's Surgical Centre, Phnom Penh,

Cambodia, ³Queen Elizabeth Hospital, Birmingham, ⁴Gloucestershire Royal Hospital

Learning Objectives: To understand that, in Cambodia, cholesteatoma is often at an advanced stage at presentation. Extrapolation from geographic data suggests that there are barriers to access in remote locations.

Introduction: We have recently instigated the first continual program for tympanomastoid surgery in Cambodia at the Children's Surgical Centre, Phnom Penh. We provide care for adults and children, and cover a population of 15 million individuals, who have previously had no access to otological surgery. We set out to ascertain the severity of disease presenting to us, and proxy measures of access to care, through a retrospective review of patient records.

Methods: We reviewed operative records of all patients undergoing tympanomastoid surgery between February 2014 and March 2016. We recorded the extent of disease, the presence of ossicular erosion, and the location and extent of erosion of the temporal bone. We compared our findings to those reported in the literature. We also used the home address of those presenting to our services to calculate the distance travelled to our centre, and compared this to the population density of each region.

Results: We retrieved records of 74 cases. Erosion of the facial canal, lateral semicircular canal, tegmen, and the ossicles is more extensive and common than reported in previous epidemiological studies. Very extensive disease is also recorded, including post-aural fistulae or abscesses, erosion into the parotid gland, exposure of the sigmoid sinus, and erosion into the internal auditory meatus. Many people had suffered for years before seeking medical care. People living near to our centre were over-represented in our cohort.

Conclusions: Cholesteatoma in Cambodia is at an advanced stage compared to that presenting in the developed world. The epidemiology of those presenting to our centre suggests that awareness of, and access to care is a significant issue for those in remote locations. This is one of the first studies to report on cholesteatoma epidemiology in the developing world, and the findings give impetus to efforts to develop infrastructure to support ear care across the developing world.

doi:10.1017/S0022215116007192

ID: IP223

Early Detection of Residual Cholesteatomas by Color Mapped Fusion Imaging and Removal by Transcanal Endoscopic Ear Surgery

Presenting Author: **Akiko Saitoh**

Akiko Saitoh¹, Tomoo Watanabe¹, Tsukasa Ito², Takatoshi Furukawa², Kazunori Futai³, Toshinori Kubota⁴, Masafumi Kanoto⁵, Yuuki Toyoguchi⁵, Takaaki Hosoya⁵, Seiji Kakehata²

¹Department of Otolaryngology, Yamagata University faculty of Medicine, ²Department of

Otolaryngology, Head and Neck Surgery, Yamagata University Faculty of Medicine, ³Yamagata City Hospital Saiseikan, ⁴Yamagata Prefectural Shinjyo Hospital, ⁵Department of Diagnostic Radiology, Yamagata University Faculty of Medicine

Learning Objectives: To demonstrate that CMFI is a reliable diagnostic modality for not only preoperatively identifying cholesteatomas but also postoperatively identifying early-stage residual cholesteatomas.

Introduction: Residual cholesteatomas have been difficult to accurately detect at an early stage during follow-up examinations of patients whom had previously undergone surgery for removal of a primary cholesteatoma. Typically shadows will appear on a CT scan, but cannot be confirmed as a residual cholesteatoma until a second CT scan is taken several months later. This second CT is then compared to the first CT scan to determine whether the shadow has increased in size, thus strongly suggesting the presence of a cholesteatoma. However, color mapped fusion imaging (CMFI) can be used to immediately evaluate such shadows. If a shadow shows up as a red area, the shadow is likely to be a residual cholesteatoma and can be immediately removed. Thus CMFI is useful in the postoperative follow-up evaluations of patients for residual cholesteatomas.

Patients and Methods: Ninety patients who had undergone the removal of a primary acquired middle ear cholesteatoma and were undergoing postoperative follow-up evaluations for residual cholesteatomas at 6-month intervals. Each patient initially underwent a CT scan. If a shadow was found which suggested the presence of a residual cholesteatoma, a CMFI was taken to determine whether the shadow was actually a cholesteatoma. This CMFI is created by combining a 1-mm thin slice non-EPI DWI with MR cisternography (MRC).

Results: Shadows were found on the initial CT scan in 68/90 patients. The presence of a residual cholesteatoma was strongly suggested in 5/68 patients based on the CMFI. These 5 patients all underwent surgery for cholesteatoma removal. The CMFI evaluations for these patients were compared to the intraoperative findings. All 5 patients were found to have a residual cholesteatoma in the same anatomical location as indicated by the CMFI and these cholesteatomas were all successfully removed.

Conclusion: CMFI is a reliable diagnostic modality for postoperatively identifying early-stage residual cholesteatomas.

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ID: IP224

Endoscopic Ear Surgery for the Removal of Residual and Recurrent Cholesteatomas

Presenting Author: **Tomoo Watanabe**

Tomoo Watanabe¹, Tsukasa Ito¹, Takatoshi Furukawa¹, Kazunori Futai², Toshinori Kubota³, Seiji Kakehata¹

¹Yamagata University faculty of Medicine,
²Yamagata City Hospital Saiseikan, ³Yamagata
 Prefectural Shinjyo Hospital

Learning Objectives: To demonstrate that the endoscopic approach is a viable option when removing residual and recurrent cholesteatomas.

Introduction: While the endoscope has long been used in surgery, its adoption has been slower in ear surgery due to the narrowness, relative inaccessibility and delicateness of the ear. However, we have successfully used the endoscope in transcanal endoscopic ear surgery (TEES) as well as a combined transcanal-transcortical endoscopic approach. TEES is a less invasive procedure used initially to remove primary cholesteatomas located in the antrum and/or attic through the ear canal without the need for a large, invasive retroauricular incision. Moreover TEES can also now be used to remove residual and recurrent cholesteatomas if they are located in the attic and/or antrum. The combined transcanal-transcortical endoscopic approach is also being used to successfully remove recurrent cholesteatomas extending into the mastoid even after removal of the primary cholesteatoma via a transcortical mastoidectomy. Therefore the endoscopic approach should be considered as an option in the removal of residual and recurrent cholesteatomas regardless of their location.

Methods: The presence and location of residual and recurrent cholesteatomas were diagnosed by a CT scan and color mapped fusion imaging (CMFI). A CMFI was created by first combining a 1-mm thin slice non-EPI DWI with MR cisternography (MRC) and then performing color mapping to enhance the visualization of the cholesteatoma. TEES was used to remove cholesteatomas located in the attic and/or antrum. When the cholesteatoma extended into the mastoid, the dual transcanal-transcortical endoscopic approach was employed including a small retroauricular incision of less than 10 mm to insert the endoscope and other tools.

