

Ladies and Gentlemen,
Dear Colleagues,

It is an honor and pleasure to welcome you to the 32nd Politzer Society Meeting in Warsaw, organized in conjunction with the 2nd World Congress of Otology under the auspices and direction of IFOS.

The scientific program of the meetings is very intensive – its five days are filled to overflowing with lectures, discussions, workshops, and sessions. We trust it will be a lively forum where participants from all corners of the world will have the opportunity to share their work and expertise and learn from others.

A major highlight of the program will be live demonstration surgeries, performed under my direction by one of the most experienced ENT surgical teams. We are keen to show you a wide range of different surgical cases and techniques, creating the opportunity to compare and learn from the similarities and differences in our approaches to specific surgical situations and decision-points.

We are happy to welcome to Warsaw the members of the Politzer Society and representatives of all national ENT societies represented by IFOS. We trust you will return home with abundant new insights and novel ideas for your research and clinical work.



Sincerely yours,

Prof. Henryk Skarżyński, MD, PhD, dr h.c. (multi)
President of the 32nd Politzer Society Meeting and 2nd World Congress of Otology

Invited Lectures

Innovations in tinnitus

Welling D.B.

Department of Otolaryngology-Head and Neck Surgery, Harvard Medical School and Massachusetts Eye and Ear, Massachusetts General, USA

Objectives: An invited review the current literature on tinnitus with a discussion on recent research and potential clinical application.

Materials: PubMed and anecdotal clinical experience.

Methods: a literature review.

Results: Over 6.000 manuscripts related to tinnitus have been published in the past decade. Progress is being made in the study of tinnitus with a number of tools including investigation of the underlying neural and physiologic networks, the confounding influence of other areas of cognitive and emotional input, and differentiation into subcategories of tinnitus. Emerging treatments include cortical reorganization, behavioral modification, transcranial magnetic and electrical stimulation, pharmacotherapeutics and somatic acoustic stimulators, among others. The lack of reliable biomarkers of tinnitus is problematic and as yet unsolved.

Conclusions: Increased understanding of the underlying pathophysiology of tinnitus is necessary for solid translational research to move forward in the treatment of tinnitus.

Patient-based outcomes assessment in Otolaryngology/Neurotology

Stewart M.G.

Department of Otolaryngology-Head & Neck Surgery, New York-Presbyterian Hospital, Weill Cornell Medical Center, New York, USA

Outcomes research is the study of the outcomes of different treatment, measured from the perspective of the patient. Outcomes include global and disease-specific quality of life, functional status, and health utility, and outcomes measurement can help facilitate cost-effectiveness assessments. Patient-based outcomes must be assessed using validated instruments. We will review the history of outcomes assessment in Otolaryngology, and present some validated patient-based tools available for use in Otolaryngology/Neurotology, and also discuss the results from important studies. We will also discuss objective outcome measures and the associations between patient-based and objective measures. We will also discuss which outcomes are most important in clinical research and patient care.

Keynote Lectures

A double-blind randomized controlled study on comparison of conventional versus total annulus excision technique for tympanoplasty: a novel approach

Singhal P., Verma N., Yadav R., Agarwal S., Sharma M.P.

Department of ENT, SMS Medical College, Jaipur, India

Objectives: To evaluate and compare total annulus excision (TAE) and conventional tympanoplasty (underlay) technique in terms of graft take up, hearing gains, complications if any and dry status.

Materials and Methods: A prospective double-blind randomized controlled interventional study at a tertiary care medical college center for 3 years.

Results: The results were compared for both the techniques in terms of graft take up, hearing gain(dB/AB closure), the status of TM/EAC and complications up to 6 months follow up.

Conclusions: Total annulus excision although may not sound palatable to most of the people but if we introspect the hypothesis and concept, we would certainly appreciate

this novel technique. The patients operated by TAE technique had better graft take-up rates, near normal AB closure and no discharge from neotympanum in most of the cases.

Beating the Drum – a new bioengineered tympanic membrane

Atlas M.D.

Ear Science Surgery, Subiaco, Australia

This presentation details the evolution of a bioengineered human tympanic membrane using modern cell biology and materials techniques. Chronic middle ear disease affects nearly 330 million people in the world but surgery is plagued by failure and recurrence due to multiple factors. An ideal reconstruction of the tympanic membrane must support cell growth but have particular biomechanical and acoustic properties whilst maintaining a complex 3D shape and ideally be transparent. We have studied the histology, cell biology, and genetics of the healing tympanic membrane and developed models of keratinocyte growth. Acoustic and biomechanical models have allowed testing of new materials. Innovative materials design with silk fibroin blends has allowed the creation of a biomaterial that possesses all of the qualities required

in chronic middle ear disease. A large multicentre trial begins next year.

Clinical performance of the Osia System – results from a prospective, international, multicenter clinical investigation

Mylanus E.¹, Arndt S.², Skarżyński P.H.³, Telian S.⁴, Briggs R.⁵

¹ Department of Otorhinolaryngology, Radboud University Medical Center, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands

² Department of Otorhinolaryngology, Universitätsklinikum Freiburg, Germany

³ Department of Oto-Rhino-Laryngology, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Department of Otorhinolaryngology, University of Michigan, Ann Arbor, USA

⁵ Department of Otorhinolaryngology, Royal Victorian Eye and Ear Hospital, Melbourne, Australia

Objectives: The Osia System is a new active transcutaneous bone conduction hearing implant indicated for patients with mixed hearing loss (MHL), conductive hearing loss (CHL) or single-sided sensorineural deafness (SSD). The system uses an implantable piezoelectric actuator that is surgically placed on the bone surface and fixated to the skull bone via an osseointegrating implant. The objective of this first clinical investigation of the new implant system was to evaluate audiological performance, patient-reported outcomes, and safety in an adult population.

Materials: The investigational device was the Osia System.

Methods: This was a prospective, international, multicentre clinical investigation conducted at five centers in Europe, USA, and Australia. Adult subjects with CHL, MHL up to 55 dB SNHL, or SSD were included in the study and were implanted unilaterally or bilaterally. Audiological evaluations included free-field hearing thresholds, adaptive speech recognition in noise and speech recognition in quiet. Audiological results were compared with unaided hearing and with a power sound processor on a Baha Softband tested pre-operatively. Patient-reported outcome measures included the *Health Utilities Index* (HUI3), the *Abbreviated Profile of Hearing Aid Benefit* (APHAB) and the *Speech Spatial and Qualities of Hearing Scale* (SSQ-12) questionnaires. Daily use was recorded. Surgical and safety parameters were collected and analysed. Primary performance evaluation was performed after 3 months of follow-up, and primary safety evaluation at 6 months post-surgery. The total study duration was 12 months.

Results: Fifty-one subjects were included in the study (37 subjects with CHL/MHL, 14 with SSD, 49 unilaterally and 2 bilaterally implanted). Statistically significant improvements compared to preoperative unaided hearing were recorded for all audiological tests: free-field audiometric thresholds (change in PTA4: -24.9 dB, $SD = 9.5$ dB; $p < 0.0001$), speech recognition in noise (change in SNR: -13.3 dB, $SD = 8.1$ dB; $p < 0.0001$) and speech in quiet (change in % correctly perceived words at 65 dB: 59.8

percent points, $SD = 27.1\%$; $p < 0.0001$). Results were also significant when analysed separately for the two subgroups CHL/MHL and SSD. Moreover, comparison to pre-operative softband tests showed statistically significantly improved audiological outcomes, with the largest differences observed in speech in noise tests and audiometric thresholds at high frequencies. Statistically significant improvements were observed on all questionnaires, including the comprehensive health state attribute of HUI3. The average daily use of the sound processor was high (mean 10.5 hours/day, $SD = 4.3$). Overall, postoperative healing was satisfactory, and few complications were reported. One implant was removed before sound processor loading due to post-surgical infection.

Conclusion: The results from the present investigation show that the Osia System is safe and provides significantly improved hearing performance and self-reported outcomes compared to the unaided situation in patients with CHL, MHL, and SSD.

Electric stimulation effect on tinnitus. Physiological new aspects in patients with sensorineural hearing loss

Ramos-Macias A.

Hospital Insular de Gran Canaria, Hospital Materno Infantil de Gran Canaria, Spain

Any model which considered the cochlea in isolation from the rest of the auditory pathway in relation to tinnitus is not now considered adequate, but there are situations where cochlear dysfunction has been implicated in tinnitus generation. Different theories have been proposed: spontaneous otoacoustic emissions. Discordant damage of inner ear cells and outer inner cells (Jastreboff) and also biochemical models.

Incidence of tinnitus in cochlear implanted patients is 66–86%, but some benefit has been widely reported (34 to 93%). Most studies use standard program optimized for speech and the changes in tinnitus pitch and timber following implantation reported attributed to surgical insertion of electrodes or even plastic changes in the auditory system caused by CI use.

We present the results that demonstrate that CI technology shows that patients with Unilateral Hearing Loss (UHL) and additional severe tinnitus handicap can effectively be treated with a cochlear implant and about 50% of the patients indicate tinnitus as primary reason for CI use and 50% indicate they use their CI for both hearing and tinnitus.

Facial nerve tumors: what you won't find in the books

Lassaletta L., Gavilan J.

Department of Otorhinolaryngology, La Paz University Hospital, Madrid, Spain

Facial nerve tumors (FNTs) are a relatively unusual cause of facial paralysis and include mainly schwannomas and hemangiomas. The general management of FNT is usually extrapolated from the approach to the more common facial nerve schwannoma. As a general rule, surgical resection with facial nerve repair is the standard management for patients with facial nerve function of House-Brackmann (HB) grade III or worse. In patients presenting with good facial nerve function, the majority of authors advocates initial observation. However, most information about FNTs is based on retrospective cases series or surgically excised tumors with the same pathology, not being useful for cases in which a preoperative diagnosis is unclear.

Main controversial topics regarding FNT are:

1. While some cases present characteristic clinical and radiological signs that suggest an FNT, it is not unusual that a certain diagnosis is not obtained with imaging, sometimes it is still unclear during surgery, and sometimes not even the pathological study is conclusive. Some lesions of the facial nerve may not be considered real tumors, although they appear so from radiological and surgical viewpoints.
2. The optimal timing for surgical planning is different from that of other facial paralysis causes, as traumatic or iatrogenic in which the starting point of a complete paralysis is usually well defined. Patients with FNT usually have progressive, or intermittent paralysis, sometimes even followed by total recovery. Preoperative presence and duration of the facial deficit represent the main prognostic factors that adversely affect the successful postoperative recovery. Therefore, deciding between observation and surgery, or among different re-innervation techniques in patients with FNT can be striking.
3. Depending on the type of tumor, the possibility of decompression or tumor resection sparing the facial nerve fibers may be considered.

In this presentation, the experience of a 15-year-old Facial Paralysis Unit with more than 40 cases of FNT will be presented. Main indications for observation vs surgery will be discussed, as well as the growing indication for radiation. Cases in which surgery is indicated despite good preoperative facial function will be explained. Patients with the most common schwannomas and hemangiomas will be shown with surgical tips for resection and grafting, or decompression if possible. Different re-innervation techniques will be described. Also, particular cases of neurofibroma, osteoblastoma, and facial nerve paraganglioma will be shown. Finally, cases with an inconclusive pathological diagnosis will be presented, emphasizing both their clinical and legal implications.

Immunology of the inner ear

Szczepek A.J.

Department of Otorhinolaryngology, Head and Neck Surgery, Charité - Universitätsmedizin Berlin, Corporate Member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health, Berlin, Germany

In the past, the inner ear was considered an immune-privileged organ. Pioneering observations of Rask-Andersen and Stahle as well as of Harris and colleagues changed this view in the eighties by demonstrating the presence of leukocytes and macrophages in the endolymphatic sac and by showing the capacity of the inner ear to participate in mounting an immune response. Immune processes were connected with the Autoimmune Inner Ear Disease (AIED) and with Meniere's disease. However, until recently, little was known about the steady-state presence of immune cells in the inner ear and 'most importantly' about their role in inner ear biology. During this lecture, various types of immune cells that were determined to reside in the inner ear will be presented and their possible role in the inner ear physiology and pathology will be discussed.

Jugular foramen surgery: pre-operative management and surgical advances

de Brito R.

Otorhinolaryngology Department - University of Sao Paulo, HRAC - University of Sao Paulo, Brazil

The jugular foramen is one of the most challenging anatomic regions for any skull base surgeon. The Infratemporal type A approach is the classic option to reach safely the foramen and control the venous drainage and carotid artery, but it is not enough in many situations where the tumor spreads intradural or to the clivus region. Regarding the high number of potential cranial nerve sequels and the difficult control of the carotid artery, many physicians prefer radiotherapy as an option to the surgery for most cases. We have been performing a modified infratemporal type A. Approach for many years, with modifications that protect both the facial nerve and lower cranial nerves with very few sequels. As the concern regarding the carotid artery, good preoperative evaluation and management give us a safe surgery. Our objective in this lecture is to discuss all aspects of the modifications and achievements for jugular foramen surgeries.

Management of infections developing in children with cochlear implants

Kaplan D.M.

Department of Otolaryngology-Head and Neck Surgery, Soroka University Medical Center and the Faculty of Health Sciences, Ben Gurion University, Negev, Israel

The management of chronic middle ear infections that develop in children after cochlear implants (COMCI) is a serious challenge. Patients may present, any time after surgery, with otorrhea, or perforation may be seen on

routine exam. Except for the risk of meningitis, such patients are at high risk for losing the possibility to stimulate the cochlear nerve due to intracochlear infection. Presented are 10 patients with COMCI. The talk will focus on the management and the outcomes of four patients with the suppurative disease and two with cholesteatoma, that required preforming a subtotal petrosectomy (STP) and cutting of the implant, with revision surgery and reimplantation at a later stage.

For the primary and secondary prevention of COMCI, the following principles are recommended:

1. Assurance that the tympanic membrane is intact at the end of surgery.
2. Tight follow-up of any children with inadvertent perforation or injury to the posterior annulus, and of patients with ventilation tubes.
3. Meticulous microscopic treatment of any implanted ear with otorrhea. When required, debridement and cautery under general anesthesia.
4. Failure of the previous step requires cutting the implant in the tympanic cavity and performing an STP with second stage reimplantation.
5. Tympanoplasty via endaural approach, for any dry perforation.

Necrotizing otitis externa – experience from a single center with 85 patients

Kaplan D.M.

Department of Otolaryngology-Head and Neck Surgery, Soroka University Medical Center, Beer Sheva, Israel

The talk will discuss the perplexing entity of necrotizing otitis externa (NOE). Define unclear issues in NOE from the literature, such as the diagnosis, the role of fungi and whether they cause a different disease in comparison to that of *Pseudomonas Aeruginosa*. Highlights of several studies of our group, with over 85 patients with NOE.

1. General characteristics and outcome.
2. Radiological characteristics of different causative agents
3. The role of surgery
4. The relation of diabetic control and the course of the disease

New trends in occupational noise-induced hearing loss

Śliwińska-Kowalska M.

Department of Audiology and Phoniatrics, Nofer Institute of Occupational Medicine, Lodz, Poland

Noise exposure through lifespan is one of the main causes of hearing loss. The highest risk of noise-induced hearing loss (NIHL) is related to exposures in the workplace and affects about 7% of the population. Occupational NIHL is irreversible, thus prevention must be the priority. Although current hearing conservations programs (HCP) have been shown to be very beneficial, the incidence of occupational NIHL is still high, reaching about 18% of overexposed workers. The presentation overviews recent research on the effects of noise on hearing in pursuit of more effective methods for the prevention of occupational NIHL. Lecture discusses the translational significance of noise-induced cochlear neuropathy shown recently in animals and the concept of hidden hearing loss in relation to current NIHL damage risk criteria. The anticipated advantages of monitoring the incidents of temporary threshold shift (TTS) in workers exposed to a high level of noise will be analyzed in regard to preclinical diagnostics of NIHL, i.e. at the stage when hearing loss is still reversible. The challenges, such as introducing speech in noise audiometry and TTS computational predictive model into HCP will be discussed. Finally, the presentation will underscore the need to develop personalized medical guidelines for NIHL prevention with accounting for several NIHL risk factors other than these included in the ISO 1999:2013. Implementing the steps mentioned above would presumably further reduce the incidence of occupational NIHL, as well as associated social costs.

Status of otological training in India

Goyal A.¹, Choudhury B.¹, Kaushal D.¹, Soni K.¹, Patro S.K.¹, Gugliani A.¹, Sharma P.P.²

¹ *Department of Otorhinolaryngology, All India Institute of Medical Sciences, Jodhpur, India*

² *Department of Community Medicine & Family Medicine, All India Institute of Medical Sciences, Jodhpur, India*

Objectives: There exist vast disparities in otological training in the world with no uniformities. The difference is guided by their population base as well as resources available, apart from their individual needs. Even in developing countries, disparities exist among them. India, being a vast and diverse country and having difference funding mechanisms for Medical Colleges, disparities do exist.

The status of training in any country defines the kind and level of care the needy patients get. It holds true not only for super specialized services like Cochlear Implants and Skull Base surgeries but probably more relevant to grass root care at the level of Primary Health Centres and neighborhood centres. In view of these facts, we evaluated the current status of otological training in India.

Materials and Methods: After obtaining clearance from our Institutional Ethical Committee, an online survey was conducted with a well-structured questionnaire. No identifier was tagged to the responses to remove any bias. The respondents were classified into three groups – E.N.T. Teaching faculties, E.N.T. Residents and Private Consultants. According to their response group, the questions were disclosed to them.

Results: Over 500 total responses were received. The results were statistically analysed according to their centre type, training facilities available to their centres, otological case load and their feedback. The cause analysis was also attempted to explain the differences. Few interesting observations emerged from the study.

Conclusions: The diversity of India is well reflected in the otological training scenario. Though it has improved significantly in the last two decades, there is still scope for further improvement in certain areas. Proposal to remove the disparities is also discussed.

Surgical management of complicated cholesteatoma

Goyal A.¹, Choudhury B.¹, Kaushal D.¹, Soni K.¹, Patro S.K.¹, Sharma V.¹, Nair N.P.¹, Khera P.²

¹ Department of Otorhinolaryngology, All India Institute of Medical Sciences, Jodhpur, India

² Department of Diagnostic & Interventional Radiology, All India Institute of Medical Sciences, Jodhpur, India

Objectives: Cholesteatoma is an entity which fascinates Otolaryngologists around the globe for ages. However, in low socio-economic conditions, it may lead to extensive complications in large numbers. The factors may be compromised immunity, ignorance, and lack of adequate facilities at grass root levels.

We get good numbers of complicated cholesteatomas. Few of those cases are reviewed and discussed.

Materials and Methods: Retrospective review of few very interesting cases of complicated cholesteatoma along with a review of the relevant literature and relevant discussion is presented. Presented cases reflect diversity with regards to presentations, diagnosis, and management.

Results and Conclusions: Cholesteatoma may present virtually with any complication especially in resource-poor and ignorant society. Not only can it cause involvement of any structure in and near temporal bones, but sometimes it may pose a great challenge to diagnosis and treatment. The current evidence for treatment of complicated cholesteatoma is also discussed.

The Esteem invisible middle ear implant: 12 years' experience

Barbara M.

ENT Clinic, NESMOS Department, Sapienza University Hospital Sant' Andrea, Rome, Italy

The Esteem active middle ear implant is the only FDA-approved, microphone-less, fully-implantable system available today for the rehabilitation of bilateral, moderate-to-severe sensorineural hearing loss (SNHL) in alternative to conventional hearing aids. At Sant'Andrea University Hospital in Rome, 42 subjects have undergone its implantation, following the manufacturer's recommendations but also with some exception (5 subjects with severe-to-profound SNHL, 1 subject under 18 years old and 1 subject with a unilateral SNHL). A long-term follow-up has been therefore achieved so that consistent findings regarding complications (including the need for explantation) and the functional outcome could be obtained and considered worth for sharing and discussing.

The surgical procedure requires the surgeon a formal accreditation by the Company (EnvoyMedical) and may be considered complex and time-consuming in respect to other AMEI or standard otosurgical procedures.

A good functional outcome has been obtained in nearly 80% of the implantees, despite the observation – in a small cohort of them – of a deterioration of bone conduction threshold in the operated ear over time. This beneficial outcome has also been observed in the “off-label” subjects presenting with a severe-to-profound SNHL. When hearing deterioration has been considered incompatible with the Esteem use, a CI has been adopted (5 subjects). Battery change today represents a mandatory step, requiring additional surgery every 4–6 years.

The role of quality measurement as otolaryngology evolves

Denneny J.C.

American Academy of Otolaryngology-Head and Neck Surgery/ Foundation, Johns Hopkins School of Medicine, USA

The intersection of technological advances and exploding healthcare costs has created the necessity to objectively evaluate and improve the practice of medicine in general and otolaryngology specifically. The ability to provide value and access will be critical to delivering specialty care in all practice settings. Defining and measuring quality is the key tool in improving patient safety, propagating team-based care, teaching and assessing individual skills, incorporating new technology and devices into the delivery system and defining ‘best care’ objectively.

Currently, Clinical Practice Guidelines and Performance Measures, which are based on literature snapshots, are the workhorses of quality reporting. Moving forward, we will define and measure quality through broad clinical data collection from both inpatient and outpatient sources, patient-reported outcomes and combine this with cost and

utilization data using a multitude of devices. To participate optimally in this transformational change, the AAO-HNS has created a clinical data registry, Reg-ent which incorporates data directly from the medical record covering all specialties within otolaryngology.

Reg-ent allows public and private quality reporting, facilitates quality improvement and optimal clinical effectiveness, creates the basis for the development of performance measures, clinical practice guidelines, and clinical pathways and enables unbiased clinical trials and product surveillance. The analytics possible through the Reg-ent platform, when fully developed, can evaluate data from all patient-related sources leading to increased accountability and improved outcomes in patient care.

The subgroups of paraganglioma in jugular foramen and bleeding control strategies of inferior petrous sinus

Dai C.F.

Otology & Skull Base Surgery Department, EENT Hospital, Fudan University, Shanghai, China

Objectives: To analyze the outcomes of microscurgically treated jugular paragangliomas following effective control of bleeding from the inferior petrous sinus.

Materials and Methods: 68 patients with jugular paragangliomas were diagnosed personally. 39 patients were undergone microscurgical resection. Based on the growth patterns of tumor, they are divided into the extraluminal tumor and intrabulbar tumor. For patients with extraluminal tumor, the sigmoid sinus tunnel-packing surgical technique was applied to control bleeding from the inferior petrous sinus. For patients with intrabulbar tumor, we applied the push-packing surgical technique to control bleeding from the inferior petrous sinus.

Results: Nineteen tumors were class C2 (48.7%), eighteen were class C3 (46.2%), and two were class CDe1 (5.1%). Among them, 25 cases were classified into intrabulbar tumor, 14 cases were diagnosed with extraluminal tumor.

Gross total tumor resection was achieved in 94.5% of the patients. The mean blood loss during surgery was 338.5 ml. The recurrence rate was 5.1%. New facial palsy and lower cranial nerve deficit occurred in 25.6% and 10.2% of the patients, respectively.

Conclusions: The infratemporal fossa approach type A with sigmoid sinus tunnel-packing or push-packing technique facilitated the control of bleeding from the inferior petrous sinus and improved the outcomes of microscurgical treatment for jugular paragangliomas.

Vestibular neurectomy: 40 years' experience

Magnan J.

Aix-Marseille University, Marseille, France

Objectives: To present our 40 years' experience on 559 vestibular neurectomy patients and their long-term follow up studied thanks to a constant medical-scientist collaboration on several items: vestibular compensation (Ulmer, Lacour), hearing (Scharf, Chays), cognitive performances (Borel), stress (Horner, Mardassi), bilateral (Lacour).

Results: 95% of the patients were cured (not only improved) of their incapacitating Meniere's disorders. The failures were a wrong indication, partial section, bilateral (<3%). 83% of patients went back to their normal life 1 to 3 months postoperatively. 9% of patients still had significant unsteadiness 6 months to 1 year postoperative. There is a close relationship between residual unsteadiness and anxiety level which changes the pure peripheral disorder in a partial central disturbance and consequently delayed the vestibular compensation.

Conclusions: Until we have not a specific treatment for Meniere's disease, vestibular neurectomy represents the best and safer procedure to cure incapacitating vertigo, but it is more demanding for the practitioner requiring additional surgical training. The average time for surgery was 6 years after the onset of the disease. It should be performed earlier before the patient is losing his hearing and/or his job.

Workshops

Vestibular evoked myogenic potentials (VEMPs)

Papathanasiou E.S.

Clinical Neurophysiologist, Fellow of the European Academy of Neurology, Clinical Neurophysiology Laboratory, Cyprus Institute of Neurology & Genetics, Cyprus

Vestibular evoked myogenic potentials (VEMPs) is a relatively new method of recording function (and dysfunction) from the vestibular nervous system but is quickly gaining wide acceptance on a global scale. Air-conducted sound can be used to stimulate the otolith organs

of the inner ear. Use of this short duration and reproducible stimulus allows one to record high amplitude responses from either the sternocleidomastoid muscle (cervical VEMPs or cVEMPs) or from the inferior oblique muscle (ocular VEMPs or oVEMPs). The former is related predominantly to saccular and inferior vestibular nerve function and its pathway, whilst the latter relates predominantly to the utricle and superior vestibular nerve. Bone conducted vibration can also be used to stimulate the otolith organs, and this method has also been found to be highly reproducible. Clinical applications are not restricted to the confirmation of Superior Semicircular Canal Dehiscence syndrome, but also has been found to be useful for other conditions such

as differentiating Vestibular Migraine from Meniere's disease, and also indicating the presence of conditions that specifically involve either the superior and/or inferior vestibular nerve in the presence of normal caloric responses. Neurological applications include ruling out vestibular neuropathy in the presence of a diffuse peripheral neuropathy, and in determining the nature of vestibular symptoms in other conditions such as multiple sclerosis. After this teaching course, the audience will be able to practice VEMPs in their own laboratories, using recording equipment that they already have, and to be able to apply the results to help diagnose cases or to be able to explain the results of therapy.

Behavioural experiments in cognitive therapy for hyperacusis

Aazh H.

Head of Tinnitus & Hyperacusis Therapy Specialist Unit, Royal Surrey County Hospital, Guildford, UK

Hyperacusis is a term that is used to describe the experience of intolerance to ordinary sounds in a way that they cause significant distress and impairment in the sufferer's social, occupational, recreational, and other day-to-day activities. Cognitive behaviour therapy (CBT) shown to improve hyperacusis symptoms as measured via Uncomfortable Loudness Levels test and hyperacusis questionnaires, and patients' physiologic response to sound as measured via heart rate, skin conductance, and eye-blink electromyogram.

CBT for hyperacusis asserts that the noise-induced distress in individuals with hyperacusis arises from the meanings they give to their experiences. For example catastrophic misinterpretation of physical symptoms (e.g., "my ears will explode when I listen to loud noises", "I will faint and no one will help me") is central to experience of panic in noisy places, while exaggerated sense of guilt due to intrusive thoughts is central to anger reaction in response to noise (e.g., "I will smash his face if he continue to make this noise", "My reaction to noises that others make is rude").

In CBT, behavioural experiments are defined as planned experiential activities undertaken by patients which are designed directly from a cognitive formulation of a problem and are aimed to (1) test the validity of patients' existing beliefs, (2) construct more adaptive beliefs, and (3) contribute to development and verification of cognitive formulation. The main aim of behavioural experiments is to change perspective. If the troublesome thought and safety behaviours are accurately captured and examined in the experiment, then the change is likely to happen even after one single key behavioural experiment.

In this workshop, clinical and research implications of using behavioural experiments in management of hyperacusis by audiologists, ENT and mental health professionals will be discussed. In addition, a case study will be reviewed in order to shed light on practical implications of this method for patients, therapists, and services.

R-001 Session S21

'Black bone MRI' as a novel technique to aid the pre-operative planning of posterior tympanotomy

Connor S.E.J.^{1,2,4}, Barnsley H.¹, Pai I.³

¹ *Neuroradiology Department, King's College Hospital NHS Foundation Trust, London, UK*

² *School of Biomedical Engineering and Imaging Sciences, King's College London, London, UK*

³ *Department of Ear, Nose and Throat Surgery, Guy's and St Thomas' NHS Foundation Trust, London, UK*

⁴ *Radiology Department, Guy's and St Thomas' NHS Foundation Trust, London, UK*

Objectives: 'Black bone MRI' is a novel MRI sequence designed as an alternative to CT for osseous imaging. It employs a high-resolution volumetric sequence with a short TE and TR with a flip angle optimised to minimise soft tissue contrast, so enhancing bone-soft tissue boundaries. A series of papers have evaluated its potential contribution in the context of craniosynostosis, craniofacial disorders, 3D cephalometry, and paediatric skull fractures.

The lack of ionising radiation is particularly appealing in young patients and when repeated examinations are required, whilst it may also be a useful adjunct to MRI protocols used for presurgical planning when osseous information is required (e.g. cochlear implants). The definition of the mastoid facial nerve canal and *chorda tympani* are a prerequisite for defining the potential surgical approach for a posterior tympanostomy.

Materials and Methods: Following institutional approval, 25 patients were prospectively enrolled in this study. For inclusion in the study, it was required that adult patients presented for routine cranial MRI and that they had previous sub-millimetric CT images through the skull base available for review. Patients with surgery or destructive pathology of the temporal bone were excluded.

A dedicated black bone sequence was performed in addition to routine clinical imaging. Two observers reviewed the MRI studies followed by the CT studies with respect to the visibility of the mastoid facial nerve and the *chorda tympani* within each petrous temporal bone ($n = 50$). In each case, a 'visibility score' was initially attributed on the black bone sequence for the confidence of demonstration (0-not demonstrated, 1-seen on minority of sections or uncertain relative to background, 2-seen on the majority of sections and clearly demonstrated relative to background, 3-seen continuously on all sections and clearly demonstrated relative to background). CT was reformatted to the same obliquity as MRI and viewed on equivalent 1 mm section thickness with a 'sharp' bone algorithm and 'visibility score' for the mastoid facial nerve and the *chorda tympani* were recorded. A 'corresponding score' was then recorded according to whether the nerves demonstrated on MRI corresponded to the paths of the nerves on CT (0-not corresponding at all, 1-partially corresponding but others not in the path, 2-partially corresponding and all in the path, 3-totally corresponding and seen on all sections).

Results: The nerves were felt to be demonstrated on all or the majority of sections in and were clearly demonstrated relative to background (scores 2/3) in 50/50 (facial nerve) and 36/50 (chorda tympani) cases with mean 'visibility score' of 2.82 (facial nerve) and 1.9 (chorda tympani) for black bone MRI. The *chorda tympani* course was not possible to clearly trace on CT in 10/50 cases. Otherwise, they were clearly demonstrated relative to the background (scores 2/3) in 50/50 (facial nerve), (40/50 chorda tympani) and with mean 'visibility scores' were 2.88 (facial nerve) and 2.26 (chorda tympani) on CT. Following CT review, the nerves demonstrated on MRI all corresponded to the path of that on CT (scores 2/3) in 50/50 (facial nerve) and (39/40 chorda tympani) with mean 'corresponding scores' of 2.88 (facial nerve) and 2.28 (chorda tympani).

Conclusions: Using a dedicated 'black bone' sequence it appears possible to reliably demonstrate the majority of the mastoid facial nerve canal in all patients, and the majority of the chorda tympani in most adult patients. It may be a useful adjunct to pre-cochlear implant MRI protocols in those centres where CT is not routinely performed, in order to provide further information on the trajectory of the proposed posterior tympanotomy.

R-002 Session S19

A biomechanical exploration of the mechanism of balloon eustachian tuboplasty

Smith M.E.¹, Sutcliffe M.², Tysome J.R.¹

¹ Cambridge Ear Institute, University of Cambridge, Cambridge, UK

² Department of Engineering, University of Cambridge, Cambridge, UK

Objectives: The mechanism of the reported clinical improvements following balloon Eustachian tuboplasty (BET) remains unknown, resulting in a proliferation of different balloon sizes, inflation pressures and surgical techniques, without an understanding of the effect changes to these parameters have on the Eustachian tube (ET). We aimed to determine the biomechanical effects of BET on the ET, comparing current BET devices and methods.

Materials and methods: BET was performed in thawed fresh-frozen human heads, and in fresh sheep heads as an animal model, validated in the course of the study. A novel experimental technique allowed quantification of plastic (permanent) and elastic (reversible) tissue deformation in model materials and then human ETs during BET, based on precision measurement of the balloon inflation pressure-volume relationship. Within the ET, 3mm and 6mm diameter balloon inflation to 2.5, 5.0, 7.5 and 10.0 bar was explored, along with staged balloon insertion. Human ETs were histologically examined following BET. High resolution micro CT scanning allowed visualisation of staged balloon inflation in sheep ETs.

Results: Both 3 and 6mm diameter balloons caused plastic ET deformation, but not in the 5mm adjacent to the nasopharynx, and only on the first inflation. Most deformation

occurred at <5 bar pressure (10–12 bar currently recommended clinically). More energy was dissipated in soft tissues during plastic deformation with 6mm balloons compared with 3mm balloons (paired L/R ears, $p = 0.006$). Histological analysis demonstrated cracks at the ET cartilage apex and mucosal tearing. Micro CT showed soft tissues to be compressed at the ET isthmus.