Results: We successfully removed residual cholesteatomas located in the attic and/or antrum and recurrent cholesteatomas extending into the mastoid using the endoscope.

Conclusion: The endoscopic approach is a viable option when removing residual and recurrent cholesteatomas regardless of their location.

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ID: IP225

Post-Stapedectomy Granuloma: A Devastating Complication

Presenting Author: **Harry Powell**

Emma Watts¹, Harry Powell², Shakeel Saeed²,
 Richard Irving³

¹Royal National Throat, Nose and Ear Hospital
 and Queen Elizabeth Hospital Birmingham,

²Royal National Throat, Nose and Ear Hospital,

³Queen Elizabeth Hospital Birmingham

Learning Objectives: Surgical debulking can be beneficial in cases refractory to medical therapy. Although it is a rare complication, post-stapedectomy granuloma should be considered in any patient presenting with tinnitus, otalgia, vertigo or hearing loss after stapes surgery.

Introduction: Our aim was to report cases of post-stapedectomy granuloma and examine outcomes following surgical debulking.

Methods: Retrospective case review. Three patients presenting with otalgia following stapedectomy between 2010 and 2015. Tinnitus, hearing loss and facial paralysis occurred in two of these cases. When symptoms failed to improve despite maximal medical therapy, patients underwent exploratory tympanotomy and exenteration of granuloma.

Results: Intra-operatively, granulation tissue consistently surrounded the oval window niche, prosthesis and long process of the incus, emulating radiographic findings. The granulomatous reaction spread along the seventh and eighth cranial nerves to reach the cochlear nucleus in one patient. In all cases, clinical improvement was demonstrable although symptoms failed to completely resolve. Overall, facial nerve function recovered, variable reductions in pulsatile tinnitus occurred and otalgia persisted in all cases. Diminution of contrast enhancement on serial MRI scans corroborated clinical improvement and permitted post-operative monitoring of disease recurrence. Post-operative complications included Grade IV facial weakness and a pseudomonas aeruginosa meningitis, both of which completely recovered.

Conclusion: To the authors' knowledge, this is the only case where granuloma has tracked to the brainstem. Surgical debulking was beneficial in these three cases of post-stapedectomy granuloma refractory to medical therapy. Although it is a rare complication, post-stapedectomy granuloma should be considered in any patient presenting with tinnitus, otalgia, vertigo or hearing loss after stapes surgery.

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ID: IP226

Revision surgery and complications after myringoplasty

Presenting Author: **Eva Westman**

Eva Westman

Umeå University

Learning Objectives: The aim of the present study is to analyze the number of revisionmyringoplasties and complications across Sweden, in the aspects of take rate/post-operative infection/tastedisturbance/tinnitus.

Myringoplasty is a common middle ear surgery performed to close a TM perforation.

Since 1997 these procedures have been reported by a majority of ENT clinics to a National Quality Register in Sweden. The data from the quality register have in this study been used to evaluate patients operated with

myringoplasties between 2002 and 2012 to study revision surgery and the complications reported in the register.

The reported complications 6–12 months after surgery are taste disturbances of corda tympani, new or persistent tinnitus and postoperative infections. National results as well as detailed results from 2 ENT clinics in Sweden, County hospitals have been analyzed to compare the frequency of complications.

A review of the patient records were made to further analyze the patients report of postoperative infections from the 2 county hospitals. To further analyze if taste disturbances and tinnitus is still persistent after a longer period after surgery a survey was sent home to all the reporter cases in the nation.

In summary patients have an increased risk for reoperation after revision surgery.

Men has a higher risk for tinnitus compared to women, an women have a greater risk for taste disturbances compared to men. Postoperative infections seem to be over reported. Tinnitus seems to be persistent long time after surgery.

doi:10.1017/S0022215116007234

ID: IP227

Comparisons of Auditory Performance and Speech Intelligibility after Cochlear Implant Reimplantation in Mandarin-Speaking Users

Presenting Author: **Che-Ming Wu**

Che-Ming Wu, Chung-Feng Hwang
Chang-Gung Memorial Hospital

Learning Objectives: This study documented the incidence of complications and revisions following CI and analyze causes and management outcomes in order to understand what could be learned from the experiences of revision CI surgery.

Introduction: Complications of Cochlear implantation (CI) sometimes lead to revision surgeries or even reimplantation. However, the auditory performance and speech intelligibility subsequent to reimplantation are not often discussed, especially in Mandarin-speaking users. This study review our experience with CI surgeries in Mandarin speaking users over a 16-year period, emphasizing causes, auditory performance, and speech intelligibility after reimplantation.

Methods: 589 patients who underwent CI in our medical center between 1999 and 2014 were reviewed retrospectively. Data related to demographics, etiologies, implant-related information, complications, and hearing and speech performance were collected.

Results: 22 (3.74%) cases were found to have major complications. Infection (n = 12) and hard failure of the device (n = 8) were the most common major complications. The incidence of minor complications was 11.04% (n = 65). In total, 18 (3.06%) patients underwent revision surgeries due to infection

(n = 9), device failure (n = 8), and severe hematoma (n = 1). Among them, 13 were reimplanted in our hospital. The mean scores of the Categorical Auditory Performance (CAP) and the Speech Intelligibility Rating (SIR) obtained before and after reimplantation were 5.5 versus 5.8 and 3.7 versus 4.3, respectively. The SIR score after reimplantation was significantly better than pre-operation.

Conclusion: The Mandarin-speaking patients who received reimplantation had restored auditory performance and speech intelligibility after surgery. Device soft failure was rare in our series, calling special attention to Mandarin speaking CI users requiring revision of their implants due to undesirable symptoms or decreasing performance of uncertain cause.

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ID: IP228

MicroRNA-21 Promotes the Proliferation and Invasion of Cholesteatoma Keratinocytes

Presenting Author: **Chen Xiaohua**

Chen Xiaohua¹, Zhaobing Qin²

¹The First Affiliated Hospital of Zhengzhou University, ²Otolaryngology Department of the First Affiliated Hospital of Zhengzhou University

Learning Objectives: Cholesteatomas is characterized by a more rapid growth and extensive bone destruction in the middle ear and mastoid cavities. MicroRNAs (miRNAs) are posttranscriptional regulators of gene expression. The goal of this study was to investigate the posttranscriptional regulatory effects controlling proliferation, apoptosis and invasion in cholesteatoma keratinocytes. Specifically, the potential role of microRNA-21(miR-21) was focused on in this study.

Methods: Cholesteatoma tissues, taking from the patients at the time of surgery, were processed for RNA and cell culture. The cholesteatoma keratinocytes were transfected with miR-21 mimics, miR-21 inhibitor or negative control miRNA, and then growth curves were drawn. Real-time reverse-transcription polymerase chain reaction was used to assess the expression levels of miR-21. EdU incorporation assay and TUNEL staining were used to assess the proliferation and apoptosis of cholesteatoma keratinocytes, respectively. The invasive abilities of cholesteatoma keratinocytes were examined using 6-well Transwell plates.

Results: MicroRNA-21 showed an up-regulation respectively cholesteatoma keratinocytes transfected miR-21 mimics as compared with cells transfected miR-21 inhibitor or control miRNA. The number of proliferative EdU-positive(EdU+) cells increased in cholesteatoma keratinocytes transfected miR-21 mimics, as compared with cells transfected miR-21 inhibitor or control miRNA. The number of TUNEL-positive cells was increased in cholesteatoma keratinocytes transfected

miR-21 mimics, as compared with cells transfected miR-21 inhibitor or control miRNA. The migrated cholesteatoma keratinocytes transfected miR-21 mimics was higher, as compared with the migrated cells transfected miR-21 inhibitor or control miRNA.

Conclusions: The present study showed that miR-21 promotes proliferation and invasion of cholesteatoma keratinocytes. The results give a partial explanation for the more aggressive clinical behavior observed in cholesteatoma.

doi:10.1017/S0022215116007258

ID: IP229

The selection of surgical technique for middle ear cholesteatoma in pediatric patients

Presenting Author: **Chen Xiaohua**

Chen Xiaohua, Zhaobing Qin
The First Affiliated Hospital of Zhengzhou University

Learning Objectives:

Method: A retrospective analysis of all cases of pediatric primary acquired cholesteatoma aged 6–14 years old between May, 2005 and August, 2009 was conducted. 86 patients(89 ears) were treated and followed from 1 to 7 years[the average is (3.8 ± 2.5) years].

Result: During the follow-up, intact canal wall mastoidectomy with tympanoplasty(ICW) was the primary surgical treatment in 38 patients(38 ears) initially, the recidivism rate was 18%(7/38), 48 patients(51 ears) underwent canal wall down mastoidectomy with tympanoplasty(CWD), the recidivism rate was 6%(3/51), the achieved rate of PTA was 68%(35/51).

Conclusion: ICW had the advantage which could preserve the physical structure of external auditory canal, however, the cholesteatomas in pediatric patients are more wide spread and erosive. The surgery should completely remove the diseased tissues and then preserve the hearing. Surgical techniques should be depending on the lesions extension, generally the tympanoplasty with open technique was more suitable.

Objective: To discuss the best strategy in surgical treatment for middle ear cholesteatoma in pediatric patients.

Method: A retrospective analysis of all cases of pediatric primary acquired cholesteatoma aged 6–14 years old between May, 2005 and August, 2009 was conducted. 86 patients(89 ears) were treated and followed from 1 to 7 years[the average is (3.8 ± 2.5) years].

Result: During the follow-up, intact canal wall mastoidectomy with tympanoplasty(ICW) was the primary surgical treatment in 38 patients(38 ears) initially, the recidivism rate was 18%(7/38), 48 patients(51 ears) underwent canal wall down

mastoidectomy with tympanoplasty(CWD), the recidivism rate was 6%(3/51), the achieved rate of PTA was 68%(35/51).

Conclusion: ICW had the advantage which could preserve the physical structure of external auditory canal, however, the cholesteatomas in pediatric patients are more wide spread and erosive. The surgery should completely remove the diseased tissues and then preserve the hearing. Surgical techniques should be depending on the lesions extension, generally the tympanoplasty with open technique was more suitable.

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ID: IP230

MicroRNA-17 Control Osteoclasts Through RANKL Targeting in cholesteatoma

Presenting Author: **Chen Xiaohua**

Chen Xiaohua, Qin Zhaobing
The First Affiliated Hospital of Zhengzhou University

Learning Objectives:

Objective: Cholesteatoma is characterized by an extraordinary extensive bone destruction in the middle ear and mastoid cavities. MicroRNAs (miRNAs) are posttranscriptional regulators of gene expression. The goal of this study was to investigate the posttranscriptional regulatory effects controlling bone destruction in cholesteatoma. Specifically, the potential role of microRNA-17 is to control osteoclasts through RANKL targeting in cholesteatoma.

Methods: Cholesteatoma, taking from patients at the time of surgery, were processed for RNA and protein extraction. Specimens of cholesteatoma and normal post-auricular auditory skin served as the control. Real-time reverse-transcription polymerase chain reaction was used to assess the expression levels of microRNA-17. Also, western blot analyses were used to assess microRNA-17's downstream target protein.

Results: MicroRNA-17 showed a down-regulation in cholesteatomas compared to normal skin. MicroRNA-17 showed 2.75 fold higher in expression in skins as compared to cholesteatomas ($P = 0.019$). The downstream target of miRNA-17, RANKL protein, was found to greatly increase in cholesteatomas.

Conclusions: This study specifically identified the down-regulation of miRNA-17 concurrent with the up-regulation of the receptor activator of NF-[Kappa]B ligand (RANKL), which activates osteoclasts and plays a significant role in the mechanism of bone destruction in cholesteatoma.

The results give a partial explanation for the more extensive bone destruction in the middle ear and mastoid cavities which has been observed in cholesteatoma.

doi:10.1017/S0022215116007271

ID: IP231**middle ear mucosal regeneration by nasal mucosal epithelial cell sheets transplantation**Presenting Author: **Yuichiro Yaguchi**Yuichiro Yaguchi¹, Kazuhisa Yamamoto²,
Tsunetaro Morino², Hiromi Kojima²¹St. Marianna University School of Medicine,²Jikei University School of Medicine*Learning Objectives:*

Postoperative regeneration of the middle ear mucosa and pneumatization of the middle ear cavity are of great importance after middle ear surgery. This study developed a new method to transplant autologous nasal mucosal epithelial cell-sheets into the damaged middle ear cavity. The aim of this study was to evaluate postoperative healing after the transplantation of the cell sheets in rabbits. Rabbit nasal mucosal epithelial cell-sheets were fabricated from a temperature-responsive culture dish and transplanted into the damaged middle ear of rabbit, which was surgically created. The healing of middle ears was evaluated with histological methods and computed tomography findings at 8 weeks after transplantation. Functional evaluation was performed by measuring the maximum middle ear total pressure reflecting a trans-mucosal gas exchange function. Two control groups were used: the normal control group and the mucosa-eliminated control group. Transplantation of nasal mucosal epithelial cell-sheets suppressed the bone hyperplasia and the narrowing of pneumatic space in the middle ear cavity more clearly than the mucosa-eliminated control group. The mucosal gas exchange function was also found to be good in the cell sheet-transplanted group. These results suggested that posttransplanted middle ear cavity was not only morphologically but also functionally similar to the normal middle ear cavity. Nasal mucosal epithelial cell-sheet was confirmed to be useful as an effective graft material after middle ear surgery and hopefully become a novel therapy in the future.