Conclusions: BET deforms the ET, increasing compliance to opening. 6mm diameter balloons cause more deformation than 3mm balloons. Higher inflation pressures and multiple balloon inflations appear not to provide additional deformation. Balloon dilation of the ET has huge potential if found to be clinically effective, but currently there is a need to understand and develop the technique further. The novel methods employed in this study will be valuable in future laboratory and in vivo studies of BET.

R-003 Session S10

A case of cochlear implantation in 31 years old woman with Fahr's disease

Durko M.¹, Szymański M.², Pajor A.¹, Rosiak O.¹, Poperek B.¹, Jankowski A.¹, Pietruszewska W.¹

¹ ENT Dept. Medical University of Łódź, Poland

² ENT Dept. Medical University of Lublin, Poland

Introduction: Fahr's disease is a rare sporadic or inherited neurodegenerative disorder characterized by symmetrical, bilateral calcifications in the basal ganglia and some other brain structures' dentate nucleus, thalamus, cerebral cortex, subcortical white matter, and hippocampus.

Aim: To report therapeutic options in case of bilateral deafness in Fahr's disease patients.

Materials and Methods: 1 y.o. woman has been referred to the ENT Dept. Medical University of Lodz with bilateral deafness. Patient presented a history of bilateral hearing impairment aided with bilateral hearing aid since 9 y.o. Patient reported complete right side deafness since January of 2016 and complete left side deafness since January of 2018. During the process of preparation for cochlear implantation after a temporal bone CT, diagnosis of Fahr's disease has been stated.

Results: Patient has been implanted on 16th June 2018 with a cochlear implant (Cochlear Nucleus 6). Postoperative period uneventful. Speech processor activation 6 weeks after surgery. The patient presented satisfactory hearing results after the implantation.

Conclusions: This case report provides information about clinical characteristics and management of patients with Fahr's disease.

R-004 Session S06

A comparison between Minimally Invasive Ponto Surgery and linear incision technique with tissue preservation: clinical outcomes after 6 months.

Caspers C.J.I., Kruyt I.J., Mylanus E.A.M., Hol M.K.S.

Department of Otorhinolaryngology, Radboud University Medical Centre, Nijmegen, The Netherlands

Objectives: To investigate and compare the clinical outcomes of Minimally Invasive Ponto Surgery (MIPS) to the linear incision technique with soft-tissue preservation for percutaneous Bone-Anchored Hearing Implants (BAHI).

Materials and methods: A prospective controlled study was performed in a tertiary referral center. 25 patients were prospectively included in the test group. The control group consisted of 25 patients who previously participated in another clinical trial and already underwent BAHI surgery. All patients were implanted with a 4.5-mm-wide implant, using the MIPS procedure in the test group and the linear incision technique with tissue preservation in the control group. Follow-up visits were scheduled 7 days, 21 days (sound processor fitting), 12 weeks and 6 months after surgery.

The primary outcome measure was skin sensibility around the implant, compared between groups. Secondary outcomes were self-perceived numbness, surgical time, soft tissue status, implant survival, Implant Stability Quotient (ISQ), subjective benefit and scar assessment.

Results: A total of 46 patients completed the 6-month follow-up. Four patients were prematurely withdrawn from the test-group due to implant loss ($N = 3$) and abutment removal ($N = 1$). No implants were lost in the control group. Sensibility, adverse soft tissue reactions, ISQ values, and subjective benefit were comparable between groups. The test group had a shorter surgical time, better cosmetic outcomes and better self-perceived numbness. However, more wound dehiscences and a statistically non-significantly higher implant loss rate were observed in the test group.

Conclusions: The MIPS technique is comparable to the linear incision technique with tissue preservation regarding sensibility and soft-tissue tolerability. The MIPS technique is further reducing surgical time and provided better cosmetic outcomes and slightly better self-perceived numbness. More research into the MIPS technique and the associated implant loss is deemed necessary until then we advise only experienced BAHI surgeons to use the MIPS technique.

R-005 Session S19

A comparison of Otovent and Valsalva auto-inflation techniques in adult Eustachian tube openingHo V.W.Q.¹, Joshi K.S.¹, Smith M.E.^{1,2}, Tysome J.R.^{1,2}¹ *University of Cambridge Clinical School, Cambridge, UK*² *Department of ENT Surgery, Addenbrooke's Hospital, Cambridge, UK*

Objectives: Otovent is a balloon device marketed for the symptomatic treatment of otitis media with effusion (OME) and obstructive Eustachian tube (ET) dysfunction in adults and children. The Otovent device provides a method of auto-inflation, a technique of passively opening the dysfunctional Eustachian tube to equalise a negative middle ear pressure. Currently, the Valsalva manoeuvre is a more common method of auto-inflation and has also been used as a test of ET opening, but it is highly dependent on patient technique. We compared Otovent against Valsalva in a healthy population to determine any differences between the two techniques in terms of 1) the magnitude and repeatability of the generated nasopharyngeal pressure and 2) the rate of subjective and objectively measured ET opening.

Materials and Methods: Healthy volunteers were recruited. Baseline ET function was clarified by the completion of the Cambridge ET dysfunction assessment (CETDA) and a series of three objective measures: tympanometry at rest, sonotubometry and tubomanometry (TMM) for wet swallow.

Volunteers performed auto-inflation with the Otovent device and Valsalva manoeuvre, repeating each manoeuvre three times with each ET function test. Maximum and plateau nasopharyngeal (NP) pressures were recorded with both methods of auto-inflation. Repeatability was characterised using the intraclass correlation coefficient (ICC). ET openings during Otovent and Valsalva auto-inflation, were directly compared using three ET function tests: volunteer-reported opening, tympanic movement under otoscopic examination, and objective opening in tubotympano-aerodynamic-graphy (TTAG).

Results: Twenty-one healthy ears from 21 volunteers were assessed. Index tests of ET function confirmed a healthy cohort. Median CETDA score was 11. External auditory pressure and tympanic compliance were within recognised standard range for healthy adults in 100.0% and 95.2% of cases respectively. ET opening rates were as expected for normal ET function using sonotubometry (82.9% open with swallows) and TMM (72.7% open with test).

Mean maximum NP pressure was significantly lower in Otovent (482 daPa, $SD \pm 118$) than Valsalva (597 daPa, $SD \pm 176$), $p = 0.026$. Mean plateau NP pressure was also significantly lower in Otovent (278 daPa, $SD \pm 39.8$) than Valsalva (486 daPa, $SD \pm 144$), $p < 0.001$. However, ICC estimates were higher for Otovent in comparison to Valsalva for both maximum NP pressure (0.694 Vs 0.633).

respectively) and plateau (0.872 vs 0.572), suggesting Otovent may be a more consistent method for generating a NP pressure for auto-inflation.

The rate of ET opening was comparable for Otovent and Valsalva for all tests: volunteer report (66.7% vs 76.2%), observed tympanic movement (71.4% vs 85.7%) and TTAG-judged objective opening (76.2% vs 81.0%).

Conclusions: Auto-inflation using the Otovent device offers a more consistent method for generating NP pressure especially when maintaining a steady pressure. However, in most individuals, the traditional Valsalva manoeuvre produces a higher NP pressure. Therefore, Otovent use is not recommended therapeutically if a patient has a satisfactory Valsalva technique. As a test of the ET function, the Otovent device may provide a simple way to deliver consistent NP pressures. Future work is required to extend the findings to ET dysfunction cohorts.

R-006 Session S23

A comparison of two different ear packing methods following tympanoplasty

Meghji S.¹, Neumann C.², Wahid W.¹,
Trinidad A.¹

¹ Department of Otolaryngology, Southend University Hospital NHS Trust, Southend-on-Sea, UK

² Department of Otolaryngology, Canterbury & East Kent Hospitals NHS Trust, Kent, UK

Objective: Packing of the external auditory canal following major ear surgery aids in healing of the tympanomeatal, holds the graft in position, helps to prevent infection and can prevent early canal cicatrization. Adverse reactions include discomfort, graft movement, hypersensitivity and infections and can vary depending on the type of packing material used. The objective of this study is to compare outcomes between two ear packing regimes.

Materials and methods: All patients undergoing tympanoplasty with or without ossiculoplasty over a 4-year period at two UK-based district general hospitals were included. Two packing regimes were employed by two surgeons: Pack A (Surgeon A) consisted of Gelfoam sponge, chloramphenicol ointment, and an otowick soaked in ciprofloxacin 0.3% drops; Pack B (Surgeon B) consisted of Gelfoam sponge soaked in ofloxacin drops and a bismuth-iodoform paraffin paste (BIPP) impregnated gauze dressing.

Results: One hundred and fifty-three tympanoplasties were performed during this period, 68 by Surgeon A and 85 by Surgeon B. There were 78 females and 75 males with a median age of 33.01 years old and an age range of 6–86 years old. Twenty patients (13.1%) had postoperative complications: 2 (1.3%) with failed grafts, 11 (7.2%) cases of myringitis, 5 (3.3%) with postoperative granulation tissue and 2 (1.3%) cases of persistent otorrhea. A Chi-squared test showed no significant difference between the pack type and complication rate ($p = 0.572$). Univariate analysis suggested that an older age ($p = 0.047$) and concurrent

canaloplasty ($p = 0.006$) had a statistically significant association with complications post-tympanoplasty. Pre-operative ear status, indication, graft type, and gender did not show any association with complication rate.

Conclusions: There was no difference between ear packing methods used in this study and the rate of complications overall. Two predictive factors, older age, and concurrent canaloplasty, were significantly associated with complications post-tympanoplasty. Old age may negatively affect healing ability and a canaloplasty is usually performed for a poorly ventilating and discharging ear, which may itself be the reason for a higher likelihood of postoperative complications.

R-007 Session S14

Academic achievements of children after cochlear implantation

Zgoda M.¹, Lorens A.¹, Obrycka A.¹,
Skarżyński H.¹

¹ World Hearing Center, Institute of Physiology and Pathology of Hearing, Implants and Auditory Perception Department, Kajetany/Warsaw, Poland

² World Hearing Center, Institute of Physiology and Pathology of Hearing, Otorhinolaryngology Surgery Clinic, Kajetany/Warsaw, Poland

Objectives: Education and subsequently employment are fundamental for individuals' psychological and socio-economic wellbeing. Hearing impairment is a disability with a particular impact on education and employment opportunities. With the application of cochlear implants, it is possible to compensate for a hearing loss much more effectively than before thus better counteracting the negative consequences of hearing impairment. Positive effects of rehabilitation of hearing and speech after cochlear implantation allow expecting that these students will achieve similar school education results as children with normal hearing. To date, only a few study reports had included an objective record of the issues related to complying with the school education requirements and school scores achieved by children using cochlear implants with the measure of standardized test for hearing children. The aim of the study was to analyze school attainments of CI children at the end of primary education and to compare results with those obtained by hearing peers.

Materials and methods: The study group consisted of 33 CI children who wrote the test for children with normal hearing at the end of primary school. The raw data of the obligatory, standardized test carried out in Poland at the end of primary education in years 2010–2014 were analyzed.

Results: Test results of CI children were not significantly different compared to the population of normal hearing children.

Conclusions: School attainments of a CI child can be at the same level comparing to hearing peers.

R-008 Session S17**Active optimization of interaural matching between a CI and a contra-lateral HA – Naida Link Technology**Shpak T.^{1,3}, Khayr R.^{1,3}, Roth O.¹, Khniefes R.^{1,2}, Yehudai N.^{1,2}, Dagan D.¹, Luntz M.^{2,3,4}¹ Ear and Hearing Program, Department of Otolaryngology Head and Neck Surgery, Bnai-Zion MC Medical Center, Haifa² Bruce Rappaport Faculty of Medicine, Technion - Israel Institute of Technology, Haifa³ Department of Communication Disorders, Haifa University, Haifa⁴ Ear and Hearing Unit, Aram, the Center for Otolaryngology Head and Neck & Maxillofacial Surgery, Assuta Medical Center, Tel Aviv

Introduction: In many/most unilateral CI cases, the worst hearing ear is implanted, and the patient continues to use a HA on the contra-lateral ear (CIHA hearing), hoping for effective matching between the CI and the HA.

Objectives: To evaluate the benefit of Naida Link technology in optimizing interaural matching (frequency, time, intensity) between the CI (AB device) and the HA in bilateral bimodal hearing.

Patients and Methods: 11 straightforward consistent adults bimodal users with stable CI map, unaided AC in the non-implanted ear of ≤ 75 dB HL at 250 and ≤ 85 dB HL at 500 Hz, ≥ 12 months experience with bimodal hearing, and $\geq 50\%$ correct for sentences at SNR +20 dB. Performance was compared between three listening conditions: with clinical HA, with Naida link HA fitted with conventional PHOANK fitting formula (tested after 1 month of experience), and with Naida link HA fitted with the bimodal optimization formula [tested after 3 and 3.5 months of experience with the bimodal fitting formula (mean was used)]. Testing included: electroacoustic verification of the participant's HA, AC threshold, and speech perception in noise tests (65 dB SPL presentation level of target speech, different locations and different characteristics of noise competitors).

Results: MS words in speech-shaped noise +5 dB, roving randomly from a 7-loudspeaker array: the conventional Naida link formula was better than own clinical HA in 10/11 of the participants with further improvement in 7 of them when the optimization technology was fitted. OLSA unpredictable sentences, roving randomly from a 7-loudspeaker array in two-talker babble: the conventional Naida link formula was better than own clinical HA in 10/11 with further improvement in 8 of them when the optimization technology was fitted. OLSA unpredictable sentences in speech-shaped noise (SNR50) presented from 3 directions: the conventional Naida link optimization formula was better than own clinical HA in 32/33 measurement, with further improvement in 9 of the 11 participants when relying specifically on the HA (i.e. when noise presented from CI side).

Conclusions: Active technologic optimization of interaural matching between a CI and a contra-lateral HA shows a clear benefit in most bilateral-bimodal users tested in the present study. Naida Link optimization formula improves speech understanding in challenging noisy situations in bilateral bimodal users.

R-009 Session S13**Adaptation of Nijmegen Cochlear Implant Questionnaire into Polish – preliminary results**Rajchel J.I.¹, Gos E.¹, Lorens A.¹, Skarżyński P.H.¹, Skarżyński H.¹¹ Institute of Physiology and Pathology of Hearing, World Hearing Center, Kajetany/Warsaw, Poland² Institute of Sensory Organs, Kajetany, Poland³ Department of Heart Failure and Cardiac Rehabilitation, Second Faculty of Medicine, Medical University of Warsaw, Warsaw, Poland

Objectives: The aim of the study is to present the preliminary results of the Polish adaptation of the reliable and widely used Nijmegen Cochlear Implant Questionnaire (NCIQ), assessing different aspects of health-related quality of life after cochlear implantation (CI).

Materials: The research group consisted of people admitted to a routine control visit in the Cochlear Department in the single tertiary ENT referral center. The patients were considered as potentially eligible for the study if they were Polish-speaking adults with at least 1-year experience of using their CI regularly. The exclusion criteria were an earlier diagnosis of concomitant neurological or psychological disorders based on the medical interview or any other condition preventing participation in a questionnaire study.

Methods: The linguistic adaptation of the NCIQ was made using translation-back translation, cognitive debriefing, and expert consensus methods. After obtaining the final Polish version of NCIQ (NCIQ-P), the evaluation of its psychometric properties took place based on the patients' responses. Every participant was asked to fill in NCIQ-P twice: once during a routine control visit in the CI Department and subsequently within two weeks at home. Additionally, patients were asked to fill-in a General Health Questionnaire (GHQ-28) and underwent a monosyllabic Prusiewicz pure-tone audiometry measurement in quiet and noise. Reliability of NCIQ-P was tested using test-retest and alpha Cronbach method. The validity of NCIQ-P was tested based on correlations with the General Health Questionnaire (GHQ-28) and free-field speech audiometry in quiet and noise.

Results: The participants consisted of 236 adults (47.88% men) aged $M = 48.5$ and $SD = 27.57$. The test-retest reliability of NCIQ was strong ($r = 0.917$; $p < 0.001$). Cronbach's alpha coefficient was acceptable to good for all of the subscales, ranging from $\alpha \pm = 0.785$ for the Basic Sound Perception Subscale to $\alpha \pm = 0.852$ for Activity Limitations subscale. There was a significant negative

relationship between NCIQ-P and all of its subscales and GHQ-28, which was the strongest for the Activity Limitations ($r = -0.327$; $p < 0.001$) and Psychological ($r = -0.292$; $p < 0.001$) subscales. A significant positive relationship was found between NCIQ-P and all of its subscales and free-field speech audiometry in quiet and noise, which was the strongest for Advanced Speech Perception ($r = 0.406$; $p < 0.001$) and Speech Perception ($r = 0.366$; $p < 0.001$) subscales. Based on these correlations, the divergent and convergent validity of NCIQ-P was proved, showing that patients with lower NCIQ-P scores report also more psychological symptoms. Additionally, results of the NCIQ-P related moderately to the free-field speech audiometry results.

Conclusions: The Polish version of NCIQ is a reliable and valid tool that can be used in a population of adult CI users to evaluate a range of CI-related aspects of quality of life. In the future, we intend to expand our research and evaluate also the factor structure of NCIQ-P as well as to establish the minimal important change needed in the CI rehabilitation process.

R-010 Session S16

An adaptive feedback cancelling algorithm for the Cochlear™ Carina® System: experimental & clinical results

Deveze A.^{1,2}, Masson C.¹, Legouge A.¹, Truy E.³, Dumoouchel Y.¹, Berger P.⁴, Tringali S.⁴

¹ Aix Marseille University, Laboratory of Applied Biomechanism, IFSTTAR UMRT24, Marseille, France

² Ramsay Générale de Santé, Ear & Skull Base Institute, Clairval Private Hospital, Marseille, France

³ Hospices Civils de Lyon, Department of Otolaryngology, Edouard Herriot Hospital, Lyon, France

⁴ Hospices Civils de Lyon, Department of Otolaryngology, Lyon Sud Hospital, Lyon, France

Introduction: An adaptive feedback canceling (AFC) algorithm was developed for use with the Cochlear™ Carina® system and tested both in an acoustic-LDV analysis platform as in a multicenter trial to determine its effectiveness in reducing feedback, distortion and audible artifacts, and thus to improve sound quality as perceived by recipients.

Patients & Methods: First, multiple testings were achieved across the following conditions: skin thickness, the position of the microphone, fixation of the transducer with the Fixed Feedback canceler (FFC) and the new algorithm (AFC). Then, a prospective study was conducted at 3 centers. Patients implanted with the Carina for at least one year were included. The study comprised two phases over 31 months. The AFC was injected in the implant processor instead of the previous FFC. Subjects were asked to rate their preferences for either feedback canceler. Differences between the two conditions were assessed in PTA and for speech score.

Results: The experimental exploratory study confirmed the ability for the AFC to overcome the dampening of

the output according to changing situations. With regards to the clinical analysis, 14 patients were enrolled. Ten patients completed the study, with three withdrawals and one explant from infection. Among study subjects, 93% expressed a preference, and 72% a strong preference, for the adaptive feedback canceler (AFC) over the fixed feedback canceler (FFC). Aided thresholds were similar or better from 2 kHz to 6 kHz for AFC as compared with FFC, an improvement attributed to better system stability. Word recognition scores were similar for AFC and FFC across presentation levels from 60 to 80 dB SPL. At 55 dB SPL, AFC showed a clinically significant improvement of 20%. In addition, the introduction of AFC has allowed a sequence of time-consuming positional measurements to be eliminated from the fitting procedure, making the process simpler and easier for clinician and patient.

Conclusions: The AFC appears to be more stable under complex and changing conditions affecting feedback, as shown by objective measures of performance, and is perceived by a large majority of users to be more comfortable and natural-sounding. The AFC is found to have satisfied its design goals, and will be incorporated in future versions of the Cochlear Carina™ Fitting Software.

R-011 Session S01

Anterior inferior cerebellar artery (AICA): audiological profile

Ferrazoli N.^{1,2}, Capra D.^{3,4}, Gusmao R.J.¹, Lavor R.U.¹, Rezende A.¹, Skarżyński P.H.^{5,6,7}, Donadon C.^{1,2}, Sanfins M.D.^{1,4}

¹ Clinica Respirare, Brazil

² Universidade Estadual de Campinas, Brazil

³ Instituto Nacional de Neurociência Translacional, Brazil

⁴ Centro de Eletrofisiologia e Neuroaudiologia Avançada, Brazil

⁵ Department of Teleaudiology and Hearing Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland

⁶ Department of Heart Failure and Cardiac Rehabilitation, Second Faculty of Medicine, Medical University of Warsaw, Warsaw, Poland

⁷ Institute of Sensory Organs, Warsaw, Poland

Introduction: Sensorineural hearing loss (SHL) and tinnitus can be many possible etiologies: hemangioma, schwannoma, glomus tumor, among others. We can observe in the imaging examination, in some cases, the presence of a vessel, most often the anterior inferior cerebellar artery (AICA) in relation to the internal auditory meatus (IAM) and coming into contact with the VIII cranial nerves and, there are many questions whether this anatomical variation can actually be seen as the cause of the symptoms mentioned.

Objective: This study aims to discuss whether AICA can be considered a differential diagnosis between the causes of SHL and tinnitus. A patient case with SHL associated with tinnitus have been reported, and the presence of bilateral AICA was the only alteration found to justify the clinical picture.

Materials and Methods: 2 women, case 01 – 65-year-old, case 02 – 74-year-old, complaining of tinnitus in both ears with no pitch variations and case 01 have significant interaural asymmetry in the conduction of sound through the area for high frequencies. In addition to hearing evaluation (pure tone audiometry, impedance with ipsilateral and contralateral acoustic reflexes) and electrophysiological assessment (auditory brainstem response, VEMPc, and electrocochleography), laboratory tests were performed, Computed Tomography (CT) of Mastoid and Magnetic Resonance Imaging (MRI) of the cerebellar point angle for investigation of the clinical picture.

Results: Both patients presented to the MRI types II or III vascular loops of the Chavda classification insinuating to the inside of the IAM bilaterally, moderately-severe sensorineural hearing loss and case 01 with interaural asymmetry in the high frequencies, which presented a higher degree of hearing loss in left ear. The absolute latency of V-wave presented an increased interaural difference of 0.64 ms (case 01) and absence of records (case 02), normal electrocochleography in the right ear and absence of records in the left ear (case 01) and absence of records both ears (case 02). The other tests were normal. After analyzing the various rehabilitation and treatment options, we opted for the attempt of ambulatory control and adaptation of bilateral hearing aids with auditory training.

Conclusions: AICA within the IAM, asymmetric sensorineural audiometric and BERA with an increased interaural difference of the absolute latencies of the V-wave may be important indicators to consider the differential diagnosis in patients with tinnitus and SHL and always associated with a quality image examination, given the enormous possibility of other retrocochlear diseases.

R-012 Session S02

Applicability of vital staining and tissue clearing to vascular anatomy and melanocytes' evaluation of temporal bone in six laboratory species

Kim Y.Y.¹, Chao J.R.², Kim C.³, Kang T-C.⁴, Park H.S.^{5,6}, Chang J.⁶, Suh J-G.¹, Lee J.H.^{5,6}

¹ Department of Medical Genetics, College of Medicine, Hallym University, Chuncheon, Republic of Korea

² Division of Otolaryngology, Department of Surgery, Yale School of Medicine, New Haven, Connecticut, USA

³ Department of Neurology, Chuncheon Sacred Heart Hospital, Hallym University, Chuncheon, Republic of Korea

⁴ Department of Anatomy and Neurobiology, College of Medicine, Hallym University, Chuncheon, Republic of Korea

⁵ Institute of New Frontier Research, Hallym University College of Medicine, Chuncheon, Republic of Korea

⁶ Department of Otorhinolaryngology-Head and Neck Surgery, College of Medicine, Hallym University, Chuncheon, Republic of Korea

The purpose of the present study was to define the applicability of tissue clearing to the field of otology.

We combined tissue clearing with vital staining perfusion via a pumping system to examine the vascular anatomy of temporal bones in laboratory animals. We used six different types of species including Korean wild mouse, mouse, Mongolian gerbil, hamsters, and Guinea pigs. A mixture of Alcian blue reagent and 4% paraformaldehyde was circulated throughout the entire circulatory system of the animal via a perfusion pump system. Transparency images were obtained from the temporal bones according to the protocol of the SunHyun 3D Imaging Kit. In examining the inner surface of the tympanic membrane, flaccid part (*pars flaccida*) was positioned along the entire marginal area in a Guinea pig. In the Guinea pig, unlike the other species, the cortical bone of the mastoid (bullae) was easily removed using cold instruments, allowing a direct approach to the enclosed structures. The distribution and pattern of cochlear melanocytes were compared among the species.

Mobius strip-like accumulated melanocytes in vestibules were shown in both the Korean wild mouse and mouse. The collateral blood supply to the cochlea in six different species was checked in various pattern.

Combining dye infusion with tissue clearing techniques, we documented the middle ear and transparent inner ear structures in six different species. The information and associated images will help other researchers to develop hypotheses and design experimental investigations.

R-013 Session S02

Application of gene therapy to a mouse model of Usher syndrome

Isgrig K., Shteamer J.W., Belyantseva I.A., Drummond M.C., Fitzgerald T.S., Jones S.M., Griffith A.J., Friedman T.B., Cunningham L.L., Chien W.W.

¹ Neurotology Program, National Institute on Deafness and Other Communication Disorders (NIDCD), National Institutes of Health (NIH), Bethesda, Maryland, USA

² Laboratory of Molecular Genetics, NIDCD, NIH, Bethesda, Maryland, USA

³ Mouse Auditory Testing Core Facility, NIDCD, NIH, Bethesda, Maryland, USA

⁴ Department of Special Education and Communication Disorders, University of Nebraska-Lincoln, Lincoln, Nebraska, USA

⁵ Molecular Biology and Genetics Section, NIDCD, NIH, Bethesda, Maryland, USA

⁶ Section on Sensory Cell Biology, NIDCD, NIH, Bethesda, Maryland, USA

⁷ Department of Otolaryngology-Head & Neck Surgery, Johns Hopkins School of Medicine, Baltimore, Maryland, USA

Objectives: Usher syndrome is the most common cause of deafness/blindness. The whirler mouse (Whrnwi/wi) is a model of Usher syndrome. It has a mutation in the whirlin gene which results in short and abnormal stereocilia in cochlear and vestibular hair cells. Consequently, these mice are deaf and have significant vestibular dysfunction. In this study, we assess whether gene

therapy with wild-type whirlin cDNA can be used as a treatment for auditory and vestibular dysfunction in the whirler mouse.

Materials and Methods: Adeno-associated virus serotype 2/8 containing whirlin cDNA (AAV8-whirlin) was delivered to the inner ears of neonatal whirler mice (P0-P5) via the posterior semicircular canal approach in vivo. Auditory function was assessed using auditory brainstem responses (ABR). Vestibular function was assessed by behavioral testing (circling, swim test, rotarod), as well as vestibular evoked potential (VsEP) measurements. Stereocilia morphology and whirlin expression were examined using immunohistochemistry.

Results: Treatment with AAV8-whirlin gene therapy resulted in whirlin expression at the stereocilia tips of inner ear hair cells in whirler mutant mice. Infected whirler hair cells have normalized stereocilia lengths compared to normal control mice. Whirler mice treated with AAV8-whirlin gene therapy had improved auditory and vestibular functions.

Conclusions: AAV8-whirlin gene therapy was effective at restoring whirlin expression and stereocilia lengths in inner ear hair cells of whirler mutant mice. In addition, AAV8-whirlin gene therapy was able to improve auditory and vestibular functions in whirler mutant mice. These results suggest inner ear gene therapy holds potential as a viable treatment for auditory and vestibular dysfunction in patients with Usher syndrome.

R-014 Session S16

Application of Vibrant Soundbridge in hearing restoration after modified radical mastoidectomies in children

Skarżyński H.¹, Mrówka M.¹, Porowski M.¹, Skarżyński P.H.^{1,2}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Fundamental aim of the radical surgery is to remove the focus of infection from the middle ear area and to ensure the patient's safety. An important principle of various modifications of those operations is to leave in place even the smallest remains of conductive apparatus of the middle ear in such a way that they do not become the source or cause of disease's recurrence while enabling effective reconstruction in future. But sometimes reconstructive surgery is impossible or ineffective. In such cases, we can help the patients with middle ear implants e.g. Vibrant Soundbridge (VSB).

Aim: The aim of this paper is the retrospective analysis of the results of VSB implantation in ears after modified radical mastoidectomies in children.

Materials and Methods: The analysis was performed in a group of 31 children; observation period was minimum 1 year. The results were assessed in about 1 month, 3 months, 6 months and 1 year in accordance with the follow-up program adopted in our Institute. The surgical procedure included implantation of VSB with direct stimulation of Round Window (RW) membrane with Floating Mass Transducer (FMT).

Results: Observed results confirm that, even in cases of very advanced, chronic otitis media with cholesteatoma, temporal bone destruction or granulation, or with all changes together, in cases where tympanoplasty is impossible or has no good results we have the possibility of hearing restoration with VSB implantation.

Conclusions: 1. Patients after radical mastoidectomy without the possibility of tympanoplastic surgery can be candidates to VSB implantation. 2. Obtaining very good hearing results in our group of patients with direct RW membrane stimulation with FMT transducer of VSB ought to be considered as the valid proposition of management of choice in such cases.

R-015 Session S09

Asymmetric enlargement of endolymphatic structures on MRI improves sensitivity for unilateral Meniere's disease

Connor S.E.I.^{1,2,4}, Pai I.³

¹ Neuroradiology Department, King's College Hospital NHS Foundation Trust, London, UK

² School of Biomedical Engineering and Imaging Sciences, King's College London, London, UK

³ Department of Ear, Nose and Throat Surgery, Guy's and St Thomas' NHS Foundation Trust, London, UK

⁴ Radiology Department, Guy's and St Thomas' NHS Foundation Trust, London, UK

Objectives: There has been considerable interest in the in vivo imaging of endolymphatic hydrops (EH) as a structural correlate for Meniere's disease (MD), using delayed post intravenous gadolinium MRI. Most studies have reported their findings using various semi-quantitative scales which reference the area of the endolymphatic structures to the area of the whole inner ear fluid space on axial sections. Hydrops is less marked in the early stages of Meniere's disease, when there may also be incomplete phenotypes precluding clinical diagnosis so additional diagnostic means would be beneficial. Unfortunately, the MRI diagnosis of mild endolymphatic hydrops is problematic since there is controversy over the ideal diagnostic area criteria and this is likely to be technique dependent (both in acquisition and analysis) so varying between institutions. Also, the presence of mild (grade 1) is frequently found in normal volunteers and in the asymptomatic ears of Meniere's patients so it is less useful diagnostically.

Since early Meniere's disease is characterised by a unilateral clinical presentation in 90% of patients, it may be that the asymmetry in the MRI appearances of the inner ear structures can be used as useful diagnostic criteria,

independent of the absolute area dimensions and grading. This would overcome some of the aforementioned diagnostic pitfalls and potentially detect milder forms of hydrops in early MD. We aimed to 1) determine the degree to which asymmetry in size of endolymphatic structures and enhancement of perilymphatic structures lateralised to the symptomatic side in unilateral Meniere's disease 2) determine if this asymmetry was present in patients without grade 2 (severe) hydrops on the symptomatic side or without asymmetry of the grades.

Materials and Methods: This retrospective study included 21 patients with probable or definite MD according to the 2015 Barany criteria, x patients with nonspecific audiovestibular symptoms felt unlikely to be isolated cochlear or vestibular hydrops. These patients underwent a 4-hour delayed intravenous Gd-enhanced 3D-FLAIR MRI between October 2017 and December 2018. A series of MRI features were rated for asymmetry between the two ears by a single neuroradiologist (20 years' experience) who was blinded to diagnosis and laterality of the symptoms. Cases were randomly mixed with 20 additional 3D-FLAIR MRI studies from other patients. Both size of structures (cochlear duct, utricle, saccule, vestibular endolymphatic space) and enhancement of the perilymphatic structures (cochlea, vestibule, semicircular canals) were assessed for asymmetry. The grade of cochlear and vestibular hydrops was also recorded according to the Nakashima grading system, and saccule: utricle ratio was assessed.

Results: The cochlear Nakashima grading was higher on the symptomatic side in 12/21 patients with 17/21 cochlear hydrops being grade 2. The vestibular Nakashima grading was higher in 13/21 patients with 12/21 being grade 2. Asymmetric enlargement of the cochlear duct was present in 20/21 patients and the vestibular endolymphatic space in 19/21 (with absent saccules in remaining 2/21 patients). Ipsilateral utricle and saccule were fused in 9/21 so precluding individual assessment of the endolymphatic structures. Asymmetric enlargement of the utricle was present in 5/12 and saccule in 10/12. There was ipsilateral (and no contralateral) increased saccule: utricle ratio in 7/12 and an absent saccule in 2/12. There was asymmetrically prominent perilymphatic enhancement demonstrated in the cochlea in 11/21, vestibule in 6/21 (but obliterated in 5/21) and semicircular canals in 8/21.