doi:10.1017/S0022215116007283

ID: IP232**KGF controls on the epithelial stem/progenitor cell proliferation in external auditory canal**Presenting Author: **Tomomi Yamamoto-fukuda**Tomomi Yamamoto-fukuda¹, Haruo Takahashi²,
Hiromi Kojima¹¹Department of Otorhinolaryngology Jikei University School of Medicine, ²Department of Otolaryngology-Head and Neck Surgery, Department of Translational Medical Science, Nagasaki University Graduate School of Biomedical Sciences*Learning Objectives:*

Introduction: The epidermal basal stem/progenitor cell maintains homeostasis of epidermis under development, self-renewal and differentiation. In many cases of adult basal stem/progenitor cell regulation, the importance of extracellular signals provided by the surrounding cells are well recognized. Keratinocyte growth factor (KGF) is a mesenchymal-cell-derived paracrine growth factor that specifically participate in tissue development as well as wound repair. In this study, we investigated the effects of over-expressed KGF during epithelial cell proliferation and differentiation by using a cell labeling system.

Methods: After anesthetized ICR mouse Flag-hKGF cDNA driven by a CMV14 promoter was transfected into ear skin with electroporation. The ears with empty vector transfection were used as controls. 5-bromo-2'-deoxyuridine (BrdU) and 5-ethynyl-2' deoxyuridine (EdU) were administered at different time points before or after KGF expression vector transfection to identify stem cells or progenitor cells, which are believed to divide slowly or to segregate chromosomes asymmetrically. At 1, 4 and 7 days after vector transfection, 3 mice at each time-point were sacrificed. The paraffin sections were used for H&E and immunohistochemistry for Flag, KGF, BrdU and cytokeratin (CK)14. EdU staining was performed according to the manufacturer's protocol (Life Technologies).

Results: Each plasmid was transfected into the epithelial and subepithelial cells, successfully. After KGF transfection, keratin accumulations were observed 3 of 3 ears at 4 days. BrdU(+)EdU(+) cells (stem/progenitor cell) were detected in the upper layer of thickened CK14 positive epithelium in KGF transfected specimens at 4 days.

Conclusions: These findings indicated that KGF overexpression may possibly increase stem or progenitor cell proliferation and block terminal differentiation, resulting in epithelial hyperplasia and stratification.

doi:10.1017/S0022215116007295

ID: IP233**Middle Ear Mucosal Regeneration by tissue-engineered cell sheets transplantation**Presenting Author: **Kazuhisa Yamamoto**Kazuhisa Yamamoto, Tsunetaro Morino, Takanori Hama,
Yuichiro Yaguchi, Hiromi Kojima

Jikei University School of Medicine

Learning Objectives:

Introduction: Recurrence of cholesteatoma is mainly caused by poor mucosal regeneration in the middle ear cavity and mastoid cavity. If middle ear mucosa can be preserved and the rapid postoperative regeneration of mucosa on the exposed bone surface can be achieved after middle ear surgery, surgical treatment for otitis media including

cholesteatoma can be potentially improved. Conventional canal wall up tympanoplasty often results in a lack of mucosal regeneration in the resected area of the mastoid cavity. We developed a novel method combining canal wall up tympanoplasty and autologous epithelial cell sheet transplantation for postoperative regeneration of the middle ear mucosa.

Methods: We obtained the approval of the ethics committee of our institution and the Ministry of Health, Labor, and Welfare. We endoscopically removed an approximately $10 \times 10\text{-mm}^2$ nasal mucosal tissue from her inferior concha. Tissue-engineered autologous nasal mucosal epithelial cell sheets were fabricated by culturing the harvested cells using temperature-responsive culture dishes for 26 days in an aseptic environment in a good manufacturing practice (GMP)-compliant cell processing center (CPC). The cultivated cell sheets were transplanted, during canal wall up tympanoplasty, onto the exposed bony surface of the attic of the tympanic and mastoid cavities where the mucosa was lost.

Results: During the cultivation, the sterile environment in the CPC was confirmed. Autologous cell sheets were successfully transplanted to human middle ear. We have already clinically applied cell sheets to treat 5 patients of middle ear cholesteatoma. All patients showed a favorable postoperative course, with no adverse events or complications.

Conclusion: This is a first-in-man study in the world that the cultured cells were transplanted to the human ear. This novel technology of transplantation might be an effective alternative to the surgical operation on intractable otitis media in the near future.

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ID: IP234

Practicality Analysis of JOS Staging System for Cholesteatoma Secondary to a Pars tensa Perforation: Japan Multicenter Study (2009–2010)

Presenting Author: **Yutaka Yamamoto**

Yutaka Yamamoto¹, Tustuya Tono², Hiromi Kojima¹, Yuka Morita³, Masafumi Sakagami⁴, Yasuo Mishiro⁴, Taeko Okuno⁵, Yasuyuki Hinohira⁶, Keiji Matsuda², Sho Hashimoto⁷

¹Jikei University School of Medicine, ²Miyazaki University, ³Niigata University, ⁴Hyogo College of Medicine, ⁵Mitsui Memorial Hospital,

⁶Kamio Memorial Hospital / Syowa University,

⁷National Sendai Medical Center

Learning Objectives:

Introduction: Primary cholesteatoma generally arises from retraction of the squamous epithelium of the tympanic membrane (TM). However, in rare cases, epithelial invasion occurs from the edge of the TM perforation and migrates to the medial surface of the TM. In such cases, a thick

TM, blunt perforation edge, and discharge of debris from the medial side of the TM are often observed. In this paper, the clinical features of the cholesteatoma secondary to a pars tensa perforation were evaluated and the pathogenesis of the disease was discussed.

Methods: A total of 599 ears that underwent surgery for fresh cholesteatoma between 2009 and 2010 at 6 institutions in Japan were recruited and cases with cholesteatoma secondary to a pars tensa perforation were selected. The criteria of the disease were defined as follows; a TM perforation in the pars tensa, continuous epithelial invasion from the perforation edge to the back side of the TM, and no adhesive lesion directly between the TM and promontrium. Incidence of the disease and clinical characteristics were evaluated retrospectively.

Results: Twenty-three ears of 23 patients with cholesteatoma secondary to a pars tensa perforation were identified. Incidence of the disease was 4.1 % of all of the cholesteatoma cases or 5.2 % of all of the acquired cholesteatoma cases. Characteristics of the disease were represented as following; high incidence in elder women, low rate of undeveloped mastoid air cell system, severe destruction of the stapes, and complex extension pathway.