Conclusions: Semi-quantitative grading systems may not reveal differences between the two ears or demonstrate severe (grade 2) hydrops in patients with unilateral MD. Asymmetric enlargement of the cochlear duct or vestibular endolymphatic structures ipsilateral to the symptomatic ear is demonstrated in almost all patients, and routine recording of these features would lend support to the presence of symptomatic endolymphatic hydrops.

R-016 Session S12

Audiological outcomes in children with microtia/atresia implanted with transcutaneous active bone conduction hearing implant

Di Gregorio M.F., Zernotti M.E., Zernotti M.

Department of Otorhinolaryngology, Sanatorio Allende, Cordoba, Argentina, Universidad Nacional de Cordoba

Objectives: To evaluate the safety and efficacy of the transcutaneous Bone Conduction Implant, the BONEBRIDGE, in patients with congenital aural atresia (CAA).

Methods: Audiometry, speech recognition test and free field audiometry were performed previous and after surgery. Word recognition scores and speech perception was evaluated using Spanish phonetically-balanced disyllables word list.

Results: Fourteen subjects were implanted with the 21 transcutaneous devices BONEBRIDGE (seven bilateral placements). The study cohort comprised seven males and seven females aged from 3 to 17 years (mean age 9.76 yrs). According to the different approaches 43% of the patients received the BB by transmastoid approach, 29% via middle fossa and finally 28% via retrosigmoidal. The pre-operative audiometry shows PTA4 = 66.4 dB (64.2–68.6, 95% – CI) and improved after activation to 19.2 dB (16.9–21.5, 95% – CI), resulting in a mean functional gain of 48 dB. Regarding speech discrimination, the pre-operative outcomes of the disyllabic measurements were 34.3% and for monosyllables 27.4%. Following activation, the speech discrimination improved to 98.6% and 97.9%, respectively. No infections or adverse device-related effects occurred in the patient group.

Conclusions: We can conclude that the BONEBRIDGE implant is a suitable solution for patients with conductive or mixed hearing loss suffering from congenital aural atresia. Different surgical techniques or approaches were used for implant placement, based on the patient's anatomy. Studies show improved functional gain, better speech perception, and lower rates of percutaneous complications associated with this implant.

R-017 Session S14

Audiology outcomes following cochlear implantation in patients with asymmetric hearing loss

Hill E., Jiang D., Nunn T., Driver S., Ballieu K., Vithlani R., Pai I.

Hearing Implant Centre, Guys and St Thomas Hospital, London, UK

Objectives: We review the one-year outcomes following insertion of adult cochlear implants in a series of patients with significant residual hearing.

Methods: We present an interesting case series of patients who underwent cochlear implantation for asymmetric hearing loss at St Thomas' Hearing Center between February 2018 and May 2019. These patients presented with residual hearing that would have placed them outside the NHS criteria for cochlear implantation. The patients were therefore implanted as a part of a GSTT sponsored and Oticon funded trial.

Results: Of the nine implanted so far, three had a history of progressive bilateral hearing loss with sudden unilateral deterioration to an anacusis ear. The significant residual hearing in the contralateral ear put them outside of NHS guidelines. All patients underwent a pre-operative MRI which was normal. They all had implantation of the anacusis ear.

We present a discussion of audiological outcomes over one year. Two patients had a rapid improvement in audiological progress, while the other patient took twelve months before achieving excellent progress. We will present this education case series as well as a review of the literature on implantation in single-sided deafness versus a patient with asymmetric hearing loss and the marked heterogeneity in these groups.

Conclusions: Patients with residual hearing can have variation in the speed of hearing rehabilitation but can achieve excellent audiological outcomes.

R-018 Session S03

Autologous fibrin glue for the repair of tympanic membrane

Karpischenko S.A., Bervinova A.N., Sopko O.N.

ENT Department, First Pavlov State Medical University of St. Petersburg, St. Petersburg, Russia

Introduction: Tympanic membrane perforations, especially in the context of chronic suppurative otitis media, are a common problem. In this cases myringoplasty procedure may be performed, however significant variation in success rates between techniques and surgeons make the outcomes unpredictable and not reliably reproducible. In recent years, some agents have been tried experimentally for the healing of tympanic membrane perforations, such as hyaluronic acid, pentoxifylline (Trental), fibrin glue (Tissucol Kit) and epidermal and fibroblast growth factors. Autologous fibrin glue is the part of the blood plasma derived from a small volume of whole blood subjected to a special centrifugation procedure, and it contains a high concentration of platelets. After it has been activated, growth factors are present with the degranulation of the platelets, and the process of wound healing begins. These growth factors include platelet-derived growth factor (PDGF), insulin-like growth factor (IGF), and vascular endothelial growth factor (VEGF). Moreover, Erkilet et al. showed positive effects of PRP when used on its own on the tympanic membrane. However, because fibrin glue is fractionated from pooled human plasma, it has been reported to be associated with a very small risk of transmission of certain diseases and hypersensitivity reaction.

Aim: In this study, we assessed the effects of autologous fibrin glue together with perichondrium graft in the repair of tympanic membrane perforations and on the processes of healing.

Materials and Methods: From December 2018 to January 2019, in the ENT Clinic of the Pavlov First State Medical University of St. Petersburg 6 patients with chronic suppurative otitis media underwent surgery (tympanoplasty 1 type). All the patient had an intact ossicular chain on preoperative CT scan. According to anamnesis 2 patients had surgery before with neotympanic membrane re-perforation in the early postoperative period. We applied the perichondrium graft and used autologous fibrin glue as a sealant. Autologous fibrin glue was made from the venous blood of patient (13 ml) using centrifugation and consists of 2 fractions: fibrinogen and thrombin. To obtain Autologous fibrin glue standard method was used: 13 ml of venous blood was obtained and drawn into 4 test tubes with anticoagulant (sodium citrate 3,2%) and centrifuged. After centrifugation middle layer, which consists of plasma, platelets and growth factors, was used further. To prepare fibrinogen cryoprecipitation method with ethanol was used. To prepare thrombin plasma process of coagulation was activated with Calcium Gluconate. We use 2 fractions of blood after perforation was closed (1:2).

Results: After 1- and 3-months microscopy examination of the ear was performed to determine the results of tympanoplasty. It was revealed that all patients have no perforations and no retraction pockets in neotympanic membrane.

Conclusions: Perforation closure failure is often associated with the migration of the autograft, so applying adhesion agents can improve the results of tympanoplasty. It is important to note that inadequate vascularization of the graft and development of inflammatory reactions also adversely affect the engraftment processes. Autologous fibrin glue is universal material that, due to its adhesion properties, facilitates the fixation of the graft, and because of high biological potential reduces the number of perforations in the postoperative period.

R-019 Session S11

Automated diagnosis of an ear disease utilizing deep learning

Cha D.C., Moon I.S.

Department of Otorhinolaryngology, Yonsei University College of Medicine, Seoul, South Korea

Objectives: Middle ear disease could be easily treated with early intervention. However, if it is not properly treated, significant sequelae may remain. Sometimes, inexperienced doctors can make misdiagnosis and poor accessibility to specialist and diagnostic tools in some area some can make it hard to early precise diagnosis. In a primary care setting, diagnosis of ear disease may rely on otoscopy alone, without additional resources such as imaging or acoustic measures. For inexperienced doctors, the supplementary tool may be beneficial for better diagnosis.

Till now, none of the automatic diagnostic tools for tympanic membrane exceed 90% of accuracy nor classification categories more than five. We developed high fidelity screening of ear disease by utilizing deep convolutional neural network(CNN) model with training large amount of image acquired from the tertiary center clinic.

Materials and Methods: 19,521 eardrum photos from the outpatient clinic of Severance Hospital between 2013 and 2017 were included. Drum photos were taken with either 4 mm or 2.7 mm OTOLUX 0-degree telescope tethered to Olympus OTV-SP1 video imaging system. The image format was in DICOM, resolution of 640 by 480 pixels. Among 19,521 photos, 6,954 photos for post-operative; 892 photos with unsatisfactory resolution were excluded. All the images were double checked by two different experienced specialists. MATLAB® (MathWorks, Inc., Natick, Massachusetts, United States) was used as the software for labeling and machine learning. Eardrum was classified into nine categories: normal, healed perforation, tympanosclerosis, attic retraction, adhesive otitis media, eardrum perforation, otitis media with effusion, EAC tumor, and otitis externa. 80 percent of the image was used for training, and 20 percent of the image was used for validation. Instead of building CNN model from scratch, we used the transfer learning technique, pretrained CNN model with ImageNet, and fine-tuned it for classifying tympanic membrane image.

Results: The classification system correctly classified given eardrums into nine categories with an accuracy of 90.2 percent. Initially, it was below 85 percent, but accuracy was improved by changing RGB layout of eardrum image and adding a hidden layer before final classification layer. This level of accuracy is comparable to a specialist in a tertiary hospital. This classification model shows its potential not only to screen ear disease but also aid underexperienced physicians.

Conclusions: This is the first study to use deep learning method to train more than 12,000 eardrums and successfully get more than 90 percent of accuracy with nine classifications. In the future, this will be used as a base model for automatic diagnosis and screening of ear disease using low-cost otoendoscopy device, and contribute to early detection of the disease, helping the world reduce the burden of hearing impairment.

R-020 Session S12

BAHA in various acquired and congenital ear malformations in children

Mrówka M.¹, Skarżyński P.H.^{1,2}, Ratuszniak A.¹, Skarżyński H.¹

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Treatment and rehabilitation of children with conductive and mixed hearing loss in cases of

congenital ear malformations (bilateral microtia with external auditory canal atresia), after chronic otitis media, or in single-sided deafness (SSD) can be conducted applying Bone Anchored Hearing Aids (BAHA).

Aim: Our aim was to assess the results of the application of BAHA in children and to compare hearing obtained with typical bone conduction hearing aids (headband hearing aid, bone conduction glasses, or cross-system in SSD) to hearing in BAHA system.

Materials and Methods: Our method of choice in the treatment of hearing impairments in presented cases of various defects of the ear was an attachment of titanium fixture to the temporal bone, with or without removal of subcutaneous tissue around attachment. The procedure was performed as one stage in older children or two-stage in younger children. After implantation the titanium screw was not used for about 6 weeks to 4 months, to provide good healing and proper osseointegration. Then a hearing aid was selected. Audiological examinations were performed 1 and 6 months after hearing aid fitting. Our material consists of 125 patients in the age from 3 y.o. to 18 y.o.

Results: Audiological results are good and sustainable. Thresholds measured in the free field audiometry wearing BAHA hearing aids are on average 8,8 dB lower in comparison to previously used hearing aids. Our patients emphasize that the new hearing aids provide better sound quality, speech understanding, are comfortable and are more aesthetic comparing to typical bone conduction hearing aids.

Conclusions: Application of BAHA in children with various hearing loss in ear malformations is good from the audiological perspective as well as with regard to safety and everyday comfort of a user.

R-021 Panel: Otology in Taiwan

Bilateral cochlear implantation in Chang-Gung Memorial Hospital, Taiwan – a preliminary report of 131 cases

Wu C.-M.

Department of Otolaryngology, Chang-Gung Memorial Hospital, Chang-Gung Hospital, Taipei, Taiwan

Introduction: Bilateral cochlear implantation is the current trend globally for the treatment of severe or profound hearing loss in adults and children. Existing literature shows that audibility in a noise-filled environment, sound-source, and high-frequency signal identification in bilateral cochlear implant (CI) recipients are superior to those with only one implant. The purpose of this study is to present the speech perception of Mandarin-speaking children after bilateral cochlear implantation and explore factors (implant time of C1, C2; inter-implant interval and CI use time) that may influence the outcome.

Materials and Methods: From Jan 2015 to Dec 2018, there are 131 cases (including 18 self-paid and 113 government reimbursement) bilateral implantation performed in our hospital. Three open-set speech perception tests were used,

including an easy-sentence test (ES), a difficult-sentence test (DS), a phonetically balanced (PB) word recognition test. Post-op speech perception tests scores were collected 3 months, 6 months and 12 months after the implantation. the outcomes (each speech perception score) were compared using inter-implant interval categories as <3 years (1st group), 3.1–5 years (2nd group), 5.1–7 years (3rd group), 7.1–10 years (4th group), and over 10 years (up to 15.8 years) (5th group). Follow-up time from 3 months to 3.9 years.

Results: The mean (median) ES scores of the second ear in each group is 79.2 (86), 91.3 (96), 84.4 (90), 56.7 (70) and 59.3 (65). DS scores is 70.4 (71), 92 (95), 78 (82), 54.1 (67) and 59 (61). PB scores of the 2nd EAR is 73.9 (76), 86.7 (88), 61.6 (60), 47.5 (40) and 45.8 (40).

Discussion: The interval between the sequential implantations are associated with the outcome of the second implant. Patients with over 7 years of the inter-implant interval have worse mean and median scores than those with less than 7 years. The cases who can attend and have the speech test performed after the second implantation also decreases with increased inter-implant interval. Only about 40% of cases with over 10 years of the inter-implant interval can have speech perception scores recorded after 6 months follow-up.

R-022 Session S14

Binaural advantages in patients after a cochlear implantation

Lorens A.¹, Kruszyńska M.¹, Obrycka A.¹, Skarżyński P.H.^{1,2,3}, Skarżyński H.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Second Faculty of Medicine, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: A lack of binaural hearing produces deficits in hearing function, particularly speech discrimination in noise and sound localization, and leads to difficulties in performing activities related to communicating in background noise. The aim of the study was to evaluate binaural effects after cochlear implantation in a different group of patients.

Materials and Methods: To enable the comparisons of results between different groups of patients (bilateral, bimodal and patients with unilateral hearing loss) we calculated the effect size (d) for all significant differences from the t -tests. Dunlap's d was calculated as recommended for experiments with repeated-measures designs, and the effect sizes were interpreted according to Cohen's classification of small (.2), medium (.5), and large (.8) effects.

Results and Conclusions: For patients with unilateral hearing loss (UHL), the central estimates (the junctures of the upper and lower uncertainty intervals) of the effect sizes are moderate for squelch ($d = .57$) and large for redundancy in quiet ($d = 1.35$), redundancy in noise ($d = .97$),

and head shadow ($d = 1.33$). The effect sizes for subjects with UHL who used a CI in the profound-loss ear are on a par with or larger than the sizes for users of bilateral CIs or of bimodal stimulation. Bilateral CIs are the best treatment option for patients with severe-to-profound hearing loss on both sides and that either bilateral CIs or bimodal stimulation are the best options for patients with a severe-to-profound loss on one side and residual hearing at low frequencies on the contralateral side. For patients with UHL, the use of a CI in the profound-loss ear is a good option that can produce the binaural effects.

R-023 Session S05

Biofilm formation and chronic otorrhea after cholesteatoma surgery

Jotic A.^{1,2}, Jesic S.^{1,2}, Cvorovic L.^{1,2}, Radin Z.³

¹ Clinic for Otorhinolaryngology and Maxillofacial Surgery, Clinical Center of Serbia, Belgrade, Serbia

² Medical Faculty, University of Belgrade, Serbia

³ General Hospital 'Djordje Joanovic', Zrenjanin, Serbia

Objectives: The objective of this study was to examine if biofilm formation in surgically treated patients with chronic otitis with cholesteatoma is responsible for complications in the early postoperative course and more frequent episodes otorrhea and persistent otorrhea in the follow-up period.

Materials: The study included the patients with chronic suppurative otitis with cholesteatoma who underwent surgical treatment (radical tympanomastoidectomy or canal-wall-down tympanoplasty) from May 2014 to June 2017.

Methods: Tissue samples included matrix and perimatrix of the cholesteatoma, taken intraoperatively. Samples were bacteriologically tested. To detect the production of biofilm, the bacterial suspensions of isolated bacterial cultures were prepared in sterile saline adjusted to a density of 0.5 McFarland standard. The ability of isolated bacteria to form biofilm was tested by commonly used microtiter plate method. Two groups were compared. 'Biofilm group' consisted of 27 patients with isolated bacteria which had the ability to form a biofilm, and 'control group' consisted of 30 patients with isolated bacteria which had no biofilm formation ability. The parameters that were followed were the time of dry epithelization of the open cavity wound dehiscence, perforation of neomembrane, the frequency of postoperative otorrhea or persistent otorrhea. Follow-up time was 12 to 16 months.

Results: It was required 26.6 days for patients in the biofilm group to achieve dry epithelization of the open cavity, and 21 days for patients in the control group ($p = 0.876$). Episodes of postoperative otorrhea were significantly more frequent in patients in biofilm group ($p \leq 0.001$). Significantly more patients in the biofilm group (13 of 27 patients, 48.14%) had postoperative otorrhea comparing to the control group (8 of 30 patients, 26.67%) ($p < 0.05$). Biofilm was detected in 92.3% of the patients in the biofilm group who had postoperative otorrhea. Persistent otorrhea was

detected in 2 (7.4%) in the biofilm group and in 1 (3.3%) in the control group ($p = 0.495$)

Conclusions: Patients in biofilm group had a greater tendency of biofilm formation and more frequent otorrhea in the postoperative period. Isolated bacteria responsible for postoperative otorrhea were different from those isolated preoperatively, which could indicate that individual characteristics of patients mucosa were responsible for biofilm formation, as well as the bacteria biofilm ability formation.

R-024 Session S08

Canal wall up tympanoplasty for chronic otitis media in children

Plichta Ł.¹, Miązek-Zapala N.¹, Suska-Więch A.¹, Górski S.¹, Porowski M.¹, Skarżyński P.H.^{1,2}, Skarżyński H.^{1,2}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

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

Objectives: To examine hearing results in pediatric patients after canal wall up ossicular reconstruction with partial ossicular replacement prostheses (PORPs) and total ossicular replacement prostheses (TORPs) in children with chronic otitis media.

Materials: A retrospective evaluation was performed on 85 pediatric patients with chronic otitis media who underwent prosthesis ossiculoplasty from 2016–2017.

Methods: Audiometry results were evaluated preoperatively and postoperatively for pure-tone average (PTA), air-bone gap (ABG) and method of ossicular reconstruction.

Results: In 39 children a PORP and in 45 TORP prosthesis were applied. 75% of children with PORPs and 68% of children with TORPs had an ABG of less than 20 dB postoperatively.

Conclusions: Children who underwent ossicular reconstruction with PORPs had slightly better postoperative hearing than did children with TORPs. Severe mucosal defect and Eustachian tube dysfunction may worsen hearing results in children.

R-025 Session S24

Case analysis for facial nerve paralysis in children

Li L., Fan Z.M., Han Y.C., Wang H.B.

Otology Department, Shandong Provincial ENT Hospital affiliated to Shandong University, Jinan, P.R. China

Objectives: To analyze the characteristics of facial paralysis in children.

Materials and Methods: The etiology of 26 pediatric facial palsy cases and the methods of diagnosis and treatment were analyzed retrospectively. Facial nerve function was evaluated via the House-Brackmann grading system.

Results: Among the 26 cases, there were 12 males and 14 females, aged from 11 months to 11 years. Bell's facial paralysis was diagnosed in 8 cases. Among the 8 cases, oral steroid hormones and antiviral drugs were given in 6 cases, and facial nerve decompression transmastoid approach was made in 2 cases. The preoperative facial nerve function of the 8 patients was grade III in 2 cases, grade IV in 4 cases, grade V in 2 cases, respectively. After the treatment, the facial nerve function improved to grade I in 6 cases, grade II in 1 case and grade III in 1 case. There were 6 cases of traumatic facial nerve paralysis, including 5 facial paralysis with temporal bone fracture and 1 case of maxillofacial injury. 5 cases were treated with facial nerve decompression via middle fossa approach, and 1 case was dealt with conservative treatment. The preoperative facial nerve function of the 6 patients was grade V in 3 cases, grade IV in 2 cases and grade III in 1 case, compared with facial nerve function of grade III in 3 cases, grade II in 2 cases and grade I in 1 case after the treatment. Among 4 cases of otitis media combined with facial paralysis, 2 cases received conservative treatment with anti-inflammatory drugs, another 2 cases received facial nerve decompression transmastoid process approach. One case of middle ear cholesteatoma complicated with facial paralysis was treated with facial nerve decompression by canal wall down mastoidectomy. One case of Ramsay Hunt syndrome was given steroid hormones and antiviral drugs. The other 6 cases included 2 cases with facial paralysis caused by immune deficiency and otitis media, 2 cases caused by malignant tumors and 2 cases of congenital facial paralysis with malformative diseases.

Conclusions: Bell's facial paralysis was the most common cause of facial paralysis in children. Corticosteroids and antiviral therapy were effective and had a good prognosis. When conservative treatment was ineffective, facial nerve decompression might be an effective treatment choice. The morbidity of facial paralysis in children caused by trauma (including craniocerebral injury, temporal bone fracture, maxillofacial injury, etc.) was higher than that in adults. The causes included falls, traffic accidents or other reasons which could lead to more serious injury. The morbidity of infection-induced facial paralysis (including Ramsay Hunt syndrome, otitis media, etc.) is lower than that in adults. Malignant tumors and immune deficiency were also important causes of pediatric facial paralysis. The etiology and prognosis of facial paralysis in children were different from that in adults. The treatment should also be based on different causes.

R-026 Session S12**Causes and prevention of revision surgery for preauricular sinus: a histopathological analysis**Kim W.J.¹, Lee Y.M.¹, Kang M.S.², Cho H.J.², Heo K.W.¹*Otorhinolaryngology-Head & Neck Surgery and 2Pathology, Inje University Busan Paik Hospital, Busan, Republic of Korea (South Korea)*

Objectives: Recurrence rates following the preauricular sinus (PAS) surgery vary. Few studies have investigated recurrence after primary PAS surgery in histopathological terms. We performed histopathological analysis of the causes of revision surgery for PAS, with a view to reducing the recurrence rate after primary surgery.

Materials: We reviewed the medical records of patients who underwent revision surgery after primary excision of a PAS between 2002 and 2017. A pathologist reviewed the histopathology slides.

Results: In total, 24 patients underwent revision surgery; of those, histopathology slides were available for 18 patients (19 revisions). The mean interval between primary and revision surgery was 50.4 months. We detected lumen with stratified squamous epithelium in 14 of the 19 (73.7%) revisions. Cartilage tissue was attached to the epithelial lining of the lumen in 14 of the 17 (82.4%) slides containing lumen. Inflammatory changes were found in all slides, and granulation tissue was detected in 10 of 19 revision surgery slides.

Conclusions: To prevent PAS recurrence after primary surgery, we recommend a wide local excision including the inflammatory soft tissue, with concomitant partial removal of the cartilage of the ascending helix adjacent to the PAS.

R-027 Session S02**Changes of blood flow in the cochlea after noise exposure: an animal model**Park K.W.¹, Shin S.-A.², Kim K.H.¹, Park Y.-H.¹¹ *Department of Otolaryngology-Head and Neck Surgery, Chungnam National University Hospital, Daejeon, Korea*² *Department of Medical Science, Chungnam National University, Daejeon, Korea*

Introduction and Objectives: Several mechanisms of damage to the cochlea by noise have been proposed, one of them is considered to be the change of microcirculation. In this study, we aimed to investigate microvascular and related molecular changes in the cochlea caused by temporary or permanent noise-induced hearing loss.

Methods: Changes of cochlear blood flow were measured after noise exposure and related vasoactive factors were observed via various molecular biologic studies.

Results: Changes in microcirculation in the cochlea showed differences with the passage of time according to the transient and permanent hearing loss models. Histopathologic studies also showed different changes in the vessels of the cochlea lateral wall and differences in vasoactive factors were observed. These have been associated with changes in inflammatory responses in the cochlea.

Conclusions: Depending on the degree of noise, the microcirculation of the cochlea changes, and different vasodilatation and vasoconstriction affect hearing changes by inducing inflammatory responses.

R-028 Session S05**Characteristics of the patients with labyrinthitis subsequent to purulent otitis media**Kazuhiko K.^{1,2}, Motohiro S.³, Murakami D.²¹ *Department of Otorhinolaryngology, Chidoribashi General Hospital, Japan*² *Department of Otorhinolaryngology and Head & Neck Surgery, Kyushu University Hospital, Japan*³ *Department of Otorhinolaryngology, Fukuoka University Chikushi Hospital, Japan*

Objectives: In general, basic medical textbooks demonstrate the pathological figures which show the destructive and irreversible change in the inner ear filled with many neutrophils and bacteria. However, we rarely encounter such patients in modern times, because antibiotic drugs are developed. The aim of this study is to detect the characteristics of the patients with labyrinthitis subsequent to purulent otitis media.

Materials: Twenty-six subjects with labyrinthitis subsequent to suppurative otitis media were recruited at the Department of Otorhinolaryngology, Chidoribashi General Hospital from April 2004 to June 2017. They were diagnosed as labyrinthitis when they had both purulent otitis media and the symptoms of dysfunction in the inner ear such as hearing loss and dizziness at the same time.

Methods: We designed a retrospective study and this work was approved by an ethics committee at Chidoribashi General Hospital. All of the data including symptoms, audiogram, nystagmus, and treatment were collected from the electric medical recording system. Statistical significance was evaluated at $p < 0.05$ on the software JMP 13 (SAS Inc., USA).

Results: The causes of labyrinthitis were acute otitis media, acute exacerbation of chronic otitis media and post-operative infection of otitis media. The complaints were otalgia, hearing loss, dizziness, ear fullness, and tinnitus in descending order of prevalence. The hearing level of high frequencies was mainly impaired rather than that of low frequencies. The hearing level in the patients with steroid therapy was well recovered while that in the patients without steroid therapy was not well recovered. The medical care vanished dizziness fully.

Conclusions: These results indicate that the equilibrium function may be well recovered rather than the hearing loss and that steroid treatment for labyrinthitis may be very effective in the impaired hearing level.

R-029 Session S19

Chronic otopathologic changes in the cochlea following temporal bone fracture

Knoll R.M., Lubner R.J., Ishai R., Alvarez V., Jung D.H., Nadol J.B., Remenschneider A.K., Kozin E.D.

Harvard Department of Otolaryngology, Boston, MA, USA

Objectives: Head injury is a major worldwide cause of death and disability worldwide. Approximately 4 to 30% of individuals following head injury have skull fractures, in which 14–22% include the temporal bone (TB). Auditory disturbance has long been recognized as one of the possible consequences of head injury with temporal bone fracture (TBF). Otic capsule-violating fractures are reported to occur in 2.5% to 5.6% of cases and are associated with a higher incidence of sensorineural hearing loss (SNHL). While the acute changes following head injury with TBF have been described, chronic cochlear changes are largely unknown. We hypothesize that following head injury with TBF there are pathological changes that occur in the cochlea. Herein, we aim to investigate the histopathology of the cochlea in patients with a history of head injury with TBF.

Materials: Subjects from the National Temporal Bone Pathology Registry.

Methods: Inclusion criteria consisted of individuals with a history of head injury with TBF. Exclusion criteria included patients with a history of noise exposure, otologic surgery involving the middle and/or inner ear, hearing loss prior to the head trauma, hearing loss due to other otological disorders, such as chronic otitis media, and/or severe post-mortem changes, e.g. compression artifact or autolysis. Cases were compared to historical age-matched controls. The cochleae were evaluated by light microscopy using quantitative methods including quantification of spiral ganglion cells (SGC) and hair cells (HC), and qualitative methods to evaluate the health of *stria vascularis* (SV), the presence of endolymphatic hydrops (EH). Contralateral non-fractured TB of unilateral TBFs were also included for comparison.

Results: Six TBs from four male patients met the inclusion criteria. Transverse, otic capsule-involving TBFs were present in 4 TB. The average age of death was 65.5 years (range of 21 to 88 years, median 76.5 years). The mean SGC count of TBF cases was 39% compared to historical age-matched controls. When comparing TBs of the same individuals (n = 4 TB), the side of the fracture showed on average 26% greater loss of SGC than the non-fractured side. Severe degeneration of HC was found in all TB fracture cases (TB = 4). Moderate to severe atrophy of SV was present in 3 fractured cases, whereas contralateral non-fractured cases showed mild atrophy of SV. Cochlear EH was found in three fractured cases.

Conclusions: Otopathological analysis in patients with a history of head injury showed distinct peripheral cochlear pathology, including reduction of ScGC even in cases without TBF. Findings have implications for the mechanism of peripheral cochlear injury following head injury.

R-030 Session S18

Classification of cochlear hypoplasia based on 3D images

Dhanasingh A.

MED-EL GmbH, Innsbruck, Austria

Introduction and Objectives: Three-dimensional (3D) segmentation of complete inner-ear structures help in the better identification of inner-ear malformation types, in particular, the connection between internal auditory canal (IAC) and cochlear portion. A new classification of cochlear hypoplasia (CH) for the first time based on 3D segmentation of inner-ear is proposed in this study.

Materials and methods: 31 pre-operative Computed Tomography (CT) dataset were loaded into 3D slicer freeware for 3D segmentation of inner-ear by capturing complete inner-ear structures from all image slices. The axial plane is better suitable for the segmentation of these structures by setting a tight grey scale threshold to avoid capturing undesired structures. The size of the cochlear portion is determined by measuring both the 'A' value (basal turn diameter) and the perimeter of the cochlear available by going along the outer wall to the extent cochlea is developed.

Results and Discussion: CH type-I is with the normal presence of IAC leading to cochlear portion along with the normal presence of vestibular portion, while CH type-II is again with the normal presence of IAC leading to cochlear portion but with some degree of disruption in vestibular portion. CH type-III is when there is a disconnection between IAC and cochlear portion. With all these three types, the size and shape of the cochlea were varying too much starting with small bud-like appearance up to one full turn of the cochlea. Cochlear lumen available for CI electrode placement was measured to be between 12 mm and 21 mm for CH type I, 3 mm to 20 mm for CH type II and 6 mm to 19 mm for CH type III. There is a good positive correlation between the 'A' value and the measured perimeter of the cochlea available.

3D visualization of the complete inner-ear along with the 2D radiographic image adds valuable information both in understanding the morphology of complete inner-ear structures and could as well in surgical pre-planning. The previous classification of CH types based on cochlear size and number of turns using the 2D radiographic images need to be revised as the IAC connecting the cochlear portion is of at most important. CI electrode choice is mainly based on the availability of the cochlear lumen. The cochlear size as measured is very similar for all the three CH types. The proposed classification (Dhanasingh classification of CH based on 3D images) in this study simplifies the whole classification process as 3D segmentation of inner-ear will reveal the

cochlear size and shape with which suitable CI electrode array can be selected.

Conclusions: Classification of Cochlear Hypoplasia malformation type based on 3D segmented inner-ear is simple to apply as demonstrated in this study. The 3D segmentation of the inner-ear could be done as a standard procedure during pre-operative image scanning which adds valuable information both in understanding outer morphology of inner-ear and also in surgical pre-planning. Irrespective of cochlear size and shape, proper connecting between IAC and cochlear portion needs to be analyzed and CI electrode array length can be selected simply based on cochlear size and shape which can be measured from the 3D image.

R-031 Session S22

Clinical features and prognosis in sudden sensorineural hearing loss with inner ear hemorrhage on 3D FLAIR MRI

Wang M.¹, Hou Z.¹, Sun X.¹, Hu N.², Xiong W.¹, Fan Z.¹, Wang H.¹

¹ Department of Otolological Medicine, Shandong Provincial ENT Hospital affiliated to Shandong University, Jinan, China

² Imaging Department, Shandong Provincial ENT Hospital affiliated to Shandong University, Jinan, China

Objective: To investigate the clinical features and prognosis in sudden sensorineural hearing loss (SSNHL) patients with inner ear hemorrhage on 3D FLAIR MRI.

Methods: The clinical data of patients with unilateral SSNHL hospitalized from May 2017 to March 2018 were analyzed. All subjects accepted clinical examinations, imaging test, audiometric and vestibular function evaluations, including otoscopy, inner ear MRI (fs 3D T1WI, 3D T2WI and fs 3D FLAIR), pure-tone audiometry (PTA), tympanometry, speech recognition score (above the hearing threshold of 30 dB HL), auditory brainstem response (ABR), distortion products otoacoustic emissions (DPOAEs) recording, vestibular bi-thermal caloric test, ocular/cervical vestibular evoked myogenic potential (o/cVEMP), vestibular autorotation test (VAT) and head impulsive test (HIT). Patients with the same type of hearing loss adopted the same treatment according to the guidelines for diagnosis and treatment of sudden hearing loss (2015, China). According to the results of MRI examination, patients were divided into different groups and the clinical features and prognosis were analyzed by SPSS 22.0 software.

Results: 18.26% (132/723) of SSNHL patients were showed hyperintensity signals in the inner ear on 3D FLAIR MRI that could involve one or more areas, including the ipsilateral cochlea, vestibular, semicircular canal, common bony feet, and posterior ampulla. The ratio of male to female was 1:1.10, and left to right side was 1:1.54. The mean age was 45.05 years, and the mean duration of disease was 10.16 days. There were 105 subjects (79.55%) accompanying with vertigo, 29 (21.97%) with cardiovascular diseases. It implied hemorrhage or protein deposition in the inner ear in

96 cases (13.28%) that showed high signals on 3D T1, T2, and T2 FLAIR sequences. It indicated protein deposition in the inner ear in 36 (4.98%) that showed high signals on T2 and T2 FLAIR sequences while equisignals on 3D T1WI sequence. The signal intensity reduced or range narrowed were observed in 75 (10.37%) on MRI followed by 1 month that was consistent with MRI findings of hemorrhage. Among 132 patients with hyperintensity signals in inner ear on 3D FLAIR MRI, there were 4 patients (3.03%) with mild hearing loss ($26 \leq \text{PTA} \leq 40$ dB HL), 11 (8.33%) with moderate ($41 \leq \text{PTA} \leq 60$ dB HL), 24 (18.18%) with severe ($61 \leq \text{PTA} \leq 80$ dB HL), and 93 (70.45%) with profound hearing loss ($\text{PTA} \geq 81$ dB HL). Regarding type, there were 3 subjects (2.27%) with hearing loss in low frequencies, 7 (5.30%) in high frequencies, 30 (22.73%) in all frequencies, and 92 (69.70%) with total deafness. The abnormal vestibular function could involve in ipsilateral, contralateral or bilateral sides. The abnormal rate of the vestibular bi-thermal caloric test was 81.06%, o/cVEMP 80.3%, HIT 70.45%, VAT 77.27%. For hearing effect, the rate of recovery was 5.30%, excellent better 25.00%, better 28.79%, and poor 40.91%, with a total effective rate of 50.09%.

Conclusions: Inner ear hemorrhage can be found in SSNHL patients on 3D FLAIR MRI, which may involve in the ipsilateral cochlea, vestibular, semicircular canal, common bony feet, or posterior ampulla. It occurs commonly in middle-aged patients and more in the right side (dominant side). Most of these patients suffer from profound hearing loss with poor prognosis and complain of dizziness resulting from vestibular function damage in ipsilateral, contralateral or bilateral sides.

R-032 Session S05

Clinical features of otitis media with ANCA-associated vasculitis (OMAAV) showing hypertrophic pachymeningitis

Morita Y., Kitazawa M., Takahashi K., Ohshima S., Yagi C., Nonomura Y., Yamagishi T., Izumi S., Horii A.

Department of Otolaryngology Head and Neck Surgery, Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan

Objective: Otitis media with ANCA-associated vasculitis (OMAAV) is a recently defined ear disease characterized by intractable otitis media with progressive mixed or sensorineural hearing loss. OMAAV can be either the AAV-related localized ear disease or aural manifestation of systemic AAV such as granulomatosis with polyangiitis (GPA), formerly Wegener granulomatosis, which usually has lung and renal complications. In general, otitis media can cause intracranial complication. Sinus thrombosis, bacterial meningitis, and epidural abscess are the main otologic intracranial complications, however, OMAAV complicates rare type of intracranial complications namely hypertrophic pachymeningitis (HP). HP is a rare inflammatory disease that causes thickening of the dura mater, headache, and cranial nerve palsies. It was reported that HP and facial nerve palsy are frequently seen complications of OMAAV localized to ear. In the present study,

we investigated the clinical features of OMAAV from the viewpoint of HP.

Methods: Among 42 OMAAV patients treated in our hospital, 23 patients (seven males and sixteen females) who underwent contrast-enhanced MRI before treatment were enrolled in the study. All 23 patients showed an elevation of serum MPO- or PR3-ANCA or positive pathology in the biopsy specimen. Several factors such as age, gender, initial symptoms including lung and renal dysfunction, blood data (WBC and CRP), initial hearing threshold, treatment regimen (use of immunosuppressant), follow-up period, hearing outcome, and recurrence were compared between the OMAAV patients with and without HP.

Results: Among the 23 OMAAV patients, eight (35%, one male and seven females) had HP, while the other fifteen (six males and nine females) did not. HP was found in the middle cranial fossa dura, internal auditory meatus dura, and parietal lobe dura in five, three, and one out of eight patients alone or in combination, respectively. There were no significant differences in age, gender, treatment regimen, follow-up period, WBC, CRP, and recurrence between the HP (+) and (–) patients. Regarding the concomitant symptoms, none of eight HP (+) patients had lung and renal dysfunction, while five of 15 HP (–) patients had lung and/or renal dysfunction. Facial nerve palsy was found in three of eight HP (+) patients (37.5%) and three of fifteen HP (–) patients (20%). However, there were no significant differences in these concomitant symptoms between the groups. Hearing level before treatment was 68.0 ± 29.1 dB for HP (+) patients and 59.0 ± 21.1 dB for HP (–) patients showing no significant difference between the two groups. However, the hearing level after treatment of the HP (+) patients was 64.9 ± 31.4 dB, which was significantly worse than that of the HP (–) patients (42.3 ± 16.6 dB) ($p = 0.013$). Prognosis of HP was good in all patients, however, facial nerve palsy found in one of eight patients who had HP at both the middle cranial fossa dura and internal auditory meatus dura remained unrecovered. There was no significant difference in recurrence of vasculitis between the HP (+) and (–) patients.

Conclusions: HP was found in 35% of OMAAV patients. All HP (+) patients had no lung or renal dysfunction, indicating that HP is the specific complication to OMAAV localized to ear. 37.5% of the HP (+) patients complicated facial nerve palsy. Therefore, we suggest that HP seen in OMAAV may be caused by direct influences of middle ear inflammation on dura rather than a dural manifestation of systemic vasculitis. Although HP improved well by the treatment, prognosis of hearing and facial palsy was poor in HP (+) OMAAV.

R-033 Session S10

Cochlear implant in vestibular schwannoma surgery – how to assess acoustic nerve integrity with an intracochlear test electrode

Amilibia E.¹, Lassaletta L.², Polo R.³, Medina M.M.³, Pérez M.¹, Roca-Ribas F.¹, Gavilán J.²

¹ Hospital Universitari Germans Trias I Pujol, Badalona, Barcelona, Spain

² Hospital Universitario La Paz, Madrid, Spain

³ Hospital Universitario Ramón y Cajal, Madrid, Spain

Objectives: To determine the usefulness of electric auditory brainstem responses (EABR) obtained intraoperatively with an intracochlear test electrode (TE) after the resection of a vestibular schwannoma (VS) and to calculate its accuracy to assess the functionality of the acoustic nerve (AN) and its suitability to conduct stimuli delivered by a cochlear implant (CI).

Materials and Methods: A prospective, multicentre study was conducted in three tertiary referral centers between January 2015 and January 2018. All the patients included underwent a translabyrinthine resection of VS with anatomic preservation of the AN with the intention to place a CI in the same operation, in all the cases an intracochlear test electrode (TE) was used to assess the integrity of the AN before CI insertion.

The following variables were registered: type of case (sporadic or neurofibromatosis type-2 [NF-2]), previous irradiation therapy, preoperative hearing class, maximum extrameatal tumor size, type of resection (total, near total, subtotal or partial) and surgeon's perception about the AN status after tumor resection (anatomically intact, traumatized or sectioned).

Electrically evoked ABR responses were obtained before performing the labyrinthectomy, after removing the tumor and before CI. The audiological evaluation was performed 1, 6 and 12 months after surgery. CI performance was assessed with pure tone audiometry (PTA) and disyllabic word recognition test (DWR).

Results: A total of 23 patients were included during the study period; 17 (74%) of them were finally implanted with a CI and one patient (4.3%) received an auditory brainstem implant (ABI). It was possible to obtain reliable EABR data in 19 of the 23 cases included in the study. Of the 17 implanted cases, positive electrically evoked ABR responses were obtained after removing the tumor in 9 cases, were negative in 4 cases and not available in 4 cases. In addition, the ABI patient had a negative EABR response.

All the cases with positive EABR obtained auditory perception. From the four cases with negative EABR, only one case had auditory perception, which constitutes the only false negative of this study. The remaining 4 cases without available data had auditory perception as well. 14 cases reported auditory perception after the activation of their CI of these, 12 remained stable at one-year follow-up and two

cases had not reached one year of follow up at the time of collecting data for this study.

Of the 12 patients with at least one-year follow-up, the mean PTA at one year was 53.9 dB. Nine cases (75%) achieved open-set speech discrimination (SD) with a mean SD of 32%, Accuracy of the TE was 94%, sensitivity 91% specificity 100%. Positive predictive value (PPV) was 100% and the negative predictive value (NPV) 80%.

Conclusions: EABR elicited with the intracochlear TE had a diagnostic accuracy of 94% for predicting auditory perception with CIs after VS removal. These results suggest that the intracochlear TE can be used intraoperatively after tumor removal, to test the integrity of the AN as a useful tool for decision-making regarding implantation.

R-034 Session S10

Cochlear implant program in Bangladesh Armed Forces

Delwar Hossain M.

Combined Military Hospital, Dhaka, Bangladesh

Bangladesh is the 8th most populous country in the world with 163 million people. The prevalence of disabling hearing loss in Bangladesh is 9.6% and 4.5% of them having sensorineural hearing loss. Hearing devices including cochlear implants are necessary for 4–6% of the population. The fact that around 13.7 million people in the country are affected by hearing impairment leads to serious economic, social, educational and vocational problems.

A cochlear implant has created a paradigm shift in the treatment of severe to profound hearing loss. In less than four decades, the cochlear implant progressed from the first attempts to elicit hearing via direct electrical stimulation of the auditory nerve to a commercially available device that has restored varying degrees of hearing to tens of thousands of deaf patients. It improves the quality of life associated with deafness by increasing their listening and communication skills, their self-sufficiency and ability to interact with others. Bangladesh Armed Forces have established a world standard Cochlear Implant Center at CMH Dhaka. Avenue has been opened to serve the non-entitled patients as well. This center will provide substantial insight into the benefits of the Cochlear Implant program in our country. A total of 99 cochlear implantation have been done at CMH Dhaka till today. In my study, I have attempted to define the current situation and challenges for cochlear Implant program in Bangladesh.

R-035 Session S18

Cochlear implant surgery in non-developed mastoid process

Khudhair H.M.

ENT Department, Surgical Specialties Hospital Medical, City Complex, Baghdad, Iraq

Presentation of the case of cochlear implant in absence of mastoid process anteriorly displaced jugular vein and obstructed posterior tympanotomy site prohibiting the insertion of the electrode through the posterior tympanotomy root. Tympanomeatal flap reflection and cochleostomy were done permeatally. Insertion of the electrode was done through attico-antroostomy. Cartilage grafting was done. Uneventful postoperative period.

R-036 Session S14

Cochlear implantation in 2050: are we prepared?

Lavy J.A., Mehta N.

Royal National ENT Hospital, London Ear Clinic, London

Objectives: To outline the problems that will be facing CI teams over the next 10–20 years.

Materials and Methods: Experience of the oldest CI team in the UK over 35 years.

Results and Conclusions: The number of implant surgeries in particular revision surgeries we are doing are likely to expand exponentially.

R-037 Session S10

Cochlear implantation outcome in patients with DFNB1 locus pathogenic variants

Oziębło D.^{1,2}, Obrycka A.³, Lorens A.³, Skarżyński H.⁴, Ołdak M.¹

¹ Department of Genetics, Institute of Physiology and Pathology of Hearing, Kajetany/ Warsaw, Poland

² Postgraduate School of Molecular Medicine, Medical University of Warsaw, Warsaw, Poland

³ Department of Implants and Auditory Perception, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Almost 80% of children with profound prelingual hearing loss (HL) have a genetic cause of deafness; most often two GJB2/GJB6 (DFNB1 locus) recessive pathogenic variants. Cochlear implantation (CI) is a treatment of choice in profound HL patients but only a few studies combine the etiology of HL with CI outcome.

Materials and Methods: Patients with profound prelingual HL who received CI before the age of 2 years and had a completed DFNB1 genetic testing were enrolled in the study ($n = 159$). LittleEARS questionnaire and relative auditory development delay (RADD) at 6th month after CI activation were used to assess auditory development.

Results: Statistically significant differences were observed in RADD between patients implanted early (before 12 months of age) vs late (after 12 months of age) and between patients with a short (≤ 6 months) vs long (≥ 6 months) hearing aids (HAs) experience. Interestingly, in the most genetically homogenous patient group with two GJB2 c.35delG pathogenic variants, there was no statistically significant difference in RADD between patients implanted early and late and between patients with a short and long HAs experience.

Conclusions: In children with homozygous GJB2 c.35delG pathogenic variants, application of CI before 12 or 24 months of age brings a similar outcome. Children with an unknown genetic cause of HL should be implanted before 12 months of age to achieve better results in auditory development. Further studies in the non-DFNB1 group are planned to determine the link between the genetic background of HL and the CI outcome.

This study was supported by the Polish National Science Centre grant no. 2017/27/N/NZ5/02369.

R-038 Session S18

Cochlear implantation outcomes in cases of cochlear malformations

Diab Kh.M., Daykhes N.A., Kondratchikov D.S., Pashchinina O.A., Yusifov K.D., Mikhalevich A.E.

Federal Scientific-Clinical Center of Otorhinolaryngology of Federal Medical Biological Agency of Russia, Moscow, Russia

Objective: To demonstrate the benefits of implantation in patients with inner ear malformations.

Patients and Methods: It has been performed 32 Cochlear Implantations (CI) on pediatric patients with Cochlear malformations to date. According to L. Sennaroglu, the malformations encountered included 4 common cavity (CC), 2 cochlear hypoplasia type II, 2 type III and 1 type IV, 2 common cavities, 3 incomplete partitions of the cochlea type I (IP-I, cystic cochlea), 10 IP-II (Mondini deformity) and 8 IP-III. In cases of round window membrane presence, the CI was performed by a classical method with transmembrane electrode insertion. In cases of the common cavity and one IP I case, the round window membrane was not identified and the electrode was inserted via cochleostomy. CSF leak occurred in all cases of IP and common cavity.

Results: The full insertion of electrodes of previously chosen length (from 11 to 27 mm) has been achieved in all cases. In cases, with gushers due to the absence of bone wall between the cochlea and IAC cerebrospinal fluid leakage were successfully stopped by reliable packing

cochleostomy/round window niche using muscle flap and silicon stopper of the electrode array.

After 6 months from sound processor activation, 5–7 years old children understand words with an open choice of more than 90%. Children up to 5 years reached similar results closer to 12 months of using the systems. Speech of 5–7 years old children after 1 year using the system were easy to understand by all. CI was less effective in cases with a CC. Children with malformed cochlea required an increasing of the adjustment session number.

Conclusions: Good visualization of the round window and transmembrane insertion of an active electrode into the spiral canal of the cochlea in patients with inner ear malformations help to minimize the trauma of the spiral organ, control liquorrhea and improve postoperative auditory performance.

R-039 Session S14

Cochlear implantation outcomes in elderly patients

Kanai R., Kitada Y., Kanemaru SI.

Department of Otolaryngology, Head & Neck surgery, Kitano Hospital, Tazuke Kofukai Medical Research Institute, Osaka, Japan

Objectives: The Japanese population is aging at a very fast rate. The proportion of the Japanese population aged ≥ 65 years is 27.7% and those aged ≥ 75 years is 13.8%. The population of elderly people with profound hearing impairment will increase as the average life span increases. Therefore, they will need cochlear implantation (CI) to restore hearing ability. However, many elderly patients and their family worry about the age-related effects of CI and complications after surgery. Therefore, it is essential for them to be given sufficient information about CI. The objective of this study is to investigate the problems and outcomes of CI surgery in elderly patients in comparison with younger patients.

Materials: A total of 76 adults (M: F = 35: 41, mean age = 64.1 years) who underwent CI surgery between May 2009 and March 2018 were enrolled in this study. These participants were divided into two groups depending on the age at implantation [Group I, younger than 75 years (22 to 74 years), $n = 51$; Group II, 75 years and older (75 to 88 years) $n = 25$]. Any history that could affect perioperative management, postoperative speech performance by CI-2004, complications, and postoperative course were compared between Group I and II.

Results: The average open set sentence score (% correct \pm standard deviation) was $82.5\% \pm 26.3\%$ in Group I and $80.6\% \pm 22.8\%$ in Group II. There was no significant difference between the scores in both groups (Mann-Whitney U test). The proportion of patients with diseases that could affect perioperative management, including hypertension, diabetes, renal failure, gastric ulcer, asthma, cardiovascular disease, cerebrovascular accident, connective tissue disease, and mental disease was 37% and 68% in Group I and II, respectively. The proportion of patients

with multiple diseases was 2% and 16% in Group I and II, respectively. Complications occurred in 9% (5/51) and 24% (6/25) of patients in Group I and II, respectively. There was no significant difference in the proportion of complications in both groups (chi-square test). There were two cases each in Group I and II with major complications that required removal of CI or surgical treatment. However, no complication that negatively affected the general condition occurred in either group. The proportion of patients continuing the use of CI were 84% (43/51) and 76% (19/25) in Group I and II, respectively. There was no significant difference in the proportion between groups (chi-square test).

Conclusions: Elderly patients tended to have multiple diseases that could affect perioperative management. However, there were no significant differences in speech perception, rate of complications, and the proportion of continuing CI use between elderly and younger patients. Although perioperative management of pre-existing diseases is essential in elderly patients, CI surgery should not be avoided only due to age. CI can be safely performed and can contribute to the improvement of quality of life in elderly patients with profound hearing impairment.

R-040 Session S18

Cochlear implants surgery in congenital middle and inner ear malformations in children

Skarżyński H.¹, Mrówka M.¹, Porowski M.¹, Skarżyński P.H.^{1,2}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Cochlear implantation in children with severe hearing loss in the cases of middle and inner ear malformation is not easy from a surgical point of view, but can be carried out by experienced otosurgeons.

Objectives: The aim of the study was to show intraoperative problems and findings and compare the hearing results of cochlear implantation in children with middle and inner ears malformation.

Materials and Methods: Our method of choice of treatment of severe hearing loss in children is cochlear implantation, even in cases with different malformations of the ear. The analysis was performed in a group of 57 children; observation period was minimum 1 year. The results were assessed in about 1 month, 3 months, 6 months and 1 year after fitting the implant speech processor, in accordance with the follow-up program adopted in our Institute. The surgical procedure was preceded by CT and in some cases CT and MRI investigation. We observed some perilymphatic gushers and oozers, and we have used various kinds of cochlear implants and electrode arrays.

Results: The acoustic results are quite good but depend on malformation type. We have not observed any severe complications (e.g. facial nerve palsy or meningitis) after surgery.

Conclusions: Our results of cochlear implant surgery in patients with middle and inner ears malformation shown, that is worth, from the audiological point of view, and not so risky for patients method of treatment.

R-041 Session S15

Combined microscopic/endoscopic approach for petrous apex cholesteatoma

Sugimoto H., Hatano M., Noda M., Takaso Y., Yoshizaki T.

Department of Otolaryngology-Head and Neck Surgery, Kanazawa University Graduate School of Medical Science, Kanazawa, Japan

Despite wide bone removal and soft-tissue dissection, achieving a complete operative field of the petrous apex is still difficult under microscopy. Low visibility inside the petrous apex is due to the small entrance and large deep area. Use of an endoscope may resolve this problem by providing a wide-angle view inside the petrous apex. We describe a technique in which we approached petrous apex cholesteatomas in two cases using combined lateral microscopic/endoscopic approaches, and discuss the utility of endoscopy in managing matrix inside the petrous apex. Endoscopes could offer a helpful tool for operating inside the petrous apex.

R-042 Session S20

Comparative study of predictors for destructive capacity of primary acquired cholesteatoma in children and adults

Jesic S.D.^{1,2}, Jotic A.D.^{1,2}

¹ Medical Faculty, University of Belgrade, Serbia

² Clinic for Otorhinolaryngology and Maxillofacial Surgery, Clinical Center of Serbia, Belgrade, Serbia

Objectives: Aggressiveness of cholesteatoma refers to the phenomena of its extension through the middle ear, especially the occupation of the mastoid, destructive effects on the bone of auditory ossicles and medial wall structures, the intensity of the inflammatory reaction in cholesteatoma perimatrix, the incidence of complications and recurrence rate after surgery. The objectives were to evaluate predictive values of cholesteatoma localization, tympanic membrane pathology, inflammatory reaction on ossicular and labyrinthine wall destruction; different surgical techniques on cholesteatoma recurrence in order to compare the aggressiveness of cholesteatoma in children and adults.

Materials: Clinical characteristics of 163 children and 272 adult ears with primary acquired cholesteatoma were analyzed: tympanic membrane status, extension of cholesteatoma, ossicular and tympanic cavity walls lesions,

mucosal status, inflammatory reaction, complications, and recurrence rate.

Methods: Prospective case series study. The data were processed using the chi-squared test, z-test for proportions and logistic regression analysis. Paraffin sections of perimatrix from 14 children, 29 adult cholesteatoma underwent immunohistochemical analysis on Nuclear Factor kappa B; 20 children, 30 adult sections underwent morphometric analysis to estimate the intensity of inflammation.

Results: Long incus process defect in both groups is predicted by localization of cholesteatoma (children $\chi^2 = 3.71$, $p = 0.324$, $OR = 7.33$; adults $\chi^2 = 11.01$, $p = 0.009$, $OR = 22.36$) and attic tympanic membrane pathology ($\chi^2 = 4.5190$, $p = 0.335$, $OR = 1.077$; $\chi^2 = 13.7309$, $p = 0.082$, $OR = 7.88$). Stapes superstructure defect is predicted with cholesteatoma localization in adults ($\chi^2 = 21.74$, $p = 0.006$; $OR = 14.69$), attic pathology in children ($\chi^2 = 7.92$, $p = 0.191$, $OR = 12.07$). Cavum tympani walls are more often destructed in adults. Significant differences exist for lateral semicircular canal (LSC) (children 4.29% vs adults 17.28%, $p < 0.01$), facial canal (FC) (children 4.29% vs adults 23.89%, $p < 0.01$) and lateral attic wall destruction (children 45.45% vs 63.28%, $p = 0.028$). Lateral semicircular canal fistula is predicted in adults by cholesteatoma localization and extension to the mastoid ($\chi^2 = 3.86$, $p = 0.494$, $OR = 3.8182$), attic pathology of tympanic membrane ($\chi^2 = 8.43$, $p = 0.148$, $OR = 8.72$); and in children by pars tensa pathology ($\chi^2 = 6.94$; $df = 2$; $p = 0.311$). There is no difference in intensity of inflammatory reaction estimated by immunohistochemical study and morphometric analysis. There is not any difference in cholesteatoma recurrence rate between the groups (14.10% in children vs 13.40% in adults). The lowest recurrence rate in both groups is for two stages intact canal-wall (ICW) procedure (11.86% for children vs 7.50% for adults), and canal wall-down (CWD) (8.52% for children vs 7.24% adults). The higher recurrence of cholesteatoma was detected for one stage ICW (36.23% for children vs 28.37% for adults). Two stage ICW procedure predicts lower recurrence rate of cholesteatoma in children and adults comparing to one stage ICW ($\chi^2 = 7.88$, $p = 0.04$, $OR = 5.06$; $\chi^2 = 4.50$, $df = 1$, $p = 0.338$, $OR = 3.26$).

Conclusions: Cholesteatoma has destructive potential in both groups, but with different predictive clinical variables suggesting its different behavior in children and adults. Adult cholesteatoma shows a higher affinity for medial tympanic walls. Pars tensa pathology of the tympanic membrane is the only predictor for lateral semicircular canal destruction in children. Attic and pars tensa pathology are both predictors for this lesion together with cholesteatoma mastoid extension and localization in adults. It is indicated that adult acquired cholesteatoma is more predictable than children cholesteatoma concerning medial tympanic wall destruction. The recurrence rate is predicted primarily by applied surgical techniques.

R-043 Session S17

Comparing hearing preservation and functional outcomes in Advanced Bionics perimodiolar vs lateral wall electrode arrays

Jiang D.¹, Pai I.¹, Obholzer R.¹, Morrison G.¹, Powell H.¹, DeKlerk A.¹, Thomas T.¹, Rhian B.¹, Bance M.², Donnelly N.², Tysome J.², Axon P.², Eititis S.², Grimes H.², Hammond K.², Bryant J.³, Khalil S.³, Lavy J.³, Saeed S.³, Shaïda A.³

¹ Guys and St. Thomas' Hospital, UK

² Cambridge University Hospitals, UK

³ University College London Hospitals NHS Foundation Trust, UK

With the change in the NICE criteria for cochlear implantation, implant centres across the UK will be seeing an increase in patient numbers with more residual hearing. Therefore, it is important to have a good understanding of hearing preservation, trends and functional outcomes between perimodiolar vs lateral wall electrodes. Last year, The Cambridge centre presented a comparison of Advanced Bionics "Slim J" and "Mid Scala" electrodes; with compelling preliminary data that a lateral wall placement provided better hearing preservation post-implantation. A year on, we are conducting a Multicentre collaborative retrospective study, comparing trends and functional outcomes on the Advanced Bionics Ultra Slim J versus Advanced Bionics Ultra Midscala electrodes.

R-044 Session S07

Comparison of the frequency of positive hearing screening outcomes in school-age children around the world – a telemedicine model

Skarżyński P.H.^{1,2,3}, Świerniak W.¹, Tarczyński K.¹, Pierżyńska I.¹, Dziendziel B.¹, Skarżyński H.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

³ Institute of Sensory Organs, Kajetany/Warsaw, Poland

Introduction: One of the priority activities of Institute Physiology and Pathology of Hearing (IPPH) is a screening program for of all ages in collaboration with numerous national centers in Europe, Asia, and Africa. The Institute team, in collaboration with numerous national centers, has laid the groundwork for screening programs - developed methods, procedures and devices for administering hearing healthcare programs for children in different countries.

Aim: The primary goal of the program is early detection of hearing impairment, especially in children who start school and at raising awareness among parents and the school environment about hearing problems. These efforts are aimed at improving the state of medicine abroad, especially in African and Asian countries, enabling access to health care and promoting a healthy lifestyle.

Materials and Methods: Hearing screening was performed in a group of almost 5,000 children aged from 6 to 12 years. Hearing tests were performed in African, Asian and European countries. The screening was performed using the Sensory Organs Platform; based on an audiometric hearing threshold measurement procedure. A modern platform developed by the Institute of Sensory Organs is essential for the affordable and universal study of a large population of children. The threshold values for air conduction were determined in the frequency range of 0.5–8 kHz. The abnormal test result was the threshold value for air conduction of 25 dB HL and more for at least one frequency in at least one ear. In addition, in some countries, the study protocol was extended to include video-otoscopy. In addition, all results were performed using SZOK system. Use of a system to assist patients with remote diagnosis and to transfer audiological screening results to the IPPH in Kajetany. It is a unique solution in the field of telemedicine

Results: A positive result of hearing screening was found in 15.9% to 24.1% of the children tested. Most of the hearing loss was benign or moderate, most often among all ears with abnormal hearing screening in children with high-frequency hearing loss. In addition, there was a large number of unilateral hearing loss. Studies have shown that the scale of hearing loss among school-age children is significant in all countries participating in the program.

Conclusions: Pilot hearing screening has shown that the organizational model of screening developed in Poland and the methods, devices and information systems used in the studies can be successfully implemented in different countries around the world. It should be emphasized that hearing screening performed outside of Poland was the first hearing screening test conducted in schools in the surveyed countries. The results confirm the high incidence of hearing problems in school children. Based on the results, it is strongly recommended to implement hearing screening in the countries concerned as a routine procedure in medical care.

R-045 Session S18

Complicated acute mastoiditis: is surgery always necessary?

Shinnawi Sh.¹, Cohen-Vaizer M.¹, Gil Z.^{1,2}, Gordin A.¹

¹ Department of Otolaryngology Head and Neck Surgery, Head and Neck Center, Rambam Healthcare Campus, Clinical Research Institute at Rambam, Rappaport Institute of Medicine and Research, Technion, Israel Institute of Technology, Haifa, Israel

² Laboratory for Applied Cancer Research, Rambam

Introduction: Acute mastoiditis is a serious complication of acute otitis media in children. Occasionally, a suppurative disease in the mastoid region spreads and can lead to intratemporal or intracranial complications. These complications, once with high mortality, have become rare, especially in developed countries. Standard of care of complicated mastoiditis involves mastoidectomy and drainage.

Recently a more conservative approach is gaining popularity in the literature. For more than 5 years we have adopted a conservative-individually tailored protocol to treat these patients. In our protocol, all patients with mastoiditis are admitted for intravenous broad-spectrum antibiotic treatment and drainage of the middle ear. Imaging, mastoidectomy or additional surgical interventions are only performed in those patients with an adverse clinical course. Children with sigmoid sinus thrombosis (SVT) receive additionally prolonged treatment with anticoagulation.

Objectives: To evaluate the results at Rambam Healthcare Campus managing children with acute mastoiditis with a conservative management protocol. Special emphasis is placed on the analysis of complicated cases.

Methods and Materials: A retrospective chart review was conducted on 101 children referred to our pediatric emergency center with the diagnosis of acute mastoiditis during a 5.5 years period (November 2013 – March 2019).

Results: 101 patients were admitted with the diagnosis of acute mastoiditis. Age distribution: 7 months to 11 years of age. Sex distribution: 53.4% male to 46.5% female ratio. All patients received intravenous antibiotics. Myringotomy was needed in 70.1% of cases as 29.9% presented with active suppurative otitis media. 31 patients (30.6%) presented an unfavorable course and required imaging with CT at an average of 2.1 days of hospitalization. Complications were found in 30.6% of patients and included: intratemporal (subperiosteal abscesses) in 25.7% and intracranial complications in 12.8% [7 patients with epidural abscess and 6 with sigmoid sinus venous thrombosis]. 83.4% of subperiosteal abscesses were successfully managed with needle or incision drainage, with mastoidectomy required only in 16.6%. 6 out of 13 patients with intracranial complications required surgical management, that is 55% of all intracranial complications were managed successfully with conservative management. All children recovered without the need for additional intervention. Average hospitalization stay was 7.3 days in the group of patients managed conservatively as compared to 15.9 in the group of patients that required surgical intervention.

Conclusions: Most children with acute oto-mastoiditis and its major complications can be treated successfully with conservative treatment. Mastoidectomy should be considered in specific cases according to the patient's reaction to conservative treatment. Intracranial complications of acute mastoiditis do not mandate surgical intervention, as well. In fact, in our series, only 32 patients required CT scanning and 45% of intracranial complications required surgical treatment. Major savings in terms of costs, surgical morbidity and radiation exposure can be expected if this protocol is incorporated widely.

R-046 Session S22**Cone-beam computed tomography in patients with secretory otitis media**

Zubareva A.A., Sopko O.N., Bervinova A.N.

ENT Department, First Pavlov State Medical University of St. Petersburg, St. Petersburg, Russia

Introduction: One form of otitis media is otitis media with effusion. In recent years, in our country has been an increase in the number of patients suffering from conductive and mixed forms of hearing loss, in particular as a result of secretory otitis media, from 17.9% in 2001 to 38.7% in 2005. The main etiopathogenetic factors of otitis media are dysfunction of Eustachian tube. Different factors could lead to obstruction of Eustachian tube, such as acute and chronic sinusitis, adenoid hypertrophy, hypertrophy of posterior end of the inferior concha, nasopharyngeal neoplasm. Therefore one of the stages of the examination of this group of patients is cone beam computed tomography (CBCT). The radiation dose per investigation is much smaller in dental CBCT than in multislice computed tomography (MSCT).

Materials and Methods: From January 2017 to June 2018, in the ENT Clinic of the Pavlov First State Medical University of St. Petersburg 19 patients (21–55 J) with otitis media with effusion underwent myringotomy (under local anesthesia using tympanostomy tube). All patients underwent otomicroscopy, rigid endoscopy of nasal cavity and nasopharynx, pure tone audiometry, tympanometry. Cone beam CT was made before and after surgery to evaluate the efficacy of treatment.

Aim: To determine the indications for performing CBCT of the temporal bones. To establish criteria for assessing the state of the pyramids of the temporal bones. To evaluate the results of treatment secretory otitis media according to CBCT.

Results: According to the CBCT all patients have the pneumatic type of mastoid cavity. Total homogeneous darkening of the mastoid process without signs of bone destruction was observed in 8 cases; in another 8 patients, a subtotal darkening of the mastoid cells with fluid levels was visualized. In two patients, mastoid pneumatization was normal. Total soft tissue density darkening of the antrum was observed in all patients. A total homogeneous darkening of the tympanic cavity without signs of fluid level in four cases was noted and in five of them a subtotal uniform darkening of the tympanic cavity (meso- and hypophypanum). The auditory ossicles in all patients were not clearly visualized. A month after myringotomy on the control CBCT, all patients had a partial restoration of pneumatization of tympanic cavity, soft tissue darkening remained around the auditory ossicles (mucosal edema). Three months after myringotomy, all patients have a complete restoration of pneumatization of the middle ear cavity.

Conclusions: The algorithm for analysis of CBCT of the temporal bones was developed: the type of structure and pneumatization of the mastoid process, evaluation of the

walls of the external auditory canal, tympanic cavity, chain of auditory ossicles. CBCT is recommended for all patients with suspected secretory otitis media as one of the main methods for the primary diagnosis of this disease, as well as a control method for assessing the structures of the middle ear after the myringotomy with ventilation tube insertion.