Conclusions: The pathogenesis of cholesteatoma secondary to a pars tensa perforation is very different from that of other types of cholesteatoma. This disease should be clearly categorized as a different type of cholesteatoma and we need to recognize the nature and behavior of this disease. Additional storage of the data and detailed analysis by the multicenter study should be continued.

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ID: IP235

Auditory test battery for the ear surgery and the postoperative evaluation

Presenting Author: **Youko Yamazaki**

Youko Yamazaki, Taeko Okuno, Yuko Hata
Mitsui Memorial Hospital

Learning Objectives: Auditory test battery.

Hearing result of the ear surgery is important for the quality of life of the patients. Pure tone audiometry, speech audiometry, and the Eustachian tube function test are done for cholesteatoma patients and chronic otitis media ear patients in our hospital.

We studied the preoperative and postoperative hearing result of the patients from the view point of quality of life.

Case: 75 year-old female. She had the drained ear on both side from her childhood. She noticed hearing impairment when she was 74 years old. She also had discharge of the ear and visited ENT doctor. She was diagnosed that she had chronic otitis media ear on both side and ENT doctor recommended her surgical intervention.

She visited our hospital. She had large perforation on both side and the pure tone audiometry showed mixed hearing

loss on both side. Pure tone average was 38.3 dB on right ear and 63.8 dB on left ear. The speech audiometry showed 100% (60 dB) on the right and 100% (100 dB) on the left. The Eustachian tube function were normal.

Tympanoplasty was done on the right ear first and on the left ear half year after.

The pure tone average improved to 20 dB on the right ear and 30 dB on the left ear.

She used the hearing aid for the left ear before the operation, but not used it after the operation. It shows the patient does not have the handicap in dairy conversation.

Hearing improvement affect not only the dairy life activity but social life activity.

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ID: IP236

Three cases of intracranial infection due to middle ear cholesteatoma

Presenting Author: **Hiroaki Yazama**

Hiroaki Yazama¹, Yasuomi Kunimoto¹, Kensaku Hasegawa², Junko Kuya¹, Hiromi Takeuchi¹

¹Faculty of Medicine, Tottori University,

²Nippon Medical School

Learning Objectives:

Introduction: Cholesteatoma can erode and destroy important structures within the temporal bone, thus it can cause the spreading of intracranial infections. We will describe three otogenic infectious cases by their routes of infection.

Case:

case 1: A 69-year-old man was treated for meningitis at another hospital. He was introduced to our hospital for further survey. We found meningitis caused by cholesteatoma, then we performed a tympanoplasty. Cholesteatoma eroded some parts of the temporal bone, and the otitis interna seemed to be a cause.

case 2: A 28-year-old man was introduced to our hospital because of temporal abscess. A CT revealed an area of low density in the middle ear associated with a bony defect at a part of the sigmoid sinus, and we found sinus-thrombosis around that area. Then we performed a tympanoplasty, and need to treat it with antibiotics for 2 months.

case 3: A 60-year-old man was treated for a brain abscess at another hospital. He was introduced to our hospital because cholesteatoma was pointed out. We performed a tympanoplasty and an abscess drainage, then continued to treat it with antibiotics for 4 months.

Discussion: Concerning the routes of otogenic intracranial infection, there are three routes: otitis interna, a direct invasion through the eroded temporal bone and a hematogenous infection such as phlebitis of meningeal veins. In all cases, it is important to remove the primary disease and continue treatment with the effective antibiotics. But in certain cases, performing an abscess drainage was also required. We decide the indication for surgery depending on the patients' condition and a proposal from the neuro-surgeon.

For our patients, a tympanoplasty was performed first because their conditions were stable due to the antecedent treatment.

Conclusions: It is controversial when to operate for cholesteatoma with intracranial complications. The appropriate treatment should be required in accordance with the condition.

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ID: IP237

Differences in clinical features between cholesteatoma in external auditory meatus and middle ear

Presenting Author: **Qing Ye**

Qing Ye¹, Yihong Wang¹, Zenglin Wang¹, Binbin Teng²

¹Fujian Medical University Fujian Provincial Hospital, ²Fujian Provincial People's Hospital

Learning Objectives:

Objective: Differences in clinical features, especially facial nerve canal lesion between cholesteatoma in external auditory meatus and middle ear were compared.

Method: A retrospective clinical analysis was made. Clinical data included 125 cases of middle ear cholesteatoma with facial nerve canal lesion and 28 cases of cholesteatoma occurred in external auditory canal from Jan. 2003 to Aug. 2014 in our hospital.

Results: Clinical course of cholesteatoma in external auditory canal was 4.97 ± 7.51 years, course of middle ear cholesteatoma was 16.60 ± 14.42 years ($P < 0.01$). 21 cases (75%) of external auditory canal cholesteatoma were manifested as pneumatic mastoid and 110 cases (88%) of middle ear cholesteatoma were manifested as diploic mastoid respectively. 22 cases (78.6%) of facial nerve canal damage in mastoid segment in cholesteatoma of external auditory meatus and 76 cases (60.8%) of facial nerve canal damage in tympanic segment in cholesteatoma of middle ear were observed ($P < 0.01$). The incidence rate of ossicular erosion in middle ear cholesteatoma was significantly higher than that in external auditory meatus ($P < 0.01$). The incidence of semicircular canal defects in middle ear cholesteatoma (30.4%), was significantly higher when compared to the incidence (10.7%) in cholesteatoma of external auditory meatus ($P < 0.05$).

Conclusion: The sites of facial nerve canal lesion in middle ear cholesteatoma and cholesteatoma of external auditory meatus were different. More attention should be paid before and during operation to avoid facial nerve injury, including physical examinations, especially otologic exams, radiological reading and careful operation.

doi:10.1017/S0022215116007349

ID: IP238**Clinical Significance of Sensorineural Hearing Loss in Pediatric Chronic Otitis Media**Presenting Author: **Noam Yehudai**

Noam Yehudai, Michal Luntz

*Bnai Zion Medical Center, Technion – The Bruce Rappaport Faculty of Medicine, Haifa, Israel**Learning Objectives:* to promote awareness to the long term effects of chronic OM in terms of SNHL.*Introduction:* Hearing loss is considered a common complication and sequela of chronic otitis media (COM). The loss is usually conductive, but sensorineural involvement also occurs. Clinically significant sensorineural hearing loss (SNHL) has been reported in adults with COM; however its significance in children is still unclear. The aim of the study is to assess the severity of SNHL in single sided COM, in a group of children, using the contra-lateral healthy ear as a control and to define risk factors for the development of SNHL in COM. Characterizing these risk factors will assist in better defining treatment indications for COM and thus reduce the occurrence of SNHL.*Methods:* The study cohort included 124 children with unilateral COM operated between 1997 and 2010. Mean age at surgery was 13.3 ± 3.2 years (range, 7–18 years), and mean duration of disease was 88.4 ± 45.0 months (range, 6–192 months). Bone conduction (BC) pure tone average (PTA) of the two ears was calculated as the average of BC thresholds at 500, 1000, 2000 and 4000 Hz. The parameters evaluated included: demographics (age, sex, and side), duration of disease, presence and location of cholesteatoma, previous otologic history and previous ear surgery.*Results:* A statistically significant difference in BC-PTA was found between the diseased ear (12.74 ± 8.75 dB) and the healthy ear (9.36 ± 6.33 dB) ($p < 0.01$). Statistically significant correlation was found between the level of SNHL in the diseased ear, age and the presence of cholesteatoma.*Conclusions:* One of the complications of chronic COM is the development of SNHL in addition to conductive hearing loss. It is imperative to actively treat COM patients in order to prevent the expected development of SNHL. An insistent approach to patients presenting with these factors is mandatory since they are prone to develop a more severe form of SNHL.