R-047 Session S20**Congenital cholesteatoma in children – case presentations**Mrówka M.¹, Skarżyński P.H.^{1,2}, Porowski M.¹, Skarżyński H.¹¹ *Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland*² *Department of Teleaudiology and Screening, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland*

Introduction: Congenital cholesteatoma is a relatively rare disease especially in children. Unrecognized early, can cause major damage to middle ear elements, leading to hearing impairment or other complications.

Aim: The aim of this work is the presentation of cases of congenital cholesteatoma in children, assessment of the results of surgical treatment and the possibility of early detection of this disease.

Materials and Methods: Of the many thousands of ear surgeries performed annually in our clinic, a group of 149 patients aged 2 to 18 with a diagnosed congenital cholesteatoma, whose follow-up period was at least 3 years, were identified. Patients were divided into two groups: in group A were the youngest patients who were only able to perform objective hearing tests and in less numerous group B older children, whom we could also do subjective studies. The majority of children were operated only from the external auditory canal, others from the dual access. Postoperative results were assessed as standard after 1, 6, 12 and 36 months.

Results: The cure, understood as the removal of cholesteatoma, was obtained in all patients, however, to achieve this, sometimes more than one surgical procedure was needed. A noticeable improvement in hearing was obtained in the majority of children with reconstructed conductive apparatus. In patients from group B, closure of the cochlear reserve to 10 dB was obtained in 94.8% of cases.

Conclusions: In the case of congenital cholesteatoma surgery success and postoperative results depend primarily on early diagnosis. In these cases, we get very good results (removal of the cholesteatoma is relatively easy, and the middle ear hearing apparatus - undamaged). All children who underwent surgery to remove congenital cholesteatoma have to be monitored (insightful video and microotoscopy, second look operations, HRCT) because, despite the excellent tools and the progress of surgery, an uncontrollable recurrence of the cholesteatoma is possible.

R-048 Session S24**Congenital Unilateral Facial Nerve Deficiency**

Hasegawa T.¹, Shimada Dias M.¹, Nakamura K.¹, Ito M.^{1,2}

¹ Department of Otolaryngology, Jichi Medical University, Tochigi, Japan

² Department of Pediatric Otolaryngology, Jichi Medical University, Tochigi Pediatric Medical Center, Tochigi, Japan

Objectives: Congenital unilateral facial paralysis is generally considered to be the result of either developmental or traumatic etiology and the most frequent cause of unilateral congenital facial paralysis is a birth injury. Congenital facial paralysis due to birth injury recovers completely within several weeks. In contrast, congenital unilateral facial nerve paralysis without birth injury is quite rare and the facial paralysis is not reversible. Case report: A 2-months-old girl with congenital unilateral facial nerve aplasia diagnosed with magnetic resonance imaging (MRI) and computed tomography (CT) is presented. Facial nerve aplasia has been considered a very rare condition, but it is likely a more frequent diagnosis in cases with irreversible congenital facial paralysis. Three-dimensional constructive interference in steady state (3D-CISS) MRI and high-resolution CT scanning are very useful for diagnosing congenital facial paralysis due to anatomic anomalies.

Conclusions: In contrast to the cochlear nerve deficiency (CND), congenital facial nerve aplasia (deficiency) is considered to be a very rare condition, but it may be a more frequent disease in cases with delayed or irreversible recovery from congenital facial paralysis. Conventional MRI and 3D-CISS MRI should be employed in cases with delayed/irreversible recovery to diagnose congenital facial nerve aplasia and other coexisting inner/middle ear anomalies.

R-049 Session S14**Considerations and rationale for Cochlear Implant Electrode Design – past, present and future**

Risi F.

Cochlear Ltd, Sydney, Australia

The electrode array of a cochlear implant forms a permanent, often lifelong interface between the implanted electronics and neural structures of the cochlea. A cochlear implant is primarily prescribed to restore hearing via electrical stimulation of the auditory nerve. As with any neural stimulator intended to either deliver electrical stimulus or record a neural response the aim is to place the electrodes in close proximity to the target nerve. The broadening of indications and concept of preservation of low frequency residual hearing over the last two decades has resulted in an increased understanding of the mechanisms and implications of intra-cochlear trauma for both hearing preservation surgery and electrical stimulation outcomes with cochlear implantation, as well as the influence of many biographic and audiological patient factors correlated with

achieving better hearing outcomes. These two goals, proximity to the cochlear nerve for electrical stimulation and preservation of cochlear structures, have typically been viewed as mutually exclusive with perimodiolar electrode arrays being preferred for the former and lateral wall electrode arrays for the latter. The design evolution of both lateral wall and perimodiolar electrodes is presented with consideration of the cochlea anatomy and continued understanding of the mechanics and dynamics of electrode insertion, along with the influence of the ongoing changes to the intracochlear environment to provide the important considerations and rationale for electrode design with the intent to provide the greatest patient benefit over their implanted lifetime.

R-050 Session S22**Detectability of minute temporal bone structures with Ultra-High Resolution CT**

Hiraumi H.¹, Obara M.², Yoshioka K.³, Ehara S.², Sato H.¹

¹ Department of Otolaryngology-Head and Neck Surgery, Iwate Medical University, Morioka, Japan

² Department of Radiology, Iwate Medical University, Morioka, Japan

³ Division of Cardiovascular Radiology, Iwate Medical University, Morioka, Japan

Objective: Computed tomography (CT) is the imaging tool of choice in the diagnosis of temporal bone lesions. With the recent progress in imaging technology, CT with a higher spatial resolution (Ultra-high resolution CT) has become available in the clinical setting. The purpose of this study is to evaluate the visibility of small temporal bone structures using ultra-high resolution CT.

Materials and Methods: The visibility of 27-minute temporal bone structures on ultra-high resolution CT images were evaluated. Non-helical axial scans were performed in 18 normal hearing ears without previous otologic diseases. Visibility was scored by an experienced radiologist and otologist.

Results: Minute temporal bone structures including the ossicular chain, the crus of the stapes, the greater superficial petrosal nerve, and the anterior malleolar ligament were clearly visualized on ultra-high resolution CT. The stapedius muscle tendon and the chorda tympani exiting the posterior canaliculus and coursing medially to the malleus could be visualized.

Conclusions: Ultra-high resolution CT provides good visualization of small temporal bone structures in normal subjects.

R-051 Session S22**Diagnosis of otitis media with effusion using optical coherence tomography**

Novozhilov A.A.^{1,2}, Shilyagin P.A.²,
Shakhov A.V.^{1,2}

¹ Federal State-Financed Health Institution, Volga District Medical Center of the Federal Medico-Biological Agency of the Russian Federation, Nizhny Novgorod, Russia

² Federal State Budgetary Scientific Institution, The Institute of Applied Physics of the Russian Academy of Sciences, Nizhny Novgorod, Russia

Introduction: Otitis media with effusion (OME) is difficult to suspect because of painless and absent of signs of inflammation. The variability of the otoscopic signs and the low specificity of the standard methods dictate the need to search for new diagnostic methods that allow quickly and reliably detect middle ear effusion.

Objectives: The goal of this study is to evaluate the possibilities of non-contact OCT in the diagnosis of OME.

Materials and Methods: 40 patients were examined, 55 ears were examined. The study group included patients with confirmed OME – 38 studies, the control group consisted of patients with a registered tympanogram of type A – 17 studies. All studies were performed under the control of a diagnostic microscope, without anesthesia. The OCT images were evaluated using the ImageJ program. The intensity of the optical signal was recorded in the area of the external auditory canal (EAC) and in the tympanic cavity (TC).

Results: In all patients, the optical signal in EAC had the same intensity. In the control group, the intensity of the optical signal from the EAC region and in the tympanic cavity was the same. In all patients with OME, the optical signal in the tympanic cavity had a significant difference from the signal in the EAC and higher intensity.

Conclusions: Detection of the middle ear effusion is possible due to the different optical properties of the gaseous and liquid medium. The numerical evaluation of OCT images provides the possibility to detect the effusion presence in the tympanic cavity by the analysis of the image parameters.

R-052 Session S24**Direct facial nerve stimulation using NIM response 3.0® during facial nerve decompression surgery can predict the outcome of peripheral facial palsy**

Yamagishi T., Ohshima S., Morita Y.,
Takahashi K., Horii A.

Department of Otolaryngology Head and Neck Surgery, Faculty of Medicine, Niigata University

Introduction: Electroneurography (ENoG) is useful for predicting prognosis of peripheral facial palsy following

steroid therapy. Greater than 90% facial nerve degeneration revealed by ENoG is a sign for poor outcome and facial nerve decompression surgery is recommended for those patients. However, prognostic predictors following decompression surgery have not been determined. NIM response 3.0® is a nerve integrity monitor usually used to avoid nerve injury in otologic surgery. We hypothesized that postoperative prognosis of peripheral facial nerve palsy can be predicted by direct nerve stimulation using NIM response.

Objectives: To investigate the relationship between the threshold of NIM response during decompression surgery and the prognosis of peripheral facial palsy.

Patient: 23 peripheral facial palsy patients who underwent decompression surgery from 2014 to 2018.

Methods: During decompression surgery with transmastoid approach, facial canal and nerve sheath were opened from the level of geniculate ganglion to stylomastoid foramen. At the end of the surgery, the thresholds of NIM response were measured by direct facial nerve stimulation at three points: geniculate ganglion (GG), 2nd geniculate ganglion (2nd G), and stylomastoid foramen (SF). Facial nerve function was evaluated before and up to six months after surgery using the Yanagihara grading score (full score, 40 points). Complete recovery was defined as the improvement of grading score to 36 points or more. The thresholds of NIM response at each site were compared between the complete recovery group and incomplete recovery group. The threshold of NIM response less than 1.0 mA at all of three points was defined as the NIM-positive. Postoperative recovery of facial nerve function was compared between the NIM-positive and -negative groups.

Results: The thresholds of NIM response in the complete recovery group at GG and 2nd G were significantly lower than those of the incomplete group: 0.58 ± 0.14 mA / 1.26 ± 0.14 mA at GG ($p < 0.015$), 0.54 ± 0.14 mA / 1.18 ± 0.17 mA at 2nd G ($p < 0.05$), and 0.59 ± 0.17 mA / 1.16 ± 0.17 mA at SF ($p = 0.98$) (complete recovery/incomplete recovery group). Postoperative Yanagihara grading scores of NIM-positive group were significantly better than those of NIM-negative group: 19.1 ± 2.7 / 5.6 ± 2.1 ($p < 0.05$) at 1 month after surgery, 28.9 ± 2.0 / 14.3 ± 3.2 ($p < 0.006$) at 3 months after surgery, and 33.5 ± 1.9 / 25.0 ± 2.4 ($p < 0.02$) at 6 months after surgery (NIM-positive/NIM-negative group). No significant difference was observed in age, sex, disease (Bell's palsy or Ramsey Hunt syndrome), the period from onset to surgery, preoperative Yanagihara grading score, and preoperative ENoG between the NIM-positive and -negative groups.

Conclusions: Although conventional preoperative ENoG could not predict the outcome after decompression surgery, intraoperative direct facial nerve stimulation using NIM response was useful to predict it.

R-053 Session S09

Discrepancies in vestibular organ function tests in patients with endolymphatic space disorders

Tacikowska G., Pietrasik K., Sosna M., Skarżyński H.

*Institute of Physiology and Pathology of Hearing, Kajetany/
Warsaw, Poland*

Objectives: Comparison of the results of the video head impulse test (vHIT), caloric test and vestibular evoked myogenic potentials (VEMPs) in patients with endolymphatic space disturbances and in vestibular neuronitis patients to characterize vestibular dysfunction and attempt to explain discrepancies in these tests.

Materials: Meniere's disease (MD) defined clinically ($n = 17$), deficit in the calorics $>39.5\%$, vestibular neuronitis (VN), more than 3 months after the episode ($n = 19$), large vestibular aqueduct syndrome and inner ear dysplasia (LVAS group $n = 7$, $n = 11$ ears), control group (for VEMP tests in the LVAS group, $n = 20$).

Methods: Bicaloric test: 30°C and 44°C , 30 s stimulation, evaluation of canal paresis according to Jongkees formula, pathology: $\text{CP} \geq 25\%$. vHIT: 20 pulses randomly to the right and left, peak speed $150\text{--}200^{\circ}/\text{s}$, evaluation of VOR gain and corrective saccade, pathology: VOR gain < 0.8 . O and cVEMP: air stimulation, short tonal pulse 500 Hz (2-2-2), evaluation of P1–N1 amplitude and response threshold in dB HL.

Results: The average deficit in the caloric test in the MD, NV and LVAS group was 52,8, 58,8, 63,3% respectively. In the vHIT test, the values of gain in MD group and in ears in LVAS group were higher than in NV group. Mean amplitude o and c VEMP in the LVAS group was significantly higher than in the control group. The mean response threshold o and c VEMP in the LVAS group were lower (for cVEMP significantly) than in the control group.

Conclusions: Patients with endolymphatic hydrops (MD, LVAS) have a discrepancy in caloric and video tests head impulse test. Hypersensitivity of the otolithic organ may occur in patients with LVAS and similar conditions.

R-054 Session S02

Effect of direct current electrical stimulation on the recovery of facial nerve crush injury

Park K.S.¹, Jang Ch.H.¹, Lee J.U.², Kim G.H.²

¹ *Department of Otolaryngology, Chonnam National University Medical School, Gwangju, South Korea*

² *Department of Biomechatronic Engineering, College of Biotechnology and Bioengineering, Sungkyunkwan University, Suwon, South Korea*

Objective: This study aimed to evaluate the effect of non-invasive electrical stimulation (ES) using transcutaneous direct current on facial nerve crush injury.

Materials and Methods: In vitro cellular responses including proliferation and differentiation using PC12 cells as well as by performing in vivo functional and morphological assessments in rat facial nerve (FN) crush injury model.

Results: Compared to the non-treated cells, the cells subjected to ES treatment showed clear in vitro neurite outgrowth and enhanced expression of differentiation genes. In this animal model, functional assessment of recovery was performed using vibrissa movement orientation and electrically stimulated muscle action potential. Moreover, the histological observation was performed using a transmission electron microscope. A higher score of recovered vibrissa movement and a more significant reduction of the threshold of electrically evoked muscle action potential were observed in the ES group than in the control group. Furthermore, histomorphometric evaluation showed that the experimental group had statistically significantly higher axon counts than did the control group. Regenerative nerve fibers were prominent in the distal segments of the ES group.

Conclusions: On the basis of these results, we think that despite the absence of NGF, the ES condition can be helpful in recovery after FN crush injury.

R-055 Session S06**Effect of higher maximum force output and signal processing on listening effort for bone-anchored hearing system users****Bianchi F., Wendt D., Wassard C., Maas P., Lunner T., Rosenbom T., Holmberg M.**¹ Oticon Medical AB, Smørum, Denmark² Eriksholm Research Center, Oticon A/S, Snekersten, Denmark³ Department of Health Technology, Technical University of Denmark, Denmark⁴ Oticon Medical, Hannover, Germany⁵ Department of Electrical Engineering, Linköping University, Sweden⁶ Linnaeus Centre HEAD, Swedish Institute for Disability Research, Linköping and Örebro Universities, Sweden,⁷ Oticon Medical AB, Askim, Sweden

Introduction: Bone-anchored hearing systems (BAHS) are one of the recommended treatments for conductive hearing losses, mixed hearing losses and single-sided deafness. All BAHS can transmit a maximum force output (MFO) that is typically well below the users' loudness discomfort level. When the output sound level reaches the MFO of the device, the sound transmitted via the skull bone to the cochlea will contain some saturation artifacts. Recent developments in the field include sound processors with significantly higher MFO that can, thus, play back a larger range of input sound levels before introducing artifacts. In addition, different algorithms to manage the MFO can also affect the extent to which saturation artifacts are introduced in the signal.

Objectives: The aim of this study was to clarify the effect of higher MFO and more advanced MFO algorithm on listening effort in bone anchored users. The hypothesis was that users would allocate less cognitive resources to listen to speech when using a sound processor with a higher MFO and a multichannel MFO algorithm due to fewer saturation artifacts in the signal.

Materials: Listening effort was estimated by measuring pupillary responses with an eye-tracking camera during a speech-in-noise task. Twenty-one participants performed the task with three different sound processors from Oticon Medical AB (Askim, Sweden): Ponto Pro (PP), Ponto 3 (P3), and Ponto 3 Super Power (P3SP). The three devices differ in their MFO level (PP: low MFO; P3: slightly higher MFO than PP; P3SP: higher MFO than P3 and PP) and MFO algorithm (PP: single channel; P3 and P3SP: multichannel).

Methods: Twenty-one adult BAHS users with a conductive or mixed conductive-sensorineural hearing loss participated in this crossover study. The participants were experienced BAHS users that were already using a Ponto sound processor prior to the commencement of the study. The three processors were tested in random order with a single-blinded experimental design. Pupil dilations were recorded at an individually adjusted signal-to-noise ratio (SNR). Two conditions were performed at the same SNR: in Condition 1, the speech level was individually adjusted to saturate the PP but not the P3SP and the noise was

consequently adjusted to lead to 95% correct intelligibility; in Condition 2 the overall level was lowered by 5 dB to reduce saturation artifacts.

Results: Lower peak pupil dilation, indicating a decrease in listening effort, was obtained with the P3SP relative to the PP in Condition 1. In Condition 2, the effect of the processor on peak pupil dilation was not significant. Pupil responses were also analyzed via growth curve analysis (GCA) to estimate the overall pupil dilation while processing and retaining the sentence in working memory. The GCA revealed that the overall pupil dilation was significantly lower with both the P3SP and the P3 relative to the PP in both conditions. In Condition 1, the overall pupil dilation was also significantly lower with the P3SP relative to the P3.

Conclusions: A significant decrease in listening effort was obtained with the two sound processors with higher MFO and a multichannel MFO algorithm (P3SP and P3) relative to a sound processor with a lower MFO and a single channel algorithm. These results indicate that a higher MFO and a more advanced MFO algorithm can decrease the number of cognitive resources that BAHS users need to allocate to process speech in noisy listening environments.

R-056 Session S09**Endolymphatic hydrops: imaging analysis and its correlation with vestibular and cochlear findings****Ohshima S., Morita Y., Yagi C., Nonomura Y., Yamagishi T., Izumi S., Takahashi K., Horii A.**

Department of Otolaryngology Head and Neck Surgery, Niigata University, Niigata, Japan

Objectives: In 1938, Yamakawa and Hallpike et al. independently reported that endolymphatic hydrops (EH) is the characteristic inner ear pathology of Meniere's disease. Seventy years after these reports, recent advances in imaging techniques have enabled visualization of EH in live patients using 3-T magnetic resonance imaging (MRI) that reconfirmed the existence of EH in almost all Meniere's patients. However, it is still uncertain how EH relates to the disease condition and symptoms. According to the 1995 consensus statement of the Committee on Hearing and Equilibrium of the American Association of Otolaryngology Head and Neck Surgery (AAO-HNS), "definite" Meniere's disease is diagnosed using clinical criteria, whereas "certain" Meniere's disease can only be diagnosed after histological demonstration of EH in postmortem temporal bone specimens. Nakajima et al. demonstrated that EH could be visualized in live patients using 3-T MRI in combination with intratympanic injection of gadolinium (Gd). Nowadays, it is even possible after intravenous administration of Gd. Heavily T2-weighted 3D-FLAIR, HYbrid of Reversed image Of Positive endolymph Signal (HYDROPS), and native imaging of the positive perilymph signal sequences are used to visualize the endolymphatic hydrops.

Aim: The purpose of this study was to correlate the location and degree of EH with various clinical parameters of Meniere's patients.

Materials: Twenty-three definite Meniere's patients diagnosed based on the definition of the Japan Society for Equilibrium Research were enrolled in the study. The mean age of the subjects was 49.6 years (range 26–83). They underwent 3-T MRI with intravenous Gd injection. Images were obtained using HYDROPS sequences using a 3-T MRI scanner.

Methods: The degree of EH in the vestibule and cochlea of the affected side was evaluated using the classification proposed by Nakashima et al. in 2009. Significant hydrops of the vestibule was defined if the ratio of the hypointense area/all vestibule was over 1/2, mild hydrops between 1/2 and 1/3, and no hydrops at a ratio under 1/3. No cochlear hydrops was defined as no displacement of Reissner's membrane, mild cochlear hydrops as displacement of Reissner's membrane without exceeding the *scala vestibuli*, and extreme cochlear hydrops with Reissner's membrane exceeding the *scala vestibuli*. Clinical parameters, including the period from onset of hearing loss or vestibular symptoms to MRI; dizziness handicap inventory (DHI); hospital anxiety and depression scale (HADS); average of the hearing threshold at 125 Hz, 250 Hz, 500 Hz, and 1000 Hz; and percentage canal paresis (CP%) were compared between the no, mild, and significant vestibular or cochlear hydrops groups.

Results: The endolymphatic space of the affected side was significantly broader than that of the healthy side for both the vestibule and cochlea. The vestibular symptom-positive period was significantly longer in the significant cochlear hydrops group than in the no cochlear hydrops group. The auditory symptom-positive period was significantly longer in the significant cochlear and/or vestibular hydrops group than in the no cochlear and/or vestibular hydrops group. There were no differences in DHI and HADS between the no and significant cochlear and/or vestibular hydrops groups. Hearing threshold was significantly higher in the significant cochlear and/or vestibular hydrops groups than in the no/mild groups. There were no differences in CP% between the no and significant cochlear and/or vestibule hydrops groups.

Conclusions: The auditory symptom-positive period, as well as low tone hearing threshold, was correlated with the degree of cochlear and vestibular EH. In contrast, neither the vestibular symptom-positive period nor CP% showed a correlation with the degree of cochlear and/or vestibular EH. This clear separation of vestibular and cochlear findings may be explained by the compensatory process acting only on vestibular dysfunction.

R-057 Session S15

Endoscopic approaches to the lateral skull base: a review

Goyal A.¹, Sharma V.¹, Khera P.², Choudhury B.¹, Kaushal D.¹, Soni K.¹, Patro S.¹, Sameema V.V.¹

¹ Department of Otorhinolaryngology, All India Institute of Medical Sciences, Jodhpur, Rajasthan, India

² Department of Radiodiagnosis and Interventional Radiology, All India Institute of Medical Sciences, Jodhpur, Rajasthan, India

Introduction and Objectives: The advent of endoscopes revolutionized the concepts of ear surgery. Initially, they were introduced as adjuncts to the conventional operating microscope in middle ear surgery to “look around the corners” in case of disease involving the hidden areas. Gradually, they were looked upon as complements to or, even substitutes of the operating microscope in middle ear cholesteatoma surgery. With further advances, endoscopes are now being envisaged as the tools of choice for transcanal approaches to the lateral skull base for excision of lesions involving the cerebellopontine angle, petrous apex, internal auditory canal (IAC) fundus, and inner ear. The aim of this paper is to present a review of the various endoscopic approaches to the lateral skull base and share our experience, though limited, of the same.

Materials and Methods: A search of existing literature describing the various transcanal endoscopic approaches alone or in combination with microscopic techniques was performed. Relevant articles were studied and a review of current literature synthesized. The approaches were broadly described as the transcanal exclusively endoscopic approach and the combined approaches (microscopic/endoscope-assisted). Various anatomical landmarks, surgical tips and pros, and cons of the approaches were described. The review is presented here along with a description of our institutional experience.

Results: The combined approaches have further been divided into three corridors: infralabyrinthine, suprameatal translabyrinthine and the transotic. The approaches were found to be able to remove the pathology successfully without an external incision with no major intra-operative complications and reasonable outcomes.

Conclusions: Endoscopic approaches to lesions involving the cerebellopontine angle, petrous apex, inner ear, fundus of IAC have been introduced in the recent years with an aim of providing transcanal corridors to these difficult-to-access areas without the need of external incisions and brain retraction. Despite the benign nature of the disease, extensive surgical dissection renders the surgery fraught with complications. These approaches were found to provide good visualization, good access, satisfactory resection, and lesser patient morbidity. They are not devoid of serious possible surgical risks though. Endoscopic approaches show much promise as replacement of the conventional microscope-based approaches but long term, adequate outcome studies are lacking at present.

R-058 Session S07**Epidemiology and prevalence of Vestibular Migraine in patients with dizziness symptoms presenting to an ENT clinic using 2018 ICHD-3b criteria****Ho E.C.¹, Lee B.W.W.²**¹ ENT Department, Tan Tock Seng Hospital, Singapore² Lee Kong Chien School of Medicine, Singapore

Objectives: Vertigo and migraine are frequent complaints in the primary care setting. Worldwide, lifetime prevalence is between 17 to 30% and 13 to 30% respectively. The clinical association between vertigo and migraine has gained traction over the past few decades as a clinical entity more than chance co-occurrence, and vestibular migraine (VM) which is the combination of vertigo, dizziness and balance disturbance with migraine has an expanding body of research which has found it to be among one of the top causes of recurrent spontaneous vertigo. However, a study on the epidemiology and prevalence of VM has yet to be done in Singapore.

Aim: The aim of this study is to determine the prevalence of VM amongst patients presenting to the ENT outpatient clinic with dizziness based on the ICHD-3B criteria, and to compare differences between VM and non-VM patients.

Materials and Methods: This is a prospective cross-sectional study conducted on 307 patients presenting to the Tan Tock Seng Hospital Ear Nose and Throat Clinic in Singapore for consultation for dizziness over a 6-week period from August to September 2018. A questionnaire was administered to collect epidemiological data, dizziness and headache symptoms as well as the impact on the quality of life. Definite and probable VM was diagnosed from the questionnaire according to the Consensus Diagnostic Criteria mutually accepted by the International Headache Society and Bárány Society and incorporated into the new International Classification of Headache Disorders (ICHD)-3 beta version of headache classification. Statistical analysis was performed using Stata. Shapiro-Wilk test was used to assess data normality and comparison between VM and non-VM groups were made using t-test or Mann-Whitney U test for continuous data, and chi-squared or Fischer's exact test for categorical data.

Results: Of the 307 patients presenting to the ENT clinic with dizziness, 70 (22.8%) were found to have probable VM while 83 (27.0%) were found to have definite VM. The study population was predominantly female (64.8%), with a mean age of 61 years. Patients with VM are associated with a younger age of presentation. There was a significantly higher proportion of VM patients with a history of motion sickness ($P = 0.006$) and familial history of first-degree relatives with dizziness and headache ($P < 0.001$) compared to non-VM patients. No significant differences were found for the prevalence of comorbidities such as smoking, alcohol or hypertension. Duration of dizziness symptoms was significantly longer ($P < 0.001$), and dizziness was associated with greater severity for patients with VM compared to non-VM patients ($P < 0.001$). Patients with VM were also more likely to find headache or both dizziness

and headache to bother them more, as compared to non-VM patients who had a significantly higher number of patients reporting dizziness to disturb them more ($P < 0.001$).

Conclusions: Subjective complaints of headache appear to accompany dizziness relatively often, and VM is a prevalent condition in patients presenting with dizziness to the ENT clinic in Singapore. It is important to be aware of the prevalence of VM and familiar in making the diagnosis to enable early treatment and improve quality of life for patients.

R-059 Session S17**Evaluation of ECochG for the monitoring of cochlear implant electrode insertion****Skarżyński H.^{1,2}, Kowalczyk A.¹, Skarżyński P.H.^{1,2,3,4}, Boruta M.¹, Walkowiak A.¹, Lorens A.¹**¹ Institute of Physiology and Pathology of Hearing Kajetany/ Warsaw, Poland² Center of Hearing and Speech Medincus in Kajetany, Poland³ Heart Failure and Cardiac Rehabilitation Department, Second Faculty of Medicine, Medical University of Warsaw, Poland⁴ Institute of Sensory Organs, Kajetany/Warsaw, Poland

Electrocochleography is a method used to record the electrical potentials generated in the inner ear and the auditory nerve as a response for acoustic stimulation. This measurement was usually used for intraoperative monitoring of cochlea functions, the recording was done from the far field like promontorium or tympanic membrane, which results in a low amplitude and poor quality of recorded potentials. In this study, we perform ECochG measurement via cochlear implant electrode for monitoring of residual hearing during insertion of cochlear implant electrode and to observe of residual hearing after implantation.

Objectives: The main goal of the study was to record acoustically evoked cochlear potentials directly from the cochlea via the cochlear implant electrode. Then the evaluation of ECochG as a medical test for monitoring of electrode array insertion and for evaluate of patient's residual hearing after surgery.

Materials and Methods: 12 adult patients (range 28–84 years) with various level of residual hearing confirmed in pure tone audiometry. All of the patients were implanted with Advanced Bionics cochlear implant with electrodes HiResTM Ultra 3D, HiFocusTM SlimJ or HiFocusTM MidScala. In this study, potentials were recorded for frequencies 250 Hz, 500 Hz, 750 Hz, and 1 kHz. Acoustic stimulation was possible by the insert earphone placed in the external ear canal and a special medical system Bionic Ear Data Collection System (BEDCS). ECochG potentials were recorded using the most apical electrode contact. The recorded signal was processed by the implant and sent via the back telemetry to the measurement PC. Measurement has started when the surgeon placed the tip of the electrode inside the cochlea and end with the completed insertion of the electrode. Evaluation contains also the postoperative measurements which were made with the same system during the standard clinical appointments.

Results and Conclusions: Cochlear Microphonics were observed in almost everyone patients (except one subject). Results were stable in time and confirmed a presence of residual hearing in the implanted ear. ECochG recording is a promising way to create the new medical test for monitoring of cochlea function during electrode insertion and for evaluation of residual hearing after surgery.

R-060 Session S15

Evaluation of the modified Pittsburgh classification for predicting disease-free survival of squamous cell carcinoma of the external auditory canal

Nabuurs C.H.¹, Kievit W.^{1,2}, Leemans C.R.³, Smit C.F.³, van den Brekel M.W.M.⁴, Pauw R.J.⁵, van der Laan B.F.A.M.⁶, Jansen J.C.⁷, Lacko M.⁸, Janssen L.M.⁹, Takes R.P.¹, Kunst H.P.M.^{1,8}

¹ Department of Otorhinolaryngology and Head and Neck Surgery, Radboud UMC, Nijmegen, Netherlands

² Department for Health Evidence, Radboud University Medical Center, Nijmegen, Netherlands

³ Department of Otorhinolaryngology and Head and Neck Surgery, Amsterdam University Medical Centres, VU University, Amsterdam, Netherlands

⁴ Department of Head and Neck Surgery, Netherlands Cancer Institute - Antoni van Leeuwenhoek, Amsterdam, Netherlands

⁵ Department of Otorhinolaryngology and Head and Neck Surgery, Erasmus Medical Centre, Rotterdam, Netherlands

⁶ Department of Otorhinolaryngology and Head and Neck Surgery, University of Groningen, University Medical Centre Groningen, Groningen, Netherlands

⁷ Department of Otorhinolaryngology and Head and Neck Surgery, Leiden University Medical Centre, Leiden, Netherlands

⁸ Department of Otorhinolaryngology and Head and Neck Surgery, Maastricht University Medical Centre, Maastricht, Netherlands

⁹ Department of Otorhinolaryngology and Head and Neck Surgery, University Medical Centre Utrecht, Utrecht, Netherlands

Objective: Squamous cell carcinoma (SCC) of the external auditory canal (EAC) is a rare disease which is staged commonly with the modified Pittsburgh classification. Our aim is to evaluate the predictive performance of this classification to predict the disease-free survival (DFS) of EAC SCC.

Methods and Materials: Nationwide Dutch cohort study including patients with primary EAC SCC diagnosed in one of the eight (academic) oncologic medical centers. These data were combined with individual patient data from the literature study. The predictive performances of the modified Pittsburgh classification were calculated using the c-index of Cox regression models.

Results: A total of 381 patients, 186 patients from the Dutch nationwide database and 195 patients from the individual patient data of ten studies included. The predicted value, expressed in the c-index, of the clinical and the pathological modified Pittsburgh classification, was 0.692 and 0.701 respectively, indicating acceptable prognostic performances.

Conclusions: The predictive performance of the modified Pittsburgh classification system by its own is acceptable

to predict the DFS of EAC SCC. Other factors need to be added to a future model to improve the predicted performance in clinical practice.

R-061 Session S04

Evidence for a causative role of PTPRQ gene in autosomal dominant hearing loss development

Oziebło D.^{1,2}, Sarosiak A.^{1,2}, Leja M.^{1,2}, Skarżyński H.³, Oldak M.¹

¹ Department of Genetics, Institute of Physiology and Pathology of Hearing, Kajetany/ Warsaw, Poland

² Postgraduate School of Molecular Medicine, Medical University of Warsaw, Warsaw, Poland

³ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Hearing loss (HL) is the most common birth defect affecting about 1–6/1000 births and the most common disability of human senses. Genetic factors play an important role in the development of HL. The PTPRQ gene has been previously reported in the context of autosomal recessive HL and in 2017 for the first time in the development of autosomal dominant HL.

Materials and Methods: A five-generation Polish family with progressive, high frequency autosomal dominant HL were recruited for the study. Genomic DNA was isolated from peripheral blood samples or buccal swabs of available family members. Clinical exome sequencing was conducted in the proband's DNA sample. Family segregation analysis of the identified variants was performed using Sanger sequencing. Results molecular genetic testing showed the presence of probably pathogenic c.6881G>A (p.Trp2294*) variant in the PTPRQ gene, which fully segregated with HL observed in the family. The identified variant is located in the last coding exon of the PTPRQ gene and introduces a premature stop codon. The c.6881G>A transition has not been reported in population databases. To date, the PTPRQ variant has been described in one family worldwide and is the only PTPRQ genetic variant causally involved in autosomal dominant HL.

Conclusions: Identification of the c.6881G>A variant provides independent confirmation of the PTPRQ involvement in autosomal dominant HL, which is progressive, affects high frequencies and is usually diagnosed in the first decade of life.

Supported by: 2016/22/E/NZ5/00470

R-062 Session Panel: AOS

Evidence-based management of chronic ear disease in the pediatric population

Bauer C.A.

Southern Illinois University School of Medicine, Springfield, Illinois

Objectives: The objectives of this presentation are to review the challenges encountered in the treatment of the

pediatric patient with chronic ear disease, present the controversies in treatment options, and propose an algorithm for managing chronic ear disease in this population.

Materials: The materials used for this presentation include systematic reviews, case-cohort studies, and case series.

Methods: A systematic review of the literature regarding the issues related to pediatric chronic ear disease including patient selection, surgical timing, tympanomastoidectomy surgical technique and approaches, outcomes and protocols for patient follow-up was performed.

Results: Multiple factors contribute to the challenges inherent in diagnosing, managing and following chronic ear disease in children. The evidence for including mastoidectomy as part of tympanoplasty in non-cholesteatoma ears and for the optimum timing of surgical intervention in this population will be presented.

Conclusions: The treatment of chronic ear disease in children must be tailored to the individual. The timing of surgery and the protocol for follow up of children with and without cholesteatoma are critical elements in optimizing outcomes for hearing and disease control, and for avoiding long-term complications.

R-063 Session S12

Experience in surgical treatment of congenital aural atresia combined with microtia

Diab K.M., Nazaryan D.N., Kondratchikov D.S., Mikhalevich A.E., Panina O.S.

Federal Scientific-Clinical Center of Otorhinolaryngology of Federal Medical Biological Agency of Russia, Moscow, Russia

Diab K.M.

Aim: To develop and introduce into the clinical practice the method for the combined aesthetic and functional rehabilitation of the patients presenting with congenital atresia of the external auditory canal (CAEAC) and the concomitant microtia.

Patients and Methods: A total of 17 patients at the age from 6 to 21 years with unilateral CAEAC and microtia were given the surgical treatment. During the intervention, atresia was resolved using the trans-mastoid approach, tympanoplasty of autofasciae and ossiculoplasty making use of the partial titanium prosthesis. We performed total ear reconstruction using porous polyethylene in 9 patients. In 8 cases was performed the placement of cranial osteointegratable titanium implants (2 implants in each case). At the second stage of the surgical intervention, the 3D silicone prosthesis of the auricle shaped on an individual basis was used in these 8 cases.

Results: The long-term follow-up observations (2 years) have demonstrated the stable formation of the tube of the external auditory canal, with the bone-air interval amounting to 15–20 dB. Full osseointegration of titanium implants

was obtained in all cases. The auricular prosthesis completely concealed the congenital defect. Extrusion of the porous polyethylene endoprosthesis was in 1 case.

Conclusions: Total ear reconstruction with porous polyethylene implants or silicone prosthesis is an excellent alternative to traditional autologous rib cartilage reconstruction. Simultaneous external ear canal atresia and total ear reconstruction provide a shorter postoperative recovery period.

R-064 Session S03

Extrusion rate and complications according to the type of ventilation tube: Multicenter registry study - Part II

Yoo M.H.¹, Cho Y.-S.², Choi J.³, Choung Y.H.⁴, Chung J.-H.⁵, Chung J.W.⁶, Han G.Ch.⁷, Jun B. h.⁸, Kim D.-K.⁹, Kim K.S.¹⁰, Lee J.H.¹¹, Lee K.-Y.¹, Lee S.H.⁵, Moon I.S.¹², Park H.J.⁶, Park S.N.¹³, Rhee J.³, Seo J.H.¹⁴, Yeo S.G.¹⁵

¹ Department of Otorhinolaryngology-Head and Neck Surgery, School of Medicine, Kyungpook National University, Daegu

² Department of Otorhinolaryngology-Head and Neck Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul

³ Department of Otorhinolaryngology-Head and Neck Surgery, Korea University College of Medicine, Korea University Ansan Hospital, Ansan

⁴ Department of Otolaryngology, Ajou University School of Medicine, Suwon

⁵ Department of Otorhinolaryngology, School of Medicine, Hanyang University, Seoul

⁶ Department of Otorhinolaryngology-Head & Neck Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul

⁷ Department of Otolaryngology-Head and Neck Surgery, Gachon University of Medicine and Science, Graduate School of Medicine, Incheon

⁸ Department of Otolaryngology-Head and Neck Surgery, Uijeongbu St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Uijeongbu

⁹ Department of Otolaryngology-Head and Neck Surgery, Daejeon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Daejeon

¹⁰ Department of Otorhinolaryngology-Head and Neck Surgery, College of Medicine, Inha University, Incheon

¹¹ Department of Otorhinolaryngology, Seoul National University College of Medicine, Seoul National University Hospital, Seoul

¹² Department of Otorhinolaryngology, Yonsei University College of Medicine, Seoul

¹³ Department of Otorhinolaryngology-Head and Neck Surgery, College of Medicine, Catholic University of Korea, Seoul

¹⁴ Department of Otolaryngology-Head and Neck Surgery, Bucheon St. Mary's Hospital, College of Medicine, Catholic University of Korea, Bucheon

¹⁵ Department of Otorhinolaryngology-Head and Neck Surgery, School of Medicine, Kyung Hee University, Seoul, Korea

Objective: Ventilation tube insertion for chronic otitis media with effusion is most commonly received operation in pediatric population. Various types of tube are used, but it is unclear as to what impact the tube shape and material

have on extrusion and complication rates. This multicenter registry study aimed to investigate the effectiveness of ventilation tube insertion and the microbiology of otitis media with effusion in children. This part II study was conducted to evaluate the postoperative results especially according to the type of ventilation tube.

Methods: Patients <15 years old who were diagnosed as having otitis media with effusion and received ventilation tube insertion were prospectively enrolled in 15 tertiary hospitals from June 2014 to December 2016. Follow-up data were collected until December 2017. After excluding patients with missing data, the data of 401 patients (727 operated ears) were analyzed among a total of 432 enrolled patients. The demographic data, surgical findings including the type of ventilation tube, and follow-up data were collected.

Results: Average follow-up duration after tube insertion was 313 ± 238 days (range 3 to 1377 days). After excluding the results of long-lasting tubes (Paparella type II and T-tube, 13 ears), silicone tube (Paparella type I, 570 ears) showed significantly ($P < 0.001$) more extended time to extrusion (average of 400 days) than titanium tube (Collar button type, 157 ears, average of 312 days). Silicone tube also showed a significantly longer time to recurrence of middle ear effusion than titanium tubes ($p < 0.001$). The rate of tube otorrhea was 2.5% in the silicone tube, and 1.3% in titanium tube, which was not statistically significant. Persistent perforation after extrusion was found in 1.2% of silicone tube inserted ears, and none in titanium tube inserted ears. In revision ventilation tube ears, there was a significantly higher rate of persistent perforation than primary ventilation tube ears (3.2% vs 0.3%) and also significantly higher rate of another revision tube surgery than primary tube ears (13.0% vs 7.5%).

Conclusions: Silicone tubes are significantly less prone to extrude early than titanium tubes. Although the rate of tube otorrhea and persistent perforation was higher in silicone tubes than titanium tubes, it was not statistically significant. Type of ventilation tube affects the time to extrusion and complication rates; therefore, we should choose an appropriate type of ventilation tube according to the patient's status.

R-065 Session S06

First clinical data on Ponto 4

Ågren J., Bianchi F., Rosenbom T.

Oticon Medical AB, Smørum, Denmark

Introduction: One of the common challenges for listeners with a hearing impairment is listening to speech in noisy environments. Hearing assistive devices include directionality and noise reduction algorithms to help hearing-impaired listeners face complex listening environments. Conventional directionality and noise reduction work by attenuating the noise and create a focus towards the front of the user. Thus, the speech information coming from other directions than the front will also be attenuated. In modern hearing aids, conventional directionality

and noise reduction systems have been replaced by a new technology that reduces the noise in complex environments while maintaining access to several talkers around the listener. This technology is implemented as a feature called OpenSound Navigator™ (OSN). With the release of Ponto 4, the new sound processor from Oticon Medical AB, the OSN feature is also available, for the first time, to bone-anchored hearing systems users.

Objectives: The aim of this study was to evaluate the OSN feature of Ponto 4 in terms of benefit in intelligibility during a speech-in-noise test, as well as users' self-reported performance.

Materials: The OSN feature consists of three main signal-processing modules: Analyse, Balance, and Noise removal. The Analyse module relies on the inputs from two microphones to obtain two estimates of sound: an omnidirectional beam and a back-facing cardioid beam. The Balance module is a directionality system that uses the sound estimates from the Analyse module to create a minimum-variance distortionless response (MVDR) beamformer that minimizes the noise while leaving the target undistorted. The Noise removal module works as a fast noise reduction system operating independently in 16 frequency bands. The OSN feature, as implemented in Ponto 4, was evaluated in this study.

Methods: This is a prospective study, where the listeners served as their own control. Listeners with a conductive, mixed conductive-sensorineural or single-sided deafness were included in the study. The listeners had bone-conduction pure tone thresholds lower or equal to 45 dB HL (average at 0.5, 1, 2, and 3 kHz) and were Ponto 3 users prior to the commencement of the study. Each listener participated in two visits. At the first visit, Ponto 4 was fitted to the individual hearing loss. After a field-trial period of about 10 days, speech-in-noise performance in a spatial setup was evaluated with the OSN feature active and inactive. Self-reported performance during the trial period was also evaluated via questionnaires.

Results: Preliminary results indicate a significant benefit of OSN. Specifically, speech-in-noise performance significantly increased when the OSN feature was activated. The complete results will be presented at the conference.

Conclusions: The outcomes of this study show that the OSN feature implemented in Ponto 4 can improve speech intelligibility in complex listening situations. By combining speech intelligibility measures in the laboratory with subjective perception in real-life listening scenarios, this is the first study to report clinical data on the benefit of OSN for bone anchored hearing systems users.

R-066 Session S04

First independent confirmation of TBC1D24 as an autosomal dominant hearing loss gene and audiological characteristics of affected individuals

Oziębło D.^{1,2}, Leja M.^{1,2}, Sarosiak A.^{1,2},
Taciowska G.³, Kochanek K.⁴, Skarżyński H.⁵,
Ołdak M.¹

¹ Department of Genetics, Institute of Physiology and Pathology of Hearing, Kajetany/ Warsaw, Poland

² Postgraduate School of Molecular Medicine, Medical University of Warsaw, Warsaw, Poland

³ Department of Otoneurology, Institute of Physiology and Pathology of Hearing, Kajetany/ Warsaw, Poland

⁴ Department of Experimental Audiology, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁵ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: To date different genetic variants in TBC1D24 gene were causally involved in the development of neurological syndromes and profound prelingual hearing loss (HL) inherited in a recessive manner (DFNB86). In 2014, the first an so far only TBC1D24 pathogenic variant has been linked with postlingual autosomal dominant HL (DFNA65).

Materials and Methods: Five-generation Polish family participated in the study. Clinical exome sequencing on the proband's DNA and family segregation analysis of the identified variants were performed. The audiological assessment included pure tone audiometry (PTA), impedance audiometry, transient evoked otoacoustic emissions (TEOAE) and auditory brainstem responses (ABRs). Vestibular system function was evaluated using ocular and cervical vestibular evoked myogenic potentials (oVEMP, cVEMP). Temporal bone computed tomography was also performed.

Results: Genetic testing revealed a novel probably pathogenic c.553G>A (p.Asp185Asn) TBC1D24 variant, which fully segregated with HL in the studied family. Clinically, progressive HL involving mainly high frequencies was observed. No TEOAE were recorded in the study subjects and no or increased threshold of the stapedial muscle reflex was found. The function of the vestibulocochlear nerve measured by ABR was normal. No vestibular dysfunction and anatomical abnormalities of the cochleovestibular system were detected.

Conclusions: Our results represent the first independent confirmation of TBC1D24 involvement in the development of autosomal dominant HL and the first thorough clinical characteristics of TBC1D24-induced autosomal dominant HL. The identified TBC1D24 variant affects the cochlear component of the auditory system and results in a high-frequency HL usually observed in the third decade of life.

This study was supported by the Polish National Science Centre grant no. 2016/22/E/NZ5/00470.

R-067 Session S04

First missense variant in N-terminal cytoplasmic region of KCNQ4: analysis of the genotype-phenotype correlation

Ołdak M.¹, Madejska A.¹, Oziębło D.^{1,2}, Leja M.^{1,2},
Skarżyński H.³

¹ Department of Genetics, Institute of Physiology and Pathology of Hearing, Warsaw, Poland ² Postgraduate School of Molecular Medicine, Medical University of Warsaw, Warsaw, Poland

³ Institute of Physiology and Pathology of Hearing, Warsaw, Poland

Introduction: Pathogenic variants in KCNQ4 are a well-known cause of autosomal dominant hearing loss (ADHL). There is a phenotypic variability observed in patients with different type and localization of KCNQ4 pathogenic variants. To date, only three frameshift mutations were described in the N-terminal cytoplasmic domain of KCNQ4 in ADHL families with late-onset and pure high-frequency HL.

Materials and Methods: DNA was collected from a five-generation family with progressive high-frequency ADHL. High throughput sequencing on proband's DNA was performed. In family members ($n = 15$) segregation analysis of the identified variants with HL was conducted using Sanger sequencing. Deep genotype-phenotype correlation analysis was performed using cross-sectional linear regression testing of pure tone audiometry results.

Results: Genetic testing revealed a novel, probably pathogenic c.274G>A (p.Glu92Lys) variant in KCNQ4, which fully segregated with HL in the studied family. The detected variant has not been reported in population databases and was classified as pathogenic. The p.Glu92Lys is the first missense variant identified in the N-terminal cytoplasmic region of KCNQ4. HL observed in the analyzed family was more severe at mid frequencies as compared to the previously published families with truncating variants located in this domain.

Conclusions: Identification of KCNQ4 p.Glu92Lys in an ADHL family confirms the association between missense KCNQ4 pathogenic variants and a high-frequency HL with similar annual progression at mid and high frequencies. The data suggest that the type of KCNQ4 detected variants provides a better prognostic factor than their topological localization.

Supported by: NCN Research Grant no. 2016/22/E/NZ5/00470 SONATA BIS6.

R-068 Session S06**First results with a sound processor for a transcutaneous system from Oticon Medical****Person A.C.¹, Philipsson M.², Eeg Olofsson M.³**¹ *Region Västra Götaland, Habilitation & Health, Hearing Organization, Gothenburg, Sweden*² *Oticon Medical AB, Askim, Sweden*³ *Department of Otorhinolaryngology, Head and Neck Surgery, Sahlgrenska University Hospital, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden*

Objectives: Implantable bone conduction devices currently on the market are divided into three types: transcutaneous direct drive, percutaneous direct drive and transcutaneous skin drive bone conduction devices. Oticon Medical is in the process of developing a new transcutaneous direct drive system – the Sentio system. The objective of the study was to evaluate the performance of first-generation Sentio sound processor in terms of audibility and speech intelligibility. In addition, the study evaluated potential skin problems and processor retention force on the skin as well as subjective benefit, satisfaction, and usability.

Methods: The study was a single-center prospective case study where ten patients previously implanted with a transcutaneous direct drive system, the BCI (the Chalmers University of Technology in collaboration with Sahlgrenska University Hospital, Gothenburg), were fitted with the first generation Sentio sound processor. Scheduled for 3–4 visits under a period of 6 months sound field unaided and aided warble tone thresholds and speech recognition score in noise was measured. In addition data on skin reactions using the Inflammation, pain and skin height/numbness (IPS) scale at baseline, 1 month and 6 months after the fitting of the device were collected. The Speech, Spatial and Quality questionnaire (SSQ) was used for self-reported benefit together with own developed questionnaires focusing on overall satisfaction and usability.

Results: Aided thresholds and speech intelligibility results showed a significant improvement compared to the unaided condition. No adverse skin reactions were reported and subjective outcomes showed positive results in terms of benefit of and usability. Overall satisfaction with the device was high.

Conclusions: The first generation Sentio sound processor provides users with good audiological outcome in terms of improved audibility, speech intelligibility, subjective benefit, and satisfaction.

R-069 Session S12**Friends, Romans, countrymen, lend me your ears – a novel combined approach to prominent ears****Wong B., Bhargava E.K., Swords C., Coyle P., Qayyum A.***Peterborough City Hospital, Peterborough, UK*

Objectives: Prominent ear is one of the most common congenital physical deformities seen in children and may give rise to serious emotional problems in children and also in adults. In general, the procedure used for the surgical correction of protruding ears (otoplasty) is a combination of incision, scoring, and suture techniques. We describe a novel technique used for correcting prominent ear without the need to score or excise any cartilage. We also discuss the pros and cons of this particular technique.

Materials and Methods: A patient of 7 years of age with prominent ears is selected to demonstrate the described technique. Written consent for the purpose of this paper including photographs was obtained from the parents.

Results: A step-by-step approach of the technique was described. The primary advantage of this technique is not having to excise any cartilaginous framework, hence maintaining the natural contour of the pinna itself and avoiding any unnecessary sharp edges. Thinning of the cartilage allows the cartilage to be folded back with ease, particularly if it is thick. Removal of the post aural fat pad from the post aural sulcus also helps in reduction of the conchal height and allows the pinna to sit back more easily. By treating both the underdeveloped anti-helix and the large, deep conchal bowl, this technique also gives the ears a more natural look compared to when just treating one aspect of the anatomical abnormality. The drawbacks of this technique include the failure or loosening of perichondrial stitch holding the anti-helical fold and having to use non-absorbable suture for the formation of anti-helix. 30 cases of the prominent ear have been corrected using the described method. No complications were reported to date.

Conclusions: The cosmetic outcomes of this technique have been excellent. The authors hope this technique may be a valuable addition to the armament of different approaches used in the correction of the prominent ear.

R-070 Session S23**From ossiculoplasty to middle ear transplant (3D prosthesis)****Tshifularo M.***ENT, University of Pretoria, Steve Biko Academic Hospital, South Africa*

Introduction: Little improvement in hearing outcome from ossiculoplasty technique and middle ear ossicular replacement prosthesis both total ossicular replacement (TORP) and partial ossicular replacement (PORP)

Prosthesis in designs improvement has occurred in the past 50 years at all (stayed behind in innovation). We know that prosthesis designs that better simulate ossicular chain: anatomically, position and functional may improve outcome significantly strong technology development such as 3D design and printing based on CT scan. Image has enabled and allowed treatments which were previously unthinkable possible. These technologies are providing solutions for some of the most unsolvable medical problems feasible in all fields of medicine – mostly Cardiology, Orthopaedics, Dental, Ophthalmology, and ENT just to name few. Ossiculoplasty is still plaque by high failure rates, with success rates defined as an airborne gap (conductive loss) of around 20 dB ranging generally from 55% to 75% improvement of hearing poor hearing results are attributed to anatomical factors (prosthesis, coupling, position) persistence or recurrence of an underlying disease process, tympanic membrane retraction, middle ear atelectasis, fibrosis, or mucosal pathology. However, none of these fully accounts for persisting airborne gaps following ossiculoplasty. These factors do not fully account for the failure rates as also in ossiculoplasty for trauma which most factors are not an issue. Some degree of hearing loss is attributed to the design of current prostheses, which do not capture all of the mechanical advantages of the normal ossicular chain. Nevertheless, it is likely that improper fit due to both inaccurate size, angulation and position of prosthesis, plays a significant role. In one series with long-term follow-up, more than 40% of failures were attributed to prosthesis or surgeon errors. 3D customer designed prosthesis could decrease the difficulties and challenges of current prostheses and improve the hearing outcomes by increasing the likelihood of proper and stable fit without extraction and instabilities. Custom printed prostheses would minimize the need for intra-operative estimates of the size and would, therefore, decrease surgical time, with resultant cost savings, patient-specific prosthesis from CT scan images patient individualization. In this study, a total Ossicular chain single unit (malleus, incus, stapes) prosthesis based on available epidemiological data of George Noussios et al. A custom Total Ossicular Prosthesis (TOP) was designed using 3D technology – Jason methodology (fabricated). Three formalin-fixed cadaveric human temporal bones with no macro or microscopic evidence of pathology. Three surgeons performed insertion of each prosthesis into each temporal bones left and right after all ossicles except plate was removed. The surgeons were asked to comment on surgery (ossiculoplasty) – easy, quick on the visual analog scale.

Results: Each prosthesis was similarly designed for both left and right. It was possible to create a single unit (TOP). Three surgeons inserted two prostheses in a single temporal bone using an operating microscope. Comment, easy, quick.

Conclusions: A custom 3D printed single unit ossicular chain prosthesis is a viable solution for reconstruction is a total ossicular chain in conductive hearing loss due to ossicular chain defect. This new approach to move from ossiculoplasty reconstruction towards ossicles (middle ear) replacement of transplant. It will add new knowledge to prosthesis development in middle with the use of 3D technology.

R-071 Session S08

From stapedectomy to crural prosthesis – new design prosthesis

Tshifularo M.

ENT, University of Pretoria, Steve Biko Academic Hospital, South Africa

New design stapes prosthesis will be presented. New design does not remove stapes, tendon incudo-stapedial joint, no crimping, stable and secure crural prosthesis. It is a minimally invasive endoscopic procedure to prevent all complications associated with current stapes demonstrate new design 3D printed prosthesis and cadaver work done.

R-072 Session S15

Fulminant cervical spine metastasis and resulting quadriplegia following lateral temporal bone resection for auricular squamous cell carcinoma

Trinidad A.

Department of Otolaryngology, Southend University Hospital NHS Foundation Trust, Southend-on-Sea, UK

Objectives: Cutaneous squamous cell carcinoma (cSCC) of the pinna is a potentially aggressive disease process. Metastatic disease is often to regional lymph nodes but may be distal, to lung and bone. Cervical spine metastases are rare and may have disastrous consequences.

Case report: A 72-year old male presented with a 2-month history of a painful, fungating, destructive mass of the right auricle. CT scan confirmed extension into the external auditory canal. A biopsy confirmed a poorly differentiated T4N2aM0 cSCC. Intervention: Radical auriculectomy, lateral temporal bone resection, radical parotidectomy, and radical neck dissection.

Results: He developed fever and right shoulder pain 9 days post-operatively. A CT scan revealed a destructive lesion involving the spinal cord despite negative pre-operative scans. He was then deemed palliative.

Conclusions: cSCC is a potentially aggressive disease that can result in bony metastasis to the cervical spine with unexpected, fatal consequences which otolaryngologists should be aware of.

R-073 Session S21**Functional surgical approach to the petrous apex cholesteatoma: a new surgical approach while referring to the patient-specific 3D-printed model****Takahashi K., Morita Y., Ohshima S., Izumi S., Yamagishi T., Yagi Ch., Nonomura Y., Horii A.***Department of Otolaryngology Head and Neck Surgery, Niigata University Graduate School of Medical and Dental Sciences*

Introduction: Unlike adult cholesteatomas, pediatric cholesteatomas easily invade deep anatomical areas, such as the petrous apex, via small air cells, with minimal bone destruction, and without any functional deficits. When surgically removing such cholesteatomas, we should pay careful attention to avoid injury to important structures, such as the facial nerve, inner ear, and middle cranial fossa, particularly in children because functional deficits in them would permanently affect their quality of life. However, excessive concern for the important structures would limit the surgical field and could leave a residue of the cholesteatoma. Hence, it is dilemmatic whether functional preservation or extirpation of cholesteatoma should be given a priority. In this study, we demonstrate a surgery referring to the patient-specific three-dimensional (3D) printed model to safely remove a pediatric congenital cholesteatoma invading the petrous apex with no functional deficits.

Patient and Results: A 5-year-old boy with congenital cholesteatoma in his left ear underwent a canal wall up tympanoplasty and mastoidectomy. The cholesteatoma invaded the petrous apex medially from the triangular area which was surrounded by the middle cranial fossa, the facial nerve, and the superior semicircular canal. We initially thought we could remove the cholesteatoma through the triangle in the primary surgery. However, we did not perform the total extirpation of the cholesteatoma because we could not have done so with confidence not to injure the important structures. A year later, a second surgery to remove the cholesteatoma residue was planned. Before the second surgery, we performed a virtual surgery on the patient-specific virtual 3D temporal bone constructed with the patient's CT data. In the virtual surgery, we successfully broadened the triangular area and removed the cholesteatoma without injuring the facial nerve, the semicircular canal, or the middle cranial fossa dura. During the second surgery, we set the drilled and sterilized 3D model besides the surgical field. We confidently drilled out the bone close to the important structures and got a large surgical view. Finally, we safely extirpated the petrous apex cholesteatoma while referring to the 3D-printed model during the surgery.

Discussion and Conclusions: Image-guided surgery using a navigation system is safe and becoming widely popular. However, it is not the case with temporal bone surgery because the accuracy of the navigation is still insufficient. We reported that a 3D-printed model was useful as a training tool to learn the surgical anatomy of the temporal bone. In the present study, we used the 3D-printed model to surgically remove a congenital petrous apex cholesteatoma. To

reach the petrous apex, some approaches have been proposed, such as the translabyrinthine, transotic, and trans-superior semicircular canal approaches, but they could not wholly preserve the auditory and vestibular functions. Because the mastoid air cells in patients with congenital cholesteatoma are usually well-developed, the petrous apex can be approached without drilling into the important structures. Although this approach cannot always be adopted, attempting a virtual surgery using patient-specific 3D data and then performing actual surgery referring to the model would prove useful for the challenging temporal bone surgery.

R-074 Session S22**Growth and late detection of post-operative cholesteatoma on long term follow-up with diffusion-weighted MRI: a retrospective analysis****Connor S.E.I.^{1,2,4}, Crossley E.³, Lancer H.³, Dudau C.^{1,4}, Pai I.³**¹ *Neuroradiology Department, King's College Hospital NHS Foundation Trust, London, UK*² *School of Biomedical Engineering and Imaging Sciences, King's College London, London, UK*³ *Department of Ear, Nose and Throat Surgery, Guy's and St Thomas' NHS Foundation Trust, London, UK*⁴ *Radiology Department, Guy's and St Thomas' NHS Foundation Trust, London, UK*

Objectives: The use of non-echo planar imaging (non-EPI) diffusion-weighted imaging (DWI) sequences have become widely accepted as a valuable tool in the evaluation of post-operative cholesteatoma, with overall sensitivity and specificity of post-operative non-EPI DWI techniques being estimated to be 94% in a recent meta-analysis. The high diagnostic accuracy has allowed non-EPI DWI to provide a non-invasive alternative to second-look surgery, and it has also proved to be useful in determining the size and location of the disease. Whilst the ability of DWI MRI to detect post-operative cholesteatomas is reasonably well established, there is less certainty regarding the optimal length of follow-up monitoring with DWI MRI for residual cholesteatoma and the frequency of imaging during this period, especially when the operated ear is clinically stable and there is no indication or desire for further surgery other than to exclude residual disease. Longer term surveillance protocols vary between centres and there is currently little evidence to support a particular approach. The appropriate interval and duration of the follow up should be influenced by the potential growth rate and any propensity to later detection of residual cholesteatoma. At our institution, over 80% of cholesteatoma cases in our centre now undergo non-EPI Half-Fourier Acquisition Single-shot Turbo spin Echo (HASTE) DWI imaging as part of postoperative surveillance for residual disease.

Aim: In this study, we aimed to evaluate the growth rate and late DWI MRI detection of post-operative cholesteatoma by examining the long-term outcomes of clinically stable ears, in which DWI MRI was utilised to guide

management following definitive surgery, and hence address the questions on appropriate scan timing, interval and minimum duration of imaging follow-up and hence define surveillance imaging protocols.

Materials and Methods: This was a retrospective case review of patients who underwent non-echo planar imaging (non-EPI) Half-Fourier Acquisition Single-shot Turbo spin Echo (HASTE) DWI MRI at our tertiary referral centre institution between February 2007 and May 2013 for post-operative cholesteatoma follow-up. The outcome data included intervals between the definitive surgery and the first and subsequent DWI MRI, the type of surgery performed, the maximum coronal dimension of each DWI hyperintense focus on imaging, the clinical status of the operated ear, and the length of follow-up after definitive surgery and the last DWI negative scan.

Results: The study evaluated 152 post-operative DWI studies performed for 88 patients. In 12 cases, DWI was initially negative but became positive on repeat imaging after a mean interval of 3.8 years from the initial cholesteatoma surgery (median 3.7 years, range 1.6–7.9). Of these, 3/12 had more than one negative/indeterminate DWI before the disease was eventually detected on imaging; in this subgroup, the mean interval between surgery and positive DWI was 3.2 years (median 2.6 years, range 2.3–4.2). 39 DWI positive foci with serial imaging demonstrated a mean growth rate of 4 mm/year (median 2 mm, range 0–18).

Conclusions: After negative initial DWI, it is proposed that interval imaging should be considered for a minimum of 5 years in stable ears following definitive cholesteatoma surgery. In view of the marked variability in growth rate, an additional interval scan between 2 and 3 years postoperatively is indicated.

R-075 Session Panel Cholesteatoma (Kania)

Has the incidence of cholesteatoma decreased? Current conditions of patients with cholesteatoma in Romania

Maniu A.¹, Radulescu L.² Gheorghe D.C.³, Stefanescu H.⁴, Necula V.¹

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

² Department of Otorhinolaryngology, University of Medicine and Pharmacy, Iasi, Romania

³ Department of Otorhinolaryngology, Emergency Clinic Hospital for Children M. Curie, Bucharest, Romania

⁴ Department of Otorhinolaryngology, University of Medicine and Pharmacy, Timisoara, Romania

Introduction: The true worldwide incidence of middle ear cholesteatoma is not known. Statistical epidemiologic studies are rather limited, but it should be noted that the incidence of acquired cholesteatoma and especially its complications have declined in recent decades.

Objectives: The objective of our study is to give an overview about the current condition of chronic otitis media

with cholesteatoma in Romania, particularly for the E.N.T. Clinic University of Medicine Cluj-Napoca.

Materials and Methods: Epidemiological data from the main Romanian University Clinic were carried out as regards to the number of patients consulted and admitted for the surgeries, from 2013–2018. Furthermore, the type of surgery and technique (canal wall down/up procedure) for primary cases were noted, the number of reintervention and the complications as well.

Results: The number of complication tributary to chronic otitis media with cholesteatoma has decreased in the recent years due to increased health care accessibility and advancement in imaging but not the number of new cases that are higher among low-income patients and the patients from rural area. The number of surgical intervention was higher based on the more reconstructive procedure used.

Conclusions: Middle ear cholesteatoma still remains an important and relatively common disorder which may have serious consequences. Therefore epidemiological and statistical data, surgical reports are very useful in order to better understand the pathogenesis and find the most suitable treatment for the disease.

R-076 Session S08

Healing acceleration of mastoidectomy through the non-incision approach of external auditory canal: CASPER procedure

Lee J.H.

Department of Otorhinolaryngology and Head and Neck Surgery, Hallym University Medical Center, Chuncheon, Republic of Korea

Objectives: To accelerate the healing process and to enhance the hearing outcome, we designed a new surgical procedure which includes canal wall up mastoidectomy without canal incision.

Materials and methods: 47 patients were enrolled in this study. Novel surgical technique was used in patients who received canal wall up/down mastoidectomy, expo-mastoidectomy and cochlea implantation (staged operation after mastoid obliteration). Preoperative and postoperative pure tone audiometry/speech discrimination score and postoperative status (healing time and complications) were analyzed.

Results: healing time of suggesting procedure was earlier than conventional mastoidectomy with canal incision. In cases of canal wall down mastoidectomy, expo-mastoidectomy, and cochlea implantation, healing process was more acceptable with this technique, even though few cases were shown in this report.

Conclusions: Canal wall up mastoidectomy without canal incision is very useful to achieve optimal surgical view, eliminate the middle ear pathology and to accelerate healing time.

R-077 Session S24**Hearing improvement after sudden sensorineural hearing loss as a predictor of vestibular schwannoma****Ungar O.J., Wengier A., Cavel O., Handzel O., Oron Y.***Department of Otolaryngology Head and Neck Surgery and Maxillofacial Surgery, Tel-Aviv Sourasky Medical Center, Tel-Aviv, Israel, affiliated to the Sackler School of Medicine, Tel-Aviv University, Tel-Aviv, Israel*

Objectives: To investigate whether there is a different pattern of response to steroidal treatment after sudden sensorineural hearing loss (SSNHL) in patients with and without a vestibular schwannoma (VS), in order to determine whether rapid hearing improvement can serve as a predictor of the presence of a VS.

Materials and Methods: A retrospective chart review of patients with SSNHLs treated at one tertiary university-affiliated medical center between January 1, 2013, and December 31, 2017.