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ID: IP239**Rat Mastoid Bullae Obliteration Using Hydroxyapatite/Chitosan Patch**Presenting Author: **Keun-Ik Yi**

Keun-Ik Yi

*Pusan National University Hospital**Learning Objectives:**Purpose:* Canal wall down mastoidectomy is often performed to prevent recurrence and complete removal of lesion in the treatment of otitis media with cholesteatoma. In this case, however, several problems can be caused to the mastoid cavity. Therefore to improve the long term stability of the mastoid cavity and to eliminate the cavity related problems significant modifications were introduced such as the mastoid obliteration technique using various methods including bone, cartilage, fat, flaps and others. This study evaluated the effectiveness of hydroxyapatite/chitosan patch (HAp/Chi patch) known as the new materials to promote osteogenesis for mastoid obliteration in animal model.*Materials and Methods:* Sprague-Dawley rats underwent mastoid obliteration using hydroxyapatite powder (Mimix[®]), cartilage and HAp/Chi patch in each five ear. CT (computed tomography) and mastoid tissue sampling was done after twelve weeks. And we evaluated the degree of osteogenesis and inflammation of tissue.*Results:* The mastoid cavity in HAp/Chi patch group was best filled in CT findings. In the histopathological aspects of the osteogenesis and inflammation, it exhibited 7.5%/20%, 28%/3% and 25%/50% in the group of cartilage, hydroxyapatite powder and HAp/Chi patch group, respectively.*Conclusions:* HAp/Chi patch is less absorbent, better to fill the mastoid cavity and more induce osteogenesis than the other obliteration material. But the degree of inflammation in HAp/Chi patch group is highest. It may be necessary to secure the stability of the mastoid obliteration material through additional experiments.

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ID: IP240**Facial Paralysis in Chronic Otitis Media with Cholesteatoma**Presenting Author: **Nadir Yildirim**Nadir Yildirim¹, Sinan Aksoy², Sermin Tok³¹Dumlupinar Universitesi Medical Faculty, ²DPU Medical Faculty Department of ORL-HNS, ³Mersin University Department of Radiology*Learning Objectives:**Objective:* Facial paralysis is a rare and drastic complication of chronic otitis media and middle ear cholesteatoma. The predisposing factors that lead to facial nerve paralysis in

cholesteatomatous ears are still obscure. Herewith, we aimed to investigate the possible etio-pathogenesis of facial paralysis in our cholesteatoma cases.

Material and Methods: We retrospectively reviewed the charts of 5 facial nerve paralysis cases that were connected to co-existing chronic otitis media with cholesteatoma and compare our findings with reported case series in literature. The duration and degree of facial paralysis, temporal bone CT findings including the size of the mastoids, dehiscence of the fallopian canal and other accompanying radiological abnormalities such as semicircular canal dehiscence, and intraoperative findings were noted.

Results: In the years of 2014–2015 we admitted 156 primary of recurring cases of middle ear cholesteatoma in our clinic, 5 (3.2%) of which also had associated facial paralysis. This percentage was comparable to those of reported series. Of those patients, 2 of whom had already been operated with canal wall-down (CWD) technique years ago for cholesteatoma that recurred. According to House-Brackmann (H-B) classification, one patient had grade 5, one patient grade 4, two patients grade 3 and one patient grade 2 paralyses. All three previously unoperated cases had relatively smaller mastoids and lateral semicircular canal (LSSC) dehiscence, detected either on CT and/or perioperatively. Fallopian canal dehiscences were in tympanic segment in 3 and in mastoid segment in 2 of the patients. All patients were operated with CWD technique as to include facial canal decompression. All but one paralyses were regressed to either HB-1 (3 cases) or HB-0 (1 case) grades postoperatively.

Discussion and Conclusion: It appears that previously existing facial canal dehiscence and small mastoids predisposes both facial canal and LSSC erosion in untreated chronic otitis media with cholesteatoma as to result in facial nerve palsy.

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ID: IP241

Randomized clinical trial for partial canal wall preserved masto tympanoplasty

Presenting Author: **Xin Ying**

Xin Ying, Song Weiming
Peking University

Learning Objectives:

Objective: To study and evaluate the outcome of partial canal wall preserved masto tympanoplasty (PCM) for chronic otitis media with cholesteatoma and/or granulation tissue.

Methods: Thirty-nine patients were randomly divided into two groups. 20 patients underwent PCM, 19 patients underwent canal wall down masto tympanoplasty (CWD). All of the patients had a follow-up period of 5 years.

Results: All the patients in the two groups underwent the operation successfully and no intraoperative or postoperative complications were found. The mean time of drying of cavity was 6 weeks (4–8 weeks) in the PCM group, while it was 8 weeks (6–10 weeks) in the CWD group. The cavity in the PCM group were near normal or slightly larger than the external auditory canal, and the tympanic flaccid part slightly wider than normal, patients could able to wear traditional hearing aids. The patients need cavity cleaning less than 1 times a year in the PCM group and 3–4 times a year in the CWD group. The surgery cavity volume was 1.4 + 0.2 ml in the PCM group and 2.6 + 1.1 ml in the CWD group ($P < 0.05$), the difference was statistically significant. There were 8 patients (40%) improved hearing level (threshold improved > 10 dB) 5 years after operation in the PCM group and 6 patients (32%) in the CWD group, no statistically significant difference. 1 patient (5%) developed a recurrent cholesteatoma which was located in the attic and 4 patients (20%) developed retraction pockets in the attic in the PCM group, while 3 patients (15.8%) developed cavity problem that the epithelial accumulation were not easy to clean in the CWD group, no statistically significant difference.

Conclusion: With PCM technique, cholesteatoma could be completely and safely removed from the middle ear, and patients had near normal postoperative external auditory canal. Therefore, PCM was a reasonable choice for the surgery of otitis media with cholesteatoma and/or granulation tissue.

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ID: IP242

Ossicular Anomaly and Endolymphatic Hydrops as Risk Factors for Complications after Ossiculoplasty

Presenting Author: **Tadao Yoshida**
Tadao Yoshida¹, Satofumi Sugimoto², Michihiko Sone²

¹Nagoya University Graduate School of Medicine, ²Department of Otorhinolaryngology, Nagoya University Graduate School of Medicine

Learning Objectives:

We report a case of endolymphatic hydrops with an ossicular anomaly, in which a hearing test showed fluctuating mixed hearing loss. A 42-year-old man with hearing impairment had experienced varying ear symptoms on his right side since elementary school. Evaluation by computed tomography showed an ossicular anomaly, and magnetic resonance imaging revealed endolymphatic hydrops in the symptomatic ear. Ossiculoplasty or stapes surgery is considered in patients with conductive hearing loss; however, the existence of endolymphatic hydrops is a risk factor for surgical complications. Preoperative magnetic resonance imaging examination may be beneficial when evaluating inner ear conditions such as ossicular anomalies, especially in cases accompanied by fluctuating hearing loss.

doi:10.1017/S0022215116007398

ID: IP243**Management strategies of glomus jugular tumor**Presenting Author: **Yasheng Yuan**Yasheng Yuan¹, Fanglu Chi², Qiang Du², Weidong Zhao², Chunfu Dai², Jing Wang², Bing Chen²¹*EYE & ENT Hospital of Fudan University,*²*Department of Otolaryngology and Skull Base Surgery, EYE & ENT Hospital of Fudan University, Shanghai 200031*

Learning Objectives: Facial nerve management in the surgery Internal carotid artery management in the surgery Intracranial vascular bypass

As for the most challenging surgery of the lateral skull base, glomus jugular tumor resection is now safely controlled and managed. In this study we focused on the strategies of facial nerve and internal carotid artery management during glomus jugular tumor surgery, especially for the C and D stage tumor in which the internal carotid artery was severely involved and could not be easily separated. Furthermore we tried the extra-intracranial vascular bypass when the internal carotid artery could not be saved in the surgery, by which the mortality and intracranial complications were greatly reduced.

doi:10.1017/S0022215116007404

ID: IP244**Optotensometry – Development of an optic method for measuring tubal function by tympanic membrane movement in a middle ear model**Presenting Author: **Thorsten Zehlicke**Thorsten Zehlicke¹, Hans Georg Fischer², Mark Stamer³, Jörg Müller⁴, Hans Wilhelm Pau⁵¹*Armed Forces Hospital/ University of Hamburg,*²*Armed Forces Hospital/ University of Hmaburg,* ³*Hamburg University of Technology, Institute of Micro System Technology,* ⁴*Hamburg University of Technology, Institute of Micro System Technology,* ⁵*University of Rostock, ENT Department*

Learning Objectives:

Introduction: The amount of pressure in the middle ear depends mainly on the function of the Eustachian tube. Currently there are no continuous recording techniques measuring Eustachian tube function in clinical context and under physiological conditions over extended periods of time.

Purpose: In this paper we investigate the suitability of an active optic triangulation method on the basis of a projected

laser-point-pattern in measuring tympanic membrane movement during pressure variations in a middle ear model.

Material and Methods: For projection we used a green semiconductor laser with an output of 1 mW and a diffractive optical element (DOE). As our measured object we used purple latex-foil (Kimberley-Clark®), fixed airtight on the cut-off end of a 2 ml syringe-tube. The movement of the foils was measured by an active optic triangulation method. To simulate pathological variations of the tympanic membrane we prepared the latex-foils in specific ways. One foil was perforated and then covered again (simulating tympanic membrane perforation), another one was partly strengthened by sticking a piece of thick, hard paper to it from the inside (simulating calcification).

Results: The test-setup, as well as the appliance of pressure-changes worked fine and measurement of foil movement in all the modified foil surfaces was possible. This shows that it is possible to record foil-movement with this system even in tympanic membranes with pathological variations. Recording tympanic membrane movements in the temporal bone model need a different set up of the measuring system.

Conclusions: In the course of this study we were able to show that it is possible to assess and record foil movement and tympanic membrane movements using a system of optic triangulation and to simulate different tympanic membrane pathologies. This could be used both in ENT medicine, as well as in aviation and diving medicine.

doi:10.1017/S0022215116007416

ID: IP245**Congenital Cholesteatoma of middle ear in children (14 cases experience)**Presenting Author: **Jie Zhang**

Jie Zhang, Jinsheng Hao, Min Chen, Wei Liu, Yang Yang, Xin Ni, Jun Zheng

Beijing Children's Hoapital, Capital Medical University

Learning Objectives:

Objective: To investigate the clinical features of Congenital Cholesteatoma (CC) of middle ear in children and provide methods for early diagnosis.

Methods: A retrospective chart review of 94 patients with a diagnosis of middle ear cholesteatoma, in Beijing Children's Hospital, between 2009 and 2015 was carried on. 14 patients with CC were identified using the criteria proposed by Levenson and Pariser, and were divided into two groups according to the course of disease. The main complaints, diagnostic methods and Potsic's stage of temporal bone CT findings were recorded.

Results:

1) 11/14 (78.57%) patients with CC were boys, with a median age of 7.20 years (from 3.33 to 10.17 years).

2) Hearing loss (13/14, 92.86%) was the most common complain. Finding methods included hearing test and CT scan (11/14, 78.57%), tympanotomy (2/14, 14.28%) and otoscopic examination(1/14,7.14%).

3) The preoperative Air-Bone conduction threshold Gap (ABG) was 40.46 ± 8.86 dB. According to the course of disease, patients with CC were divided into two groups (A 6/14, B 8/14). There was no significant difference in pre-operative ABGs (38.10 ± 7.43 dB & 42.09 ± 9.96 dB, $P = 0.427$).

4) According to Potts's stage among A, B groups($P = 0.043$).

5) Modified canal wall up mastoidectomy was the preferred procedure and 11/14 (78.57%) patients had this surgery done. In 6 patients followed up, the difference between pre-ABG and post-ABG(36.26 ± 5.56 dB & 21.70 ± 3.80 dB, $P = 0.004$) was significant.