Results: A total of 420 patients were treated for SSNHL during the five-year study period. Treatment consisted of intraoral prednisone 1 mg/kg/day. The male-to-female ratio was 1.00: 1.17, and the median age at diagnosis was 38 years (range 18–82): neither parameter correlated to the presence of VS. Magnetic resonance imaging scans demonstrated a homolateral VS in 20 patients (4.76%). Audiometric testing at seven days after steroidal treatment initiation revealed that the pure tone average of 60% of the 400 patients without VS improved 80% of the 20 patients with VS improved ($p = 0.0007$).

Conclusions: Improvement of hearing within one week after steroidal treatment initiation in patients with SSNHLs may suggest the presence of a VS.

R-078 Session S12**Hearing outcomes of surgery versus implantable hearing devices in congenital aural atresia: a literature review and our experience****Hill E., Powell H., Pai I., Ghulam H., Jenkins M., Jiang D.***St. Thomas' Hearing Implant Centre, Guy's and St. Thomas' NHS Foundation Trust, London, UK*

Introduction: The conventional management of aural atresia is based on canalplasty in conjunction with ossiculoplasty as a sole procedure or in conjunction with a pinna-plasty, to achieve both aesthetic and functional goals. In the literature, surgery achieves a 25 dB hearing gain in 60% of patients, with a similar percentage of patients achieving an air-bone gap between 20 to 30 dB at 12 months. In contrast, the percutaneous osseointegrated bone conduction device appears to achieve a more consistent hearing

outcome with over 95% of patients achieving an air-bone gap level less than 30dB. In the last decade, Medel Vibrant Soundbridge, with stapes or round window vibroplasty, has provided a new option for hearing the rehabilitation, without the need for a percutaneous abutment, with the benefits of ear specific hearing and the possibility of greater gain. The timing of this procedure can be either in conjunction with pinna-plasty or as a stand-alone procedure prior than pinna reconstruction, the possibility at a far earlier age to promote binaural hearing.

Methods: A literature review was performed comparing hearing outcomes of conventional aural atresia surgery versus percutaneous osseointegrated bone conduction device versus Medel Vibrant Soundbridge vibroplasty in congenital aural atresia patients. The short and long term complications and the impact of implantable devices on the reconstruction surgery has also been investigated. We will provide a case series of the St Thomas Hearing Centre experience in performing Medel Vibrant Soundbridge in this cohort, discussing our experience with outcomes and limitations.

Results of the review will be discussed in the consensus session of 32nd Politzer Society meeting on the management of congenital aural atresia.

R-079 Session S10**Hearing preservation in CI: a comprehensive review and meta-analysis for strategic planning****Pawan S.***Department of ENT, SMS Medical College, Jaipur, India*

Objectives: The aims of this study is to review and investigate various factors/methods for hearing preservation in cochlear implantation with a meta-analysis of existing literature.

Materials and Methods: A total number of 100 patients reviewed retrospectively for a residual hearing based on various factors and methods and an extensive literature search was done and analysed.

Results: All patients were reviewed based on various factors like cause of illness, age of implantation, preoperative hearing, audiometry, BERA, method of implantation, techniques of insertion, length, and type of implant, etc.

Conclusions: Various methods are useful for residual hearing preservation in cochlear implantation. The hearing preservation methods also help potential candidates for future innovative therapies.

R-080 Session S08**Hearing recovery in advanced otosclerosis**David L., Ilie M., Popovici M., Sinziana S.*Clinica Urechii Chirurgie, Bucharest, Romania*

Introduction: Otosclerosis is a primary disease of the temporal bone that leads to stapes ankylosis. The main symptom is hearing loss. Treatment includes surgery, medical treatment, and methods of sound amplification.

Objectives: To evaluate the functional hearing outcome of stapes surgery in patients with advanced otosclerosis.

Materials and methods: Retrospective study of 613 patients with otosclerosis operated between 2008–2019, using pure tone audiometry, speech audiometry, 3D impedance, CT scan. Audiologic assessment (pure tone audiometry and speech audiometry), was performed before surgery and 2/6 months postoperatively. A high-resolution temporal bone CT scan was routinely performed before surgery.

Results: Postoperative functional hearing outcome (ABG closure) is quite similar in cases with advanced otosclerosis, compared to middle ear otosclerosis cases (stapedo-vestibular ankylosis only). Stapes surgery showed excellent functional hearing outcomes in our study, with a low complication rate.

Conclusions: Stapedotomy should be considered the first option to restore hearing even in advanced otosclerosis.

R-081 Session S07**Hearing Threshold Level in the Elderly of Northern China**Ai Y.^{1,2}, Zhaomin F.¹, Haibo W.¹

¹ Department of Otolaryngology-Head and Neck Surgery, Shandong Provincial ENT Hospital, Shandong Provincial ENT Hospital affiliated to Shandong University, Jinan, P.R. China

² Clinical Auditory Center, Shandong Provincial ENT Hospital, Shandong Provincial ENT Hospital Affiliated to Shandong University, Jinan, P.R. China

Introduction: Age-related hearing loss (ARHL) is considered as the most common cause of hearing loss in the world. It is characterized by decreased hearing sensitivity and poor speech understanding, especially in a noisy environment. It has been confirmed that ARHL is independently associated with cognitive decline, dementia, depression, and loneliness and may result in huge expenditures. There have been some studies about the epidemiology of ARHL. But the majority of them are derived from a western developed country. There are few epidemiological studies about presbycusis in China, especially for the population living in rural areas.

Objectives: To describe the hearing sensitivities of a population living in rural areas of north China aged 60 years and older. To statistic the prevalence of tinnitus in the

elderly and analyze whether there is any difference in the pure tone threshold between the elderly with tinnitus and without tinnitus.

Materials and Methods: A total of 2021 elderly people (1148 females and 873 males) participated in our study. All of them are from rural areas of Yanggu County, Shandong Province. Exclusion criteria were based on medical history and audiometric data. Subjects with conductive hearing loss, mixed hearing loss, non age-related sensorineural hearing loss, and asymmetric sensorineural hearing loss were excluded in the study. In addition, unreliable subjects were also excluded. Finally, 1863 subjects (1062 females and 801 males) were analyzed. Their ages varied from 60 to 93 years at the time of auditory testing, with the mean age of 71.16 years. According to the age, data were divided into three age groups: 65-years group between 60 and 69 years ($n = 798$), 75-years group between 70 and 79 years ($n = 928$), and an older group older than 80 years ($n = 137$). Before pure tone test, ears were examined and obstructive wax was removed if necessary. GSI 61 clinical audiometer calibrated according to ISO 389 was used for pure tone audiometry, with supra-aural earphone (TDH 39) for air conduction, and a bone vibrator Radioear B-71 for bone conduction. Tinnitus matching was undergone if a subject complaint of tinnitus.

Results: Hearing threshold levels at all frequencies increased with age ($p < 0.01$). HTL increased gradually with frequency. At frequencies of 125, 500, 2k and 4 kHz, the elderly have a significantly higher threshold in the left ear than in right ear ($p < 0.01$). The hearing threshold at 1 kHz was not markedly different between the left ear and right ear. In addition, at a frequency of 8k Hz, the elderly have a higher threshold in the right ear. Compared with women, men have a markedly worse threshold at frequencies of 2k, 4k and 8 kHz. There were 174 subjects (9.34%) complaint of tinnitus. There was no significant difference between female subjects and male subjects in the prevalence of tinnitus. Nevertheless, the subjects with tinnitus had a worse hearing threshold at all frequencies in the suffered ear ($P < 0.01$).

Conclusions: The data from this study can provide useful information for hearing health of the population living in rural areas of China.

R-082 Session S11**Hugging those curves – a retrospective evaluation of a trainee's training curve in endoscopic ear surgery**Bhargava E.K., Wakelam O., Leach L., Masood A., Qayyum A.*Peterborough City Hospital, UK*

Introduction: Endoscopic ear surgery (EES) is rapidly emerging as a mainstream surgical modality, with recent literature highlighting its advantages over traditional approaches. As more surgeons are adopting the technique, trainees in otolaryngology are in the midst of a 'revolution' in middle ear surgery. The aim of this study was

to evaluate the learning curve of endoscopic tympanoplasty for an ENT trainee already trained in microscopic tympanoplasty.

Methods: Study design: Case-Control Study Setting: district general hospital patients: all patients that underwent tympanoplasty (endoscopic and microscopic), performed between 2016–2018 by single trainee surgeon trained in microscopic ear surgery. Patients with incomplete records were excluded. Patients were divided into a control group (group A – microscopic surgery) and case groups (Group B – early EES, Group C – late EES).

Results: Outcome measures: Primary – graft success. Secondary – hearing gain, duration of surgery.

Results: 60 EES and 36 control cases included. No significant difference in graft success rates or hearing gain between cases and control. The hearing gain was significantly better and duration of surgery shorter in group C compared to Group B.

Conclusions: Endoscopic tympanoplasty is equally effective and quicker than microscopic surgery. Duration of surgery decreases and hearing outcomes improve with a trainee's experience. Results of EES remain stable along the learning curve for a trainee trained in microscopic surgery. This study provides much-needed insight into the learning curve of trainee ENT surgeons who we hope will one day be at the helm of such revolutions in otolaryngology practice in the not so distant future.

R-083 Session S04

Identification of a novel pathogenic MYH14 mutation in a Chinese family with autosomal dominant nonsyndromic hearing loss

Wang M.¹, Zhou Y.², Zhang F.³, Jin Y.³, Fan Z.¹, Bai X.⁴, Wang H.^{1,3}

¹ Department of Otolological Medicine, Shandong Provincial ENT Hospital affiliated to Shandong University, Jinan, China

² Department of Otorhinolaryngology Head and Neck Surgery, First Affiliated Hospital of USTC, Division of Life Sciences and Medicine, University of Science and Technology of China, Hefei, China

³ Shandong Provincial Key Laboratory of Otolaryngology, Shandong Institution of Otolaryngology, Jinan, China,

⁴ Department of Clinical Laboratory, Shandong Provincial Hospital affiliated to Shandong University, Jinan, China

Objectives: To identify the disease-related gene mutants in a Chinese Han family associated with postlingual onset and progressive sensorineural hearing loss.

Materials and Methods: A Chinese Han family consisted of 15 members in 4-generation associated with non-syndromic sensorineural hearing loss was enrolled. All participants underwent audiometric and vestibular function evaluations systematically, including otoscopy, pure-tone audiometry (behavior observation audiometry for infant), tympanometry and acoustic reflex threshold, auditory

brainstem response (ABR), distortion products otoacoustic emissions (DPOAEs) recording, vestibular bi-thermal caloric test, electrocochleogram, ocular/cervical vestibular evoked myogenic potential, high-resolution computed tomography of temporal bone, and magnetic resonance imaging of brain. Peripheral blood samples were obtained and genomic DNA was extracted from family members. Targeted next-generation sequencing was performed to search for the candidate mutations and co-segregation of the phenotype were verified by Sanger sequencing and Polymerase Chain Reaction – Restricted Fragment Length Polymorphism (PCR-RFLP). 200 normal-hearing persons were recruited as controls.

Results: In the four-generation family consisted of 15 members, 4 (II-1, II-5, III-1, and IV-1) affected by the postlingual non-syndromic sensorineural hearing loss that presenting as an autosomal dominant inheritance. The hearing loss was bilateral symmetrically and moderate in all frequencies. They showed a progressive hearing impairment that started in the 1st or 2nd decade and led to moderate hearing loss in the 5th decade of life. No vestibular symptom or positive test result was present. Targeted next-generation sequencing of deafness genes was employed on 3 affected individuals, and a novel missense mutation, c.5417 C > A (GCC→GAC), in MYH14 gene was successfully identified as the pathogenic cause. Next, Sanger sequencing and PCR-RFLP analysis were performed to confirm further this mutation, which was predicted to lead to substitution at codon 1806 (D1806N) and change Tcagc/caagg, in this family and 200 normal controls that were co-segregated with the deafness phenotype.

Conclusions: A novel mutation of c.5417 C>A (GCC→GAC) in MYH14 gene that caused autosomal dominant hearing loss was the first time to report and should be the ninth pathogenic variant for MYH14 gene resulting in DFNA4.

R-084 Session S21

Image assisted temporal bone surgery, using the medical image processing system

Nishizaki K.¹, Kataoka Y.¹, Kariya S.¹, Akagi N.², Tachibana T.³

¹ Otolaryngology-Head & Neck Surgery, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Science, Okayama, Japan

² Radiology, Okayama University Hospital, Okayama, Japan

³ Otolaryngology, Japanese Red Cross Society Himeji Hospital, Himeji, Japan

Objectives: The purpose of this study is to develop a safe method for ones (to remove the bridge and to lower the facial ridge) of the most dangerous procedures in canal wall down mastoidectomy by using the medical imaging processing system. The medical image processing system is useful for the evaluation of ear diseases and the planning, education, simulation, and navigation of ear surgery. Canal wall down mastoidectomy has been recently chosen especially in cases with recurrent cholesteatoma depending on the preference of the operator. Since the number of patients with cholesteatoma appears to be decreasing

by appropriate interventions for ear diseases that develop cholesteatoma, the decreasing chance to master canal wall down technique should be compensated by other methods. Although cadaver dissection or temporal bone surgery simulator is one of the alternatives, the medical image processing system can replace them. Here, we introduce image-assisted ear surgery using the medical imaging processing system.

Materials: 0.25 mm, 1024 matrix ultra-high resolution CT (Aquilion Precision, Canon Medical Systems, Tokyo, Japan) images of the temporal bone with ear disease.

Methods: Three-dimensional reconstructive images (3DRIs) of ultra-high resolution temporal bone CT were made using a medical image processing system (Synapse Vincent, Fuji Film, Tokyo, Japan). A series of sagittal images from lateral to medial help simulate ear surgery because ear surgery usually progresses from lateral to medial. Longitudinal and transversal axes of the bridge and facial ridge were set by changing points of view for 3DRIs and a series of images cut from lateral and medial were made to know a safe procedure to remove the bridge and to lower the facial ridge in ear surgery.

Results: 3DRIs showed that the lateral wall of the attic (bridge) has a slope with an anteroinferior-posterosuperior tilt. The deepest point is the anteroinferior point of the bridge, equivalent of the anterosuperior point of the tympanic ring. One of the safest sequences of resecting the bridge is shown to make a slope parallel to the lateral wall of the attic, subsequently to resect the bridge as anteriorly as possible, and finally to remove the bridge by cutting the overhanging bone from anterior. In advancing the resection of the bridge, the posterior buttress is clearly formed and is divided into the facial ridge and the posterior wall of the external auditory canal as the facial recess opens. Lowering the facial ridge sometimes causes damages to the facial nerve and the lateral semicircular canal. 3DRIs showed that the second genu of the facial nerve is located most laterally in the temporal bone and the lateral semicircular canal is located in the posterior superior part of the facial ridge. The facial ridge also has a curved longitudinal axis and the transversal axis. 3DRIs showed that one of the safest ways of lowering the facial ridge is shown to remove the ridge on the extension of resection of the bridge resecting the overhanging bone by identifying the horizontal segment of the facial ridge as a landmark according on the policy of resecting the bridge in removing the incus or destroyed incus. In the case with intact incus, the posterior ligament of the incus is paid attention to be attached to bone protruding from the horizontal segment of the facial nerve canal. This should be taken into consideration in lowering the facial ridge in the case with intact incus.

Conclusions: The medical imaging processing system is a useful tool to understand complicated anatomy about ear surgery and develop a novel technique of ear surgery.

R-085 Session S02

Imaging tympanic membrane surface vibrations

Hamra M.¹, Shinnawi Sh.², Weigler A.¹, Yelin D.¹, Cohen-Vaizer M.²

¹ Department of Biomedical Engineering, Technion – Israel Institute of Technology, Haifa, Israel

² Department of Otolaryngology Head and Neck Surgery, Rambam Healthcare Campus

Introduction: The tympanic membrane plays a key role in the human hearing by translating air pressure waves into bone vibrations, and its function and dynamics are directly linked to various pathologies and hearing disorders. Current methods for imaging tympanic membrane dynamics, including stroboscopic holography and Doppler OCT would be challenging for in-vivo applications due to high system complexity or the need for point-by-point scanning.

Objectives: Here, we demonstrate in-vivo imaging of the tympanic membrane dynamics of a human volunteer using interferometric spectrally encoded endoscopy (iSEE).

Materials and Methods: Briefly, in iSEE, spectral interference between a reference signal and the reflectance along a spectrally encoded transverse line is captured by a high speed (50 kHz) spectrometer. Using single-axis scanning across the membrane provides a two-dimensional interferometric data that is later analyzed using specialized software. The imaging probe includes a single optical fiber, optics for light delivery and scanning of the tympanic membrane, and a dedicated port for transmitting the excitation acoustic signals comprised of multiple single-frequency stimuli.

Results: The study could be used for developing a compact system that could be incorporated into conventional clinical otoscopes for providing functional information non-invasively with unprecedented resolution and sensitivity.

R-086 Session S04

Important contribution of STRC copy number variations to the development of mild-to-moderate hearing loss

Harasimowicz B.¹, Oziębło D.^{1,2}, Skarżyński H.³, Ołdak M.¹

¹ Department of Genetics, Institute of Physiology and Pathology of Hearing, Warsaw, Poland ² Postgraduate School of Molecular Medicine, Medical University of Warsaw, Warsaw, Poland

³ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Copy number variations (CNVs) are a common cause of genetically determined hearing loss (HL). CNVs are frequently found in the STRC gene which is related to autosomal recessive HL. Due to the presence of STRC

pseudogene and technological limitation of CNVs detection, large deletions and duplications encompassing STRC are still an underestimated contributor to HL development.

Materials and Methods: A group of 50 patients with mild-to-moderate HL diagnosed before the age of 10 and with no DFNB1 pathogenic was recruited for the study. All patients were tested for CNVs in STRC gene using quantitative comparative fluorescent PCR (QF-PCR) with primers specific to the STRC gene and its pseudogene followed by multiplex-ligation probe amplification (MLPA).

Results: Genetic prescreen with QF-PCR revealed a complete deletion of the STRC tested regions in 24% (24/100) and partial deletion in 5% of the studied alleles (5/100). This method allowed us also to identify two complete and two partial deletions of tested regions in the STRC pseudogene. Complete deletions of the STRC gene regions were fully confirmed by mlPA. One additional STRC partial deletion and one duplication were also detected. Considering the genotypes, in 26% (13/50) of HL patients homozygous or compound heterozygous CNVs were detected. In 10% (5/50) of patients, only simple heterozygous CNVs was found.

Conclusions: This study shows that CNVs in STRC are a frequent cause of mild-to-moderate hearing loss in Polish patients. There is a strong need to include CNVs analysis of STRC gene in the standard HL diagnostic workflow.

R-087 Session S21

In a Rich Man's World – a cost comparison between total endoscopic ear surgery and microscopic surgery for attic cholesteatoma

Bhargava E.K., Wakelam O., Leach L., Masood A., Qayyum A.

Peterborough City Hospital, Peterborough, UK

Introduction: Endoscopic ear surgery (EES) is rapidly emerging as a mainstream surgical modality, with recent literature highlighting its advantages over traditional approaches. This study tests the null hypothesis that there is no difference in direct costs of total endoscopic ear surgery and microscopic ear surgery for attic cholesteatoma in a British National Health Service District General Hospital setting.

Methods: Study Design: Retrospective cost comparison setting: district general hospital cost comparison: Direct cost comparison of anaesthetic set up, surgical setup, and surgical time between total endoscopic ear surgery and microscopic ear surgery for attic cholesteatoma.

Main outcome measures: Direct costs of anaesthetic set up, surgical setup, and surgical time

Results: Total endoscopic ear surgery had a significant cost saving of over £1500 per operation.

Conclusions: Total endoscopic ear surgery is more cost-effective than microscopic surgery for attic cholesteatoma in a British National Health Service District General Hospital setting.

R-088 Session S08

Incidence and timing of post-operative complications: a personal review of 2500 stapes surgeries

Lavy J.A.

Royal National ENT Hospital, London, UK

Objectives: To assess the incidence and timing of post-operative complications following primary and revision stapes surgery.

Materials: Review of a personal surgical database of over 2500 procedures.

Methods: Analysis of database.

Results: The incidence and timing of the common complications of stapes surgery (dizziness, tinnitus, taste disturbance, hearing loss, displacement of the prosthesis and facial weakness) are presented.

Conclusions: The results contribute to more accurate patient information for patient choice and surgical consent.

R-089 Session S07

Influence of age on the results of Dichotic Digit Test (DDT) based on analysis of hearing screening in school-age children

Gocel M.¹, Świerniak W.¹, Tarczyński K.¹, Skarżyński P.H.^{1,2,3}

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

³ Institute of Sensory Organs, Kajetany/Warsaw, Poland

Introduction: The main purpose of hearing screening programs is the early detection of hearing defects, including the risk of auditory processing disorders. Central Auditory Processing Disorders (CAPD), according to the American Speech-Language-Hearing Association (ASHA), refers to difficulties in the perceptual of auditory information in the Central Nervous System (CNS). Undetected and untreated, CAPD affects the child's quality of life, social skills and causes many school problems. One of CAPD test is Dichotic Digit Test (DDT), which assesses binaural integration skills.

Aim: The aim of this study was to estimate the effects of age on the results of the Dichotic Digit Test (DDT) and to estimate medium results for 7/8 years old and 12/13 years old children.

Materials and Methods: Screening was performed in Warsaw (Poland), from February to June 2018, using the Sense Examination Platform, developed by the Institute of Sensory Organs and the Institute of Physiology and Pathology of Hearing. In the present study results based on the

audiogram test and the dichotic digit test were investigated. From almost 18,000 tests, 2500 results were randomly selected. Due to bad acoustic conditions and lack of co-operation, 89 participants were excluded. In this study, only children with normal hearing sensitivity were taken into consideration (427 were eliminated). Eventually, out of 1984 pupils, two age groups were selected: first 7/8 years old (first grade) and second 12/13 years old (sixth grade). Afterward the percentage of correct DDT test answers were compared in each group.

Results: 7 and 8 years old children obtain poorer results compared with children aged 12 and 13 years. Average DDT results in younger group was 73,9% for right ear ($SD = 16,17$) and 51,54% for left ear ($SD = 23,98$). The mean outcomes in 12/13 years old children were: 84,52% for right ear ($SD = 12,3$) and 73,42% for left ear ($SD = 18,7$). Moreover, in the group of older children scatter of results was much smaller than in the group of younger children.

Conclusions: Age has a significant impact on the results of the Dichotic Digit Test. Analyzing DDT results, specialists should take into consideration factors that may affect the results, including age and studied ear. Research in the group of older children is characterized by greater credibility and stability.

R-090 Session S09

Influence of endolymphatic hydrops on acoustic energy absorbance

Kobayashi M., Yoshida T., Sone M.

Department of Otorhinolaryngology, Nagoya University Graduate School of Medicine, Nagoya, Japan

Objectives: The presence of endolymphatic hydrops (EH), especially in the vestibule, could affect the transmission of acoustic energy to the inner ear, but no detailed analysis of this condition has been clinically reported. We measured acoustic energy absorbance at the inner ear with or without EH using wideband tympanometry (WBT) and tried to elucidate auditory findings related to EH.

Materials: A total of 32 ears from 16 patients who underwent 3-T magnetic resonance imaging (MRI) to evaluate the presence of EH were examined, retrospectively. The degree of EH in the vestibule was classified into three grades (no, mild, and significant), and pure tone audiometry (PTA) and WBT were measured in each ear before and after a glycerol drip. The PTA and WBT data of each subject were calculated and analyzed with a comparison between the ears with and without significant EH.

Results: MRI evaluation showed significant, mild, and no EH in 19, 3, and 10 ears, respectively. Ears with significant EH (the significant EH group) showed significantly higher absorbance values on WBT than ears with mild or no EH (the non-significant EH group) at low frequencies (570–620 Hz). Changes in absorbance values after the glycerol drip were observed in some ears without threshold change on PTA. The absorbance values after the drip

on WBT were significantly changed in the significant EH group in the low (400–440 Hz) and middle frequencies (3100–3200 Hz and 3500–3600 Hz) than those of the non-significant group.

Conclusions: This study showed significantly higher absorbance values of acoustic energy at the inner ears in ears with significant vestibular EH at the low frequencies. The high absorbance observed in ears with significant EH does not necessarily indicate effective transmission of acoustic energy to the cochlea. The changes in absorbance values after the glycerol drip observed on WBT might demonstrate the improvement of impaired transmission of acoustic energy to the inner ear, which could not be detected on PTA.

R-092 Session Panel: Otology in Taiwan

Initial mapping within 24 hours and others: an evidence-based review of 500 cochlear implantations in Cheng Hsin General Hospital

Li L.P.-H.

Department of Otolaryngology, Cheng Hsin General Hospital, Faculty of Medicine, National Yang-Ming University

Since the launch of the Auditory Center in 2004, there have been more than 500 surgeries of cochlear implantation in Cheng Hsin General Hospital. The number is about 1/6 of the total amount in Taiwan. In this section, the authors want to present an evidence-based review out of our articles and share our experiences in terms of following issues: (a) safety and feasibility of a minimally invasive approach (~2.5 cm) and thus initial frequency mapping within 24 hours after the implantation; (b) evolution of impedance field telemetry after one day of activation in cochlear implant recipients; (c) different behaviors of impedance changes for different implant devices; (d) deep learning-based noise reduction approach to improve speech intelligibility for cochlear implant recipients; (e) music training for the improvement of pitch perception in prelingually deafened children with cochlear implants; (f) contribution of bimodal hearing to pitch perception for prelingually deafened cochlear implant recipients; (g) benefits of music therapy for the outcome of speech rehabilitation program. We aimed to provide an overview of cochlear implantation in Taiwan with specific respect to the surgical approach, electrophysiological changes, application of artificial intelligence, and music performance/therapy.

R-093 Session S23

Inlay Cartilage Tympanoplasty for large, marginal perforations

Cohen-Vaizer M., Barzilay R., Shinnawi Sh.

Department of Otolaryngology Head and Neck Surgery, the Head and Neck Center, Rambam Healthcare Campus, Clinical Research Institute at Rambam, Rappaport Institute of Medicine and Research, Technion – Israel Institute of Technology, Haifa, Israel

Introduction: Inlay Cartilage Tympanoplasty has gained increasing popularity in the last years after presenting

consistently excellent anatomic and functional results in the treatment of central, small perforations. In 2014, Ried et al. described the yo-yo technique. An Inlay technique in which the tragal cartilage and perichondrium are crafted in a way that they remained united at the center of the graft, the epithelium around the perforation is removed, and the perichondrium is placed laterally while the cartilage lays medial to the tympanic membrane. At our center, we have extended this technique to treat even large, marginal perforations.

Materials and Methods: A retrospective chart review of 199 tympanoplasties operated in our center from March 2016 to June 2018. Pre-, intra- and post-operative results were compared between inlay yo-yo and underlay island grafts techniques. 65 patients underwent yo-yo tympanoplasty and 118 were operated with the island graft technique. Similar preoperative features of the size of perforation (57 vs 39%) and hearing (13/31 vs 11/25) were found.

Results: Excellent results were achieved in both groups in terms of complete closure of perforation (93 and 91%) and hearing improvement (9/17 and 7/11). While a significant reduction in surgical time was achieved with the inlay yo-yo technique (38 vs 58 min).

Conclusions: The yo-yo inlay technique achieves excellent anatomical and functional results, even in large or eccentric perforations, while reducing significantly operating times

R-094 Session S17

Intraoperative ECochG monitoring of the SlimJ electrode insertion in patients with low-frequency residual hearing

Lenarz T., Salcher R., Bardt M., Buechner A.

Department of Otolaryngology, Medical University of Hannover, Hannover, Germany

Introduction: Today's cochlear implant (CI) candidates have a significant residual hearing. Through dedicated atraumatic electrode designs together with adapted soft surgical techniques, the aim is to preserve the residual hearing as much as possible. The SlimJ electrode array from Advanced Bionics was developed with a focus on easy handling and preservation of cochlear structures and residual hearing. With the electrocochleography (ECochG) measurements it is possible to monitor the insertion process of the electrode array in real time and adapt the insertion speed, depth, and angle with the aim to minimize the insertion trauma. The underlying mechanism is the acoustic stimulation and active monitoring of the cochlear microphonics (CM) through the most apical contact of the CI.

Materials and Methods: Up-to-date 111 CI candidates have been implanted with the HiRes Ultra implant and SlimJ electrode. In 47, a substantial amount of low-frequency residual hearing was present prior to CI surgery and the ECochG was monitored intraoperatively. All CI users underwent post-operative follow-up including hearing threshold as well as speech perception measures for at least 4 months post-op.

Results: The SlimJ electrode was successfully inserted in all cases through the round window. At one month post-op in 72% of the CI users hearing loss of less than 30 dB was measured, in 40% less than 15 dB. Driven by the ECochG signal, the insertion of the electrode was halted or the electrode withdrawn until the CM recovered. Changes in CM amplitude during electrode array insertion were in line with surgical feedback and a surgical video review. Intra- as well as post-operative ECochG measures, were correlated to low-frequency hearing preservation. Subjects were grouped according to their intra-operative curve progression: 1) final amplitude at least 80% of maximal amplitude, 2) final amplitude between 20% and 80%, 3) complete loss (< 20%). Hearing loss 4 weeks after surgery (expressed as LF PTA) in group 1 was 11.7 dB and significantly lower than in group 2 (20 dB). In group 3 the hearing loss was 28 dB, but with only 5 subjects assigned to this group, a statistical comparison was not possible.

Conclusions: The SlimJ electrode array is easy to handle and is suitable for atraumatic insertion through the round window and adjusted insertion depth controlled by ECochG measurements. Both electrode design, as well as surgical technique, are important for reliable hearing preservation. The hearing preservation with SlimJ electrode is possible in the majority of patients. Important factors for hearing preservation are the atraumatic electrode design, the surgical technique and the intraoperative cochlear monitoring using electrocochleography.

R-095 Session S18

Intraoperative surgical findings and difficulties of pediatric cochlear implantation

Khudhair H.M.

ENT Department, Surgical Specialties Hospital, Medical City Complex, Baghdad, Iraq

Objectives: To assess the intraoperative surgical findings and difficulties of cochlear implantation in the preschooler age group and how to overcome these difficulties.

Materials and Methods: Cross-sectional study was conducted. 426 patients between 18 months to the end of 6 years old, who had severe to profound S.N.H.L. were selected after no hearing improvement occurred with wearing of hearing aids for at least 6 months. A multidisciplinary team (otolaryngologist, audiologist, radiologist, pediatrician, psychiatrist, neurologist) was selected for assessment of the patients and subject them for the candidacy of the patient for cochlear implantation, any patient not fulfilled the criteria of assessment was excluded. Unilateral cochlear implantation was done for all the patients. Data regarding the surgical findings and difficulties are designed according to the surgical steps of cochlear implantation (mastoidectomy, bone well setting, posterior tympanotomy, middle ear cavity, and cochleostomy or round window approach)

Results: The most common age group was 3–4 years. The study showed that (54%) of patients were females, while

(46%) of patients were males, female to male ratio was 1.2:1. The most frequent finding and difficulty during mastoidectomy for cochlear implantation was the presence of Koerner's septum (29.81%) while in bony well drilling, dural exposure (31.7%) was the most frequently encountered. During posterior tympanotomy, the most common finding was non-pneumatized antral threshold angle (40%). In the middle ear, eight patients (1.87%) found to have O.M.E. The most common surgical finding and difficulty during cochleostomy or round window approach was abnormal round window niche position in posteroinferior direction (9.154%). The majority of these findings and difficulties had been overcome during surgery and successful CI was done for the patients, while only a few cases were postponed

Conclusions: 1. Cochlear implantation surgery had multiple steps with a large number of difficulties, but most of these difficulties can be managed during surgery without complications. 2. Good assessment of patients by otolaryngeal examination, radiological and audiological investigations with good experience and multidisciplinary teamwork make cochlear implantation surgery with a low rate of complications.

R-096 Session S02

Intratympanic administration of PLGA-nanoparticles to the inner ear: histopathological and electrophysiological effects in a rat model

Ocak E., Mittal R., Zhu A., Perdomo M., Pena S.A., Mittal J., Eshraghi A.E.

¹ Department of Otolaryngology, Ankara University, Ankara, Turkey

² Department of Otolaryngology, University of Miami, Miami, USA

Introduction: Noninvasive and targeted drug delivery to the cochlea is a challenging issue due to anatomic inaccessibility of the inner ear and poor penetration of systemically-delivered drugs. In this manner, a method for targeted drug delivery that can be performed in an outpatient setting will provide a less invasive approach and reduce complications associated with surgical approaches.

Materials and Methods: Polylactic-co-glycolic acid (PLGA) nanoparticles were administered into the rat middle ear through intratympanic (IT) injection. The contralateral ears served as the control group. The localization of red-fluorescent conjugated nanoparticles into the inner ear was determined by subjecting paraffin embedded rat cochlea sections to immunohistochemistry after staining with DAPI to stain cell nuclei. Hearing thresholds were determined by auditory brainstem responses (ABRs) and distortion product otoacoustic emissions (DPOAEs). Cochleae were harvested at post-injection day 15 and subjected to histopathological examination to determine cochlear morphology.

Results: ABR and DPOAE measurements taken in the nanoparticle-injected and control ears revealed similar hearing thresholds at post-injection day 7 and 15. On the

confocal microscopy of cochleae injected with red fluorescent-conjugated nanoparticles and saline, a strong signal was detected in nanoparticle injected ears. The signal indicated that injected nanoparticles have been localized to inner and outer hair cells and spiral ganglion neurons. Light microscopic study of both groups demonstrated no infiltration of inflammatory cells neither in the nanoparticle injected cochleae nor in the control cochleae at post-injection day 15.

Conclusions: The results of this study suggest that IT administration of PLGA nanoparticles lead to their in vivo permeability all the way to the inner ear. PLGA nanoparticles have no significant adverse effects on auditory hair cells and hearing thresholds as determined by ABRs and histological examination. This delivery method appears to be promising for future use in clinical studies. The results of this study may lay the foundation for developing non-surgical nanoparticle-based novel treatment modalities for inner ear disorders.

R-097 Session S22

Is CT or MRI the optimal imaging investigation for the diagnosis of large vestibular aqueduct syndrome and large endolymphatic sac anomaly?

Connor S.E.I.^{1,2,4}, Dudau C.^{1,4}, Pai I.³, Gaganasiou M.⁵

¹ Neuroradiology Department, King's College Hospital, NHS Foundation Trust, London, UK

² School of Biomedical Engineering and Imaging Sciences, King's College London, London, UK

³ Department of Ear, Nose and Throat Surgery, Guy's and St Thomas' NHS Foundation Trust, London, UK

⁴ Radiology Department, Guy's and St Thomas' NHS Foundation Trust, London, UK

⁵ Radiology Department, 51 General & VA Air Force Hospital, Athens, Greece

Objectives: MRI and CT are widely and variably used for the evaluation of potential inner ear developmental anomalies in patients with audiovestibular symptoms. The most frequent macroscopic inner ear abnormality demonstrated on imaging studies is that of the large vestibular aqueduct (LVAS) as shown by CT. There remains controversy as to whether CT or MRI is more accurate for the diagnosis of this inner ear anomaly. Since MRI is now the principle imaging modality used in the evaluation of congenital or progressive sensorineural hearing loss (SNHL) and asymmetric cochlear thresholds, it is important to determine whether a CT is additionally required to increase diagnostic sensitivity for LVAS. We explored whether there was a difference between measurements obtained with CT and MRI for the diagnosis of large vestibular aqueduct syndrome or large endolymphatic sac anomaly and whether this influenced diagnosis on the basis of previously published threshold values (Valvassori and Cincinnati). We also investigated whether isolated dilated extraosseous endolymphatic sac occurred on MRI. Secondary objectives were to compare inter-observer reproducibility for the measurements and to investigate any mismatch between the diagnoses using the different criteria.

Materials and Methods: Subjects diagnosed with large vestibular aqueduct syndrome or large endolymphatic sac anomalies were prospectively identified. For subjects with both CT and MRI available ($n = 58$), two independent observers measured the midpoint and operculum widths. For subjects with MRI (+/- CT) available ($n = 84$), extraosseous sac widths were also measured.

Results: There was no significant difference ($p > 0.05$, Wilcoxon) between the midpoint ($p = 0.76$) and operculum measurements ($p = 0.82$) obtained with CT versus MRI. There was a 95% agreement between the mean midpoint measurements obtained with CT and those obtained with MRI. However, the agreement figure slightly decreased (90%) for mean operculum width measurements. CT alone diagnosed large vestibular aqueduct syndrome or large endolymphatic sac anomalies in 2/58 (Valvassori) and 4/58 (Cincinnati), whilst MRI alone diagnosed in 2/58 (Valvassori). There was a 93% CT/MRI diagnostic agreement using both criteria. Only 1/84 demonstrated isolated extraosseous endolymphatic sac dilatation. There were 8 cases in which measurements indicated a LVA/LESA diagnosis using the Cincinnati but not the Valvassori criteria. There were no cases where measurements indicated a LVA/LESA diagnosis using the Valvassori but not the Cincinnati criteria. The MRI based LVA/LESA diagnosis was less dependent on which criteria were used. Midpoint measurements are more reproducible between observers and between CT/MR imaging modalities. The inter-observer reproducibility was good to excellent for all CT/MRI based measurements, although optimal at the midpoint and with MRI based measurements. The percentage agreement for the two observers of 95/98% (CT) and 93/97% (MRI) respectively.

Conclusions: In conclusion, there is no significant difference between the CT and MRI based midpoint and operculum width measurements with a 93% agreement in terms of LVA/LESA diagnosis, however, there is potential for additional diagnoses of LVA/LESA to be made when MRI is supplemented with CT using either measurement criteria. CT does not demonstrate an overall increased diagnostic sensitivity when applying the Valvassori criteria, although those additional cases diagnosed with CT do correlate well with clinical findings. Isolated enlargement of the extra-osseous endolymphatic sac is rarely seen on MRI and hence is a largely theoretical benefit of MRI. The MRI based LVA/LESA diagnosis was less dependent on which measurement criteria were used, and it should be noted that midpoint measurements are more reproducible between observers and between CT/MR imaging modalities.

R-098 Session S20

It's cement to be – mastoid obliteration using injectable hydroxyapatite cement

Gao C., Bhargava E.K., Masood A., Qayyum A.

Department of ENT, Peterborough City Hospital, Peterborough, UK

Objectives: Report the outcomes of patients who underwent obliteration of the mastoid cavity using hydroxyapatite cement.

Materials and Methods: Type of study: retrospective case series. Patients: all patients who underwent mastoid surgery and primary obliteration or revision mastoid surgery and obliteration using injectable calcium phosphate-based paste that forms hydroxyapatite cement in vivo.

Primary outcome measure: dry, well-epithelized cavity tolerating on follow-up tolerating water entry, with no post-op infection.

Results: 16 patients had obliteration using hydroxyapatite cement during mastoid surgery with a mean follow up of 292 days. All post-op cavities were dry, well epithelized, and tolerated water entry. There was no case of extrusion/post-op infection.

Conclusions: Injectable calcium phosphate-based paste that forms hydroxyapatite cement in vivo may be a viable and safe alternative to other materials used for mastoid obliteration, with the advantages of ease of use and mouldability.

R-099 Session S06

Loading time of the sound processor after bone-anchored hearing implantation and pre- and postoperative differences: The preferences of our patients

Caspers C.J.L., Kruijt I.J., Mylanus E.A.M., Hol M.K.S.

Department of Otorhinolaryngology, Radboud University Medical Centre, Nijmegen, Netherlands

Objectives: Loading times after Bone-Anchored Hearing Implant (BAHI) surgery have gradually decreased over the past decade. Recently, loading times within one week or even the same day as surgery have been proposed.

Objectives: This study aims to assess the patient's perspective of optimal loading time after bone-anchored hearing implantation.

Methods and Materials: A prospective, randomized, comparative, patient questionnaire study was performed in a tertiary referral center. All included patients received two questionnaires before surgery: the validated *Glasgow Health Status Inventory* (GHSI) and a 'preference' questionnaire in which the patient was asked to choose their preferred time point for sound processor loading and the rationale behind it. Postoperatively, the preference questionnaire was provided at three-time points after surgery: directly postoperative, seven days and three weeks. Independent on preference, all patients in the study were loaded three weeks after surgery, which is our standard practice. The primary outcome was the preferred time point of loading before surgery. The secondary outcome was changed in preferred time point after surgery.

Results: Sixty patients were included. Preoperatively, the majority of patients (70%) preferred sound processor loading within one week after surgery, whereby 43% preferred loading directly postoperatively. Reasons to choose to load

on the same day as surgery were quick hearing rehabilitation and practical considerations. These preferences did not correlate with the total GHSI-score nor duration of hearing loss. Directly after surgery, no change in preference was observed. However, at seven days and at three weeks after surgery, significantly more patients preferred loading at a later time point. At 1 week, 50% of the patients preferred loading within 1 week and at 3 weeks only 40% of the patients.

Conclusions: Pre-operatively, a majority of patients would prefer receiving the sound processor within the week after surgery. The number of patients preferring loading within one week declined after surgery. However, postoperatively, still approximately 50% preferred earlier loading than the current standard of three weeks.

R-100 Session S09

Long-term outcomes of triple semicircular canal plugging for the treatment of intractable Meniere's disease: a single center experience of 361 cases

Zhang D., Lv Y., Han Y., Li Y., Li X., Wang J., Song Y., Kong L., Jian H., Fan Z., Wang H.

*Department of Otolaryngology-Head and Neck Surgery, Shandong Provincial ENT Hospital, Shandong Provincial ENT Hospital affiliated to Shandong University, Jinan, P.R. China
Key Laboratory of Otorhinolaryngology, National Health Commission (Shandong University), Jinan, P.R. China
Shandong Provincial Key Laboratory of Otolology, Jinan, P.R. China
Shandong Institute of Otolaryngology, Jinan, P.R. China*

Objectives: This study was aimed to explore the long-term efficacy of triple semicircular canal plugging (TSCP) in the treatment of intractable Meniere's disease (MD) so as to provide a new method in the framework of treatment with MD.

Materials and Methods: Three hundred and sixty-one unilateral MD patients, who were treated with TSCP in our hospital between Dec. 2010 and Sep. 2016, were recruited in this study for retrospective analysis. Vertigo control and auditory function were monitored during a period of two-year follow-up. Seventy-three patients who were subjected to intratympanic gentamicin were selected as a control group. Pure tone audiometry, caloric test, vestibular evoked myogenic potential (VEMP) were performed in a two-year follow-up.

Results: The total control rate of vertigo in TSCP group was 97.8% (353/361) in the two-year follow-up, with complete control rate of 80.3% (290/361) and substantial control rate of 17.5% (63/361). The rate of hearing loss was 26.3% (95/361). The total control rate of vertigo in intratympanic gentamicin group was 83.6% (61/73), with complete control rate of 63.0% (46/73) and substantial control rate of 20.5% (15/73). The rate of hearing loss was 24.7% (18/73). The vertigo control rate of TSCP was significantly higher than that of chemical labyrinthectomy ($\chi^2 = 24.798$, $p < 0.05$). There was no significant difference in hearing loss rate between two groups ($\chi^2 = 0.087$, $p > 0.05$).

Conclusions: Triple semicircular canal plugging (TSCP), which can reduce vertiginous symptoms in patients with intractable Meniere's disease (MD), represents an effective therapy for this disorder. It might become a new important method in the framework of treatment with MD.

R-101 Session S20

Malformations associated with congenital cholesteatoma of the middle ear

Denoyelle F., Distinguin L., Simon F., Couloigner V., Leboulanger N., Loundon N., Garabédian E.N.

Department of Pediatric Otolaryngology Head and Neck Surgery, Necker-Enfants Malades Hospital, APHP and Paris Descartes University, Paris, France

Objectives: The etiopathogenesis of congenital cholesteatoma (CC) remains controversial. The objective of this study was to determine in a large series if there is an association of CC with other malformations.

Methods: Retrospective study in a tertiary care center; inclusion period: between January 2007 and February 2017. Studied parameters: age, sex, side, comorbidities (malformations and other diseases), diagnostic work-up, type of surgery, CC location and ossicular chain involvement.

Results: 173 cases of primary surgery of CC of the middle ear were included. 17 CC cases (9.8%) were associated with malformations, involving in all cases the craniofacial region. The most frequently associated malformation was preauricular fistulae (8/173; 4.6%). Other malformations were: first branchial cleft cyst, nasal dermoid, labio-palatal cleft, preauricular fibrochondroma, and middle ear malformations.

Conclusions: The association between CC and other malformations is not rare suggesting that CC might be related to plurifocal developmental anomalies.

R-102 Session S22

Mammalian cochlear hair cell imaging using optical coherence tomography: Feasibility study

Choi S.-W.¹, Lee J.-W.¹, Kang J.¹, Oh S.-J.¹, Kong S.-K.¹, Kim H.², Kim M.², Choi J.²

¹ *Department of Otorhinolaryngology and Pusan National University School of Medicine, Biomedical Research Institute, Pusan National University Hospital, Busan, Republic of Korea*

² *Koh Young Technology Inc., Geumcheon-gu, Seoul, Republic of Korea*

Objectives: The purpose of this study was to determine whether OCT was capable of resolving cochlear micro-anatomy at a cellular level such as the mammalian cochlear hair cells (ex vivo).

Methods: Immediately following sacrifice, the temporal bone of a Sprague-Dawley rat was harvested. After

extracting the cochlea from temporal bone, soft tissues and cartilages of cochlea were removed and the cochlear epithelium was isolated. To confirm whether OCT is capable of identifying the hair cell, we prepared neomycin group and non-treated (control) group for comparing the arrangement of normal and defected hair cell. Stained hair cells were analyzed by fluorescence microscope and OCT. In this study, we used the multi-resolution OCT system built-in-house, which was equipped with a swept-source light source with a central wavelength of 1310 nm, a spectral bandwidth of 100 nm, and average output power of 8 mW. Postnatal day three Sprague-Dawley rats were used to test the swept-source OCT system, and the images recorded were compared with fluorescence microscope images of the intracochlear microanatomy. A total of ten Sprague-Dawley rats were divided into two experimental groups: normal and neomycin treated (control) groups.

Results: The inner and outer hair cells and auditory nerve fibers of the rat cochlea were clearly identified.

Conclusions: At present, there are no readily available imaging modalities that can provide tomographic information on cochlear microstructure without biopsy and fixation. To understand the link between inner ear pathology and auditory function, it is essential to develop a new imaging system that can explain the anatomical structure of the inner ear. OCT is an imaging modality that enables the assessment of the cochlear microanatomy with a resolution and speed that is superior to conventional CT and MRI. This study demonstrates the feasibility of using OCT imaging systems for determining cochlear microanatomy such as IHC, OHC, and auditory nerve fibers (ex vivo); however, significant progress remains to be made. Future efforts should aim to improve the resolution and penetration depth of the OCT and determine whether it is possible to generate similar imaging results in live animal subjects. Although several technical problems remain to be overcome, OCT may provide scientists and clinicians a solution for in vivo imaging of human cochlear hair cells. While further research is needed in this area, findings could be used to encourage research into the area of cochlear microstructure imaging in the future.

R-103 Session S15

Management and surgical outcomes in patients with lateral skull base Paragangliomas

Daikhes N.A., Diab K.M., Nazhmutdinov I.I., Umarov P.U., Zagorskaya D.A., Paschinina O.A.

Federal Scientific-Clinical Center of Otorhinolaryngology, Federal Medical Biological Agency of Russia, Moscow, Russia

Objectives: To analyze the long-term effectiveness of surgical treatment in patients with temporal bone paragangliomas.

Materials and Methods: During the period from December 2014 to October 2018, 73 patients with temporal bone paragangliomas aged 33 to 82 years were operated. Type A paraganglioma was detected in 27 (37%) patients who

made up the group I. The group II included 31 (42,5%) patients with type B tumors. The group III consisted of 15 (20,5%) patients who had diagnosed with type C paraganglioma. The tumor of patients with type A paraganglioma was removed through the retroauricular transmeatal approach, the tumor of patients with type B paraganglioma was removed through the transmastoid approach, the tumor of patients with type C paraganglioma was operated using infratemporal approach.

Results: As a result of using various surgical approaches with adequate visualization of anatomical structures good functional results were obtained: it was possible to maintain the cranial nerve function; the recovery of facial nerve function up to grade 3 on the House-Brackman scale was noted in all patients with type C paragangliomas. The hearing improvement was achieved in the majority of patients in groups I and II. According to MRI, there was no tumor recurrence in none of the patients in the postoperative period (maximum observation time was 36 months).

Conclusions: The use of various accesses with adequate visualization of the middle ear atomic structures for removal of temporal bone paraganglioma allows to remove the tumor completely and to prevent the intracranial spread of the tumor.

R-104 Session S20

Mastoid obliteration for problematic mastoid cavities – a learning curve and lessons learned through revision surgery

Neumann C., Hickson C., Lee C.W., Trinidad A.

East Kent University Hospitals NHS Foundation Trust, Kent, UK

Objectives: To present the results of mastoid cavity obliteration during a surgical learning curve and the technical refinements learned through revision of such cases.

Materials: A total of 62 mastoid obliterations for problematic mastoid cavities in 61 patients were performed between July 2014 and Feb 2019. All patients underwent regular follow-up in the clinic and Half-Fourier Acquisition Single-shot Turbo-spin Echo Magnetic Resonance Imaging (HASTE MRI) to check for disease recidivism (recurrent and residual cholesteatoma).

Methods: The mastoid obliteration technique used a mid-temporal flap, cartilage, and highly-porous beta-tricalcium phosphate granules, along with ossiculoplasty where possible. In patients requiring subsequent revision, an endoscopic technique was possible in 4 ears, with open technique in the remainder of 3 cases.

Results: The results for recidivism, perforation and Chronic Otitis Media Benefit Inventory (COMBI) scores are presented. Six patients (7 ears, representing 11.3%) required subsequent revisions and one patient underwent a revision for a false-positive finding on MRI scan. The revisions were undertaken for recurrent cholesteatoma (3 ears), residual cholesteatoma (1 ear) and perforation (3 ears, 2 patients). The average COMBI score was 3.88, with 3.68 for

improvement in symptom severity (highest score for improvement in ear discharge and malodorous discharge were 4.76 and 4.67 respectively); 4.03 for lifestyle, work, and health care usage impact; 3.7 for general well being.

Conclusions: The mastoid obliteration technique presented is a reliable technique and achieves good results even with the surgical learning curve accounted for. It is desirable that failures are revised by the same surgeon as this allows for an invaluable learning experience and leads to personal technique refinement. Tips and tricks to minimize recidivism and surgical failure are discussed.

R-105 Session S03

Meatotympanoplasty for external auditory canal stenosis and Lateralized tympanic membrane

Kina K.¹, Mari D.², Miyako H.¹, Hisashi S.¹, Makoto I.³

¹ ENT, Kanazawa Medical University, Kanazawa Ishikawa, Japan,

² ENT, Jichi Medical University, Shimotsuke Tochigi, Japan

³ ENT, Jichi Children's Medical Center Tochigi, Shimotsuke Tochigi, Japan

Objectives: The aim of the present study is to evaluate the postoperative hearing level and the outcomes of 10 cases with external auditory canal stenosis (EACS) and/or lateralized tympanic membrane (LTM) who underwent meatotympanoplasty.

Materials and Methods: This study is a retrospective case series of patients with EACS and/or LTM having undergone meatotympanoplasty from 2008 to 2018. We perform meatotympanoplasty with the concepts of the following points. 1) Making a large EAC and a functional wide TM. 2) In order to prevent postoperative cavity problem, we don't perform a canal wall down mastoidectomy.

Results: We have experienced 10 cases. The mean age at surgery was 31.6 years. We have treated 2 cases as tympanoplasty type 1, 8 cases as tympanoplasty type 3c. The average of preoperative and postoperative air-bone gaps (ABG) is 40.4 dB and 23.0 dB respectively. Postoperative ABG less than 30dB achieved in 80% (8/10) of the patients. There were 4 cases with postoperative complications (re-stenosis of the EAC and/or re-lateralization of the TM). We performed a second surgery in two cases, and they show good progress until today.

Conclusions: These results indicate that our surgical method is one of the useful techniques for EACS and LTM. However, we need further consideration on how to prevent re-lateralization of the tympanic membrane after surgery.

R-106 Session S05

Microglial activation in the cochlear nucleus after early hearing loss in rats

Noda M.¹, Miyako H.¹, Hisashi S.¹, Makoto I.², Tomokazu Y.¹

¹ Kanazawa University Hospital Otolaryngology-Head and Neck Surgery, Kanazawa, Japan

² Jichi Children's Medical Center Tochigi, Tochigi, Japan

Objectives: Microglia are highly specialized tissue macrophages in the central nervous system. Their activation in the auditory system has been reported in adult hearing loss models, but their status in the developing auditory system is less understood. Therefore, we investigated microglial status in the cochlear nucleus (CN) during normal developing periods and after exposing rats to amikacin, a potent ototoxin, around the time of hearing onset.

Methods: To develop the deafness model, rats were administered with a daily intraperitoneal injection of amikacin (500 mg/kg) from postnatal day 7 (P7) to P15. To evaluate the expression of ionized calcium binding adaptor molecule 1 (Iba1), we performed immunohistochemical analysis using rat brains from P10–60. To compare the expression of microglia-related gene, reverse transcription quantitative polymerase chain reaction (RT-qPCR) analysis were performed.

Results: Immunohistochemical analysis revealed that, under normal conditions, microglia had relatively large cell bodies with several extended processes that surrounded other cells at P10, while the sizes and number of these cells gradually decreased afterward. In contrast, when amikacin was administered from P7 to P15, microglia maintained large cell bodies with relatively shorter processes at both P15 and P21. Furthermore, RT-qPCR analysis revealed upregulation of genes including phagocytotic and anti-inflammatory markers after amikacin administration.

Conclusions: These results suggest that microglia are activated in the CN, and they may contribute to tissue remodeling after an early hearing loss in the developing auditory system.

R-108 Session Panel: Otolology in Taiwan

Minimally traumatic stapes surgery for otosclerosis

Shiao A.-S.

Cheng Hsin General Hospital, Taipei, Taiwan

Otosclerosis is a progressive degenerative disease of the otic capsule, the incidences are high in Caucasians, but low in Blacks, Asians, and Native Americans. Even the hearing problem may be helped by hearing aid or cochlear implantation, stapedotomy with piston insertion is still the main treatment modality for Otosclerosis. The learning curve is longer for Otolologist in Taiwan due to the low incidence, and the complications include persistent vertigo or severe

hearing loss, which happens about in 1% of surgical patients. How to minimize the operative procedure which may damage the inner ear is the key point to get the better postoperative hearing outcome and decrease the complication rate. In the past 20 years, the author tries to refine the stapes surgery, called “Minimally Traumatic Stapes Surgery”, surgical technique and postoperative hearing results will be discussed.

R-109 Session S11

Mobile applications in teleaudiology – possibilities of application and their effectiveness

Kutyba J., Gos E., Skarżyński P.H.

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

³ Institute of Sensory Organs, Kajetany/Warsaw, Poland

Introduction: Due to the growing interest in new technologies, mobile application developers have created a number of tools that may be potentially useful in clinical practice as well. More and more applications are being introduced in the field of audiology, used for example in the assessment of hearing or helpful in reducing the severity of tinnitus. Are these new tools for telemedicine? What can be their uses? What is its effectiveness? These and many other questions are born as their popularity increases. In order to be able to answer at least some of them, the team from the Institute of Physiology and Pathology of Hearing decided to test a few selected tools.

Objectives: The aim of the study is to present the possibilities and efficiency of selected mobile phone applications that can be used in audiology.

Materials and Methods: Applications that can be installed on mobile phones with the Android system were selected for testing. The first one allows you to independently perform a hearing screening test, while the second one is designed to support patients in tinnitus therapy. Applications were evaluated in terms of effectiveness, usability, ease of use and satisfaction with use. Application ratings based on surveys and questionnaires.

Results: The exact results obtained from the tools will be presented during the conference

Conclusions: Phone applications are a relatively new invention that people of all ages enjoy. The possibility of their application in everyday medical practice is a relatively new field of research in the field of audiology. Current data suggest their effectiveness in different hearing-related domains. In order for created tools to fulfill their functions, one of the tasks of telemedicine should be to oversee emerging applications, determine their effectiveness and cooperate with specialists in a given field in the process of creating new tools.

R-110 Session S21

MRI evaluation of endolymphatic hydrops: significance for stapes surgery

Sone M., Kobayashi M., Yoshida T.

Department of Otorhinolaryngology, Nagoya University Graduate School of Medicine, Nagoya, Japan

Objectives: Visualization of endolymphatic hydrops (EH) has become possible using 3-T magnetic resonance imaging (MRI) after intratympanic or intravenous injection of gadolinium. We have investigated the presence of EH among patients with clinical symptoms related to Meniere's disease and other otological disorders. EH could be found among candidates for middle ear surgery, including stapes surgery. Preoperative EH could represent a risk factor for inner ear disturbances following surgery. We have investigated the presence of EH on MRI in ears with clinical otosclerosis and evaluated the efficacy of such MRI evaluations for the management of stapes surgery. Clinical features of ears with otosclerosis and EH are important to identify predictors of EH in ears that are candidates for stapes surgery, to avoid possible complications following the procedure.

Materials and Methods: Subjects diagnosed with otosclerosis who agreed to MRI examination were retrospectively recruited to this 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, or significant). Hearing levels and the extent of otosclerotic lesions graded based on computed tomography (CT) were compared among groups.

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 the successful improvement of hearing levels, but a case with severe EH in the vestibule showed postoperative nystagmus and a long period of dizziness. Average thresholds in ears with significant EH were significantly higher at several frequencies, for both air and bone conduction than in ears with no or mild EH. Significant EH was more frequently observed in ears showing advanced stages on CT than in those without advanced stages.

Conclusions: The presence of EH in the vestibule on MRI might represent a high-risk factor in ears that are candidates for stapes surgery. EH was frequently present in ears with otosclerosis, especially those with severe hearing loss or advanced disease on CT.

R-111 Session S06

Multimodal analysis of the tissue response to a bone-anchored hearing implant

Calon T.G.A.¹, Johansson M.L.^{2,3}, Omar O.²,
Shah F.A.², Budding D.^{4,5}, Trobos M.²,
Thomsen P.², Stokroos R.J.⁶, Palmquist A.²

¹ Department of Otorhinolaryngology, Head and Neck Surgery, Maastricht University Medical Center, Maastricht, Netherlands

² Department of Biomaterials, Institute of Clinical Sciences, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

³ Oticon Medical AB, Askim, Sweden

⁴ Department of Medical Microbiology & Infection Control, VU University Medical Center, Amsterdam, Netherlands

⁵ IS-Diagnostics Ltd., Amsterdam, Netherlands

⁶ Department of Otorhinolaryngology, Head and Neck Surgery, University Medical Center Utrecht, Utrecht, Netherlands

Introduction: Treatment of mixed and conductive hearing loss with the bone-anchored hearing system (BAHS) is generally successful with good clinical outcomes. However, the mechanisms leading to complications, such as inflammation, infection, pain and implant loss, are poorly understood. Elective implant removal is rare, and only a few cases are found in the literature where a detailed analysis of the retrieved implant and surrounding tissue have been carried out. We report the case of a 39-year-old woman that previously received a BAHS presented with recurrent episodes of adverse soft tissue reactions accompanied by pain. Due to persistent pain complaints without macroscopic signs of inflammation, the patient requested implant removal. The abutment was removed 14 months post-surgery.

Objectives: The aim of this study was to provide a detailed characterization of various tissue compartments, which would offer unique evidence for the patient's pain complaints related to BAHS.

Materials and Methods: This patient was enrolled in a prospective clinical trial. Clinical characteristics, bacterial swabs, and soft tissue biopsies were collected at baseline, 12-week follow-up, during episodes of soft tissue complications and at the time of implant removal. The implant was finally retrieved en bloc with the surrounding bone. The swabs were evaluated using a bacterial profiling technique which detects bacterial DNA (IS-pro™). The relative expression of genes related to inflammation (IL-1 β , IL-6, TNF- α , TGF- β , MIP-1 α), tissue metabolism (TIMP-1, COL1 α 1), vascularization (VEGF, FGF-2), and bacterial infection (TLR-2) was determined in the soft tissue biopsies using qPCR. After resin embedding, the peri-implant bone was subjected to analyses using X-ray micro-computed tomography (micro-CT), qualitative histology and quantitative histomorphometry, Backscattered electron scanning electron microscopy (BSE-SEM) and Raman spectroscopy. The soft tissue biopsy obtained at implant removal was embedded in paraffin for identification and localization of *Staphylococcus aureus* and coagulase-negative staphylococci (CoNS) using fluorescence in situ hybridization (FISH).

Results: Histological evaluation showed an implant well-integrated in dense, mature, bone with a high degree of bone-to-implant contact (58%) and the bone area within the threads (82%). These results were confirmed by micro-CT, BSE-SEM and Raman imaging. The top region adjacent to the implant flange revealed a considerable amount of inflammatory infiltrate, containing mainly chronic inflammatory cells suggesting a bacterial presence at the peri-implant bone. The molecular analysis by IS-pro™ revealed polymicrobial colonization including *S. aureus* and *S. epidermidis*. The localization of *S. aureus* and CoNS in the soft tissue biopsy was confirmed by FISH. During inflammation, IL-1 β , IL-6, TNF- α , MIP-1 α , FGF-2, and TLR-2 expression were all strongly up-regulated compared with the 12-weeks expression profile. TGF- β expression only moderately increased during inflammation. In contrast, TIMP-1, COL1 α 1, and VEGF expression decreased during inflammation compared with the 12 weeks expression.

Conclusions: Here we present an elaborate case report of a patient reporting chronic pain that persisted after abutment removal with a stable implant using a multimodal analysis approach. Our analyses suggest that chronic pain related to the BAHS can result from a chronic bacterial infection with observed intra-cellular bacteria, even without macroscopical signs of infection.

R-112 Session S05

Myringoplasty with double medial-lateral graft: technique and results

Harguindey A.-C., Olarieta F.J., Antoli-Candela F.

Institute of Otolaryngology and Head and Neck Surgery of Madrid, Spain

A surgical technique for a myringoplasty with medial-lateral double graft, with autologous temporal fascia graft, with its indications and anatomic and functional results, are described. 100 cases of myringoplasty performed with this technique are studied, the types of tympanic perforations in which it is performed, the particularities by which this technique is selected and how it is performed. The selection of the patient, of the approach (endaural or retroauricular), the surgical act of resection of the epithelial remains and plaques of miringoesclerosis, the placement of the grafts, and the measures to avoid lateralizations of the neo-eardrum. Anatomic and functional results one-year post surgery are analyzed. An anatomic closure of the perforation is achieved in 95%. We found a statistical difference in the results in children over 10 years. The percentage of closing of the children under 10th, of the 12.5% of the persistence of perforation is lower compared to 2.5% in those over 10 years. As complications, 4% of epithelial pearls, 1% of retractions, and 3% of thickening due to *epithelitis* that yielded with topical treatment. Functionally there is a closure of the UDA below 20dB in 85%, with 38% less than 10 dB. Other intraoperative findings that justify these results are analyzed. It is concluded that auditory anatomic and functional results are better than other surgical techniques in the selected cases, and allow a functional exploration of tympanic box aeration by tympanogram.

R-113 Session S05

Myringoplasty with the patients with eosinophilic otitis mediaYoshihiko E.¹, Yukiko I.², Naohiro Y.¹¹ Jichi Medical University Saitama Medical Center, Saitama, Japan² Tokyo-Kita Medical Center, Tokyo, Japan

Introduction: Eosinophilic otitis media (EOM) is an intractable otitis media characterized by a highly viscous effusion containing eosinophils. The viscous effusion occasionally fluid-filled the middle ear cavity and tympanic perforation occurred. Despite steroids being given systematically and by intratympanic injection to treat this disorder, in some cases bacterial infection complicated and progressive hearing loss occurred. Nevertheless, a retrospective study involving multiple institutions revealed many failures associated with tympanoplasty.

Objectives: The purpose of the study was to clarify myringoplasty will lead not only hearing improvement but also clinically well control.

Methods: 12 patients with 16 EOM ears were performed myringoplasty in this study. We analyzed hearing results, operation successful rate, re-perforation, and bacterial infection after the operation, and compared with patients with chronic otitis media with perforation, who were performed myringoplasty in our facility. Patients were clinically evaluated every 3 weeks or 6 weeks and clinical control was evaluated using “severity scores of EOM”. The degree of “severity scores of EOM” was evaluated according to five items: (1) quantity of MEE or otorrhea; (2) condition of the middle ear mucosa; (3) frequency of intratympanic injection of steroids; (4) frequency of administration of systemic corticosteroids; and (5) frequency of administration of antibiotics. These items were scored from 0 to 2. Three of the items (1, 2, and 3) were evaluated separately for each ear and two of the items (3 and 5) in each participant.

Results: Speech range air conduction showed statistical improvement change (dB, mean \pm SD: 41.5 dB \pm 12.3 dB to 34.6 \pm 9.22, $P < 0.001$). Operation successful rate (81.3%), re-perforation (12.5%), and bacterial infection after the operation (12.5%) was equivalent to the results of patients who had an operation with chronic otitis media. Average “severity scores of EOM” patients decreased from 2.79 to 1.42 after seven to nine months after the operation, though control EOM patients treated with steroids but without operation had stable scores (3.47–3.06, $P = 0.0713$).

Conclusions: Myringoplasty is useful for EOM. We consider repairing the tympanic membrane prevents bacterial infection and clinical good control of EOM lead hearing preservation.

R-114 Session S20

Nationwide survey of middle ear cholesteatoma using staging and classification criteria proposed by the Japan Otological SocietyYamamoto Y.¹, Tono T.², Matsuda K.², Komori M.¹, Morita Y.³, Hato N.⁴, Sakagami M.⁵, Kojima H.¹, Takahashi H.⁶¹ Department of Otolaryngology, Jikei University School of Medicine