Conclusion: CC of middle ear in children happened more in boys than in girls. Hearing loss was the most common complaint. The shorter was the course of disease, the less damage of the structure of middle ear would be. Hearing test, CT, tympanotomy and otoscopic examination were usually used for diagnosis.

doi:10.1017/S0022215116007428

ID: IP246

Bony Meatoplasty with Cartilage Reconstruction for External Auditory Canal Cholesteatoma: A Minimal Invasive Approach

Presenting Author: **Ke Zhang**

Ke Zhang, Tao Pan, Qingsong Liu, Jia Ke, Shaoxing Zhang, Furong Ma

Peking University Third Hospital

Learning Objectives:

Objective: To assess the outcome and advantage of bony meatoplasty with cartilage reconstruction (BMCR) for stage IV(M) external auditory canal cholesteatoma (EACC) with specific invasion in mastoid cavity.

Methods: Retrospective review of six cases of stage IV(M) EACC. Three cases followed by traditional canal-wall-down tympano-mastoidectomy. The other three underwent cartilage reconstruction of bony meatoplasty without radical mastoidectomy.

Results and Conclusion: The preoperative symptoms of all six patients were otalgia, ear fullness and hearing loss. All HRCT demonstrated external auditory canal (EAC) lesions invasion into mastoid cavity. The follow up was between 21 months to 54 months and no recurrence occurred on any of the six patients. It was observed that the patients underwent bony meatoplasty with cartilage reconstruction could also achieve the result of eradicate the disease process. Moreover, compared with the traditional radical operation, BMCR was a minimal invasive approach that maintained the normal structure of EAC and shortened the

healing time. The patients underwent BMCR also demonstrated better hearing and quality of life.

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ID: IP247

Influence of cystic tumor degeneration on management strategy in vestibular schwannoma

Presenting Author: **Zhihua Zhang**

Zhihua Zhang, Zirong Huo, Qi Huang, Zhaoyan Wang, Jun Yang, Hao Wu

Department of Otolaryngology Head & Neck Surgery, Xinhua Hospital Shanghai Jiaotong University School of Medicine, Shanghai Key Laboratory of Translational Medicine on Ear and Nose diseases, Ear Institute Shanghai Jiaotong University, Shanghai 200092, China

Learning Objectives:

Objective: In this study, we focused on the influence of cystic tumor degeneration on management strategy of vestibular schwannoma.

Methods: The patients with vestibular schwannomawhowere operated at our center from 2006 January to 2013 December were retrospectively analyzed. There were 96 patients having sporadic cystic vestibular schwannomas, recognized by the presence of cystic components both on the preoperative magnetic resonance imaging and intraoperatively, were included. And 96 random cases with solid vestibular schwannomas were used as a control group. The clinical, operative feature and surgical outcomes were reported.

Results: Cystic vestibular schwannomas are associated with rapid growth, worse hearing level (94.8% of patients with hearing level in class C or D) and more frequent onsets of sudden hearing loss than solid tumor. The longterm good facial nerve function rate in cystic tumor is worse than that in solid tumor because of strong adhesion between tumor capsule and facial nerve (30.2% vs 44.8%, $p = 0.037$). There was no significant difference in complications, mortality and recurrence.

Conclusion: Surgical resection should be the preferred management strategy for cystic vestibular schwannomas. Physician should inform patient with cystic tumor. In case of difficult dissection in peripheral thin wall cystic tumor, near total tumor resection is suggested for protection of facial nerve function and quality of life.

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ID: IP248

Hearing restoration for adults with vestibular schwannoma in the only-hearing ear: ipsilateral, contralateral or bilateral cochlear implantation?

Presenting Author: **Zhihua Zhang**

Zhijia Zhang, Zirong Huo, Qi Huang, Zhaoyan Wang, Jun Yang, Hao Wu

Department of Otolaryngology Head & Neck Surgery, Xinhua Hospital Shanghai Jiaotong University School of Medicine, Shanghai Key Laboratory of Translational Medicine on Ear and Nose diseases, Ear Institute Shanghai Jiaotong University, Shanghai 200092, China

Learning Objectives:

Objective: To explore auditory outcome of cochlear implantation (CI) performed in patients diagnosed with vestibular schwannoma (VS) in the only-hearing ear.

Patients and methods: A retrospective analysis of three cases is carried out. All study participants have a long history of hearing loss on the one side and a newly-presented symptom of a gradual hearing loss due to VS on the other side, who then received ipsilateral, contralateral or bilateral CI. Imaging examination and audiological tests were carried out before operation. Hearing outcomes were measured by the pure tone audiogram (PTA) and the open set speech discrimination score (SDS). Mean follow-up time was 18 months.

Results: During follow-up period, none of the three patients had a remarkable improvement in their speech recognition, whether got unilateral or bilateral CI. However, PTA showed positive results in all of the three cases, which conferred an awareness of environmental sounds and was an adjuvant to lip reading. The patient with bilateral CI showed significantly better performance on the open set speech perception compared to the other two patients with unilateral CI, especially in noise.

Conclusions: CI meets the goals of lower PTA, improved lip reading and perception of environmental sounds. However, SDS is not significantly improved after CI. Bilateral CI is more beneficial than unilateral CI on either side.

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ID: IP249

Retroauricular infections in patients with congenital aural stenosis

Presenting Author: **Yaying Zhu**

Yaying Zhu, Jing Shan, Ying Chen, Youzhou Xie, Tianyu Zhang

Eye, Ear, Nose and Throat Hospital of Fudan University

Learning Objectives:

Objectives: To identify the retroauricular infection occurring in patients of congenital aural stenosis (CAS) with those in first branchial cleft fistula. To reduce the misdiagnosis and make right treatments.

Design: Retrospective review.

Subjects: 105 CAS patients who underwent meatoplasty with canalplasty and/or tympanoplasty between Jan 2011 and June 2014.

Results: During the surgery, of the 105 patients, no cholesteatoma was found in 26 patients, age from 2 yr to 29 yr, the median age was 11 yr. Cholesteatoma of the external ear canal (EC) was associated in 79 patients, age from 2 yr to 45 yr, the median age was 10 yr. Of these 79 patients, 18 had retroauricular infections, age from 3 yr to 38 yr, the median age was 6 yr. Of the 105 patients, 2 patients had preauricular fistula, 3 had first branchial fistula, 4 patients with retroauricular abscess were misdiagnosed as the first branchial cleft fistula. The narrow external auditory meatus, computed tomography and magnetic resonance imaging made it easier to identify the two diseases. Drainage of the abscess was done at the first stage to control the infections for both diseases. The second stage of the operation was canalplasty for those CAS with EC. While for the first branchial cleft fistula, the surgeons paid more attention to the facial nerve.

Conclusion: The retroauricular infections occurring in CAS should be identified with the first branchial cleft fistula. The canalplasty of CAS associated with EC will get a satisfactory results even complicated with severe infections.

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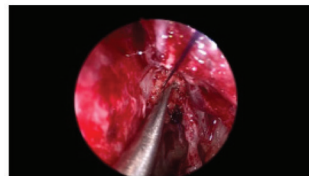
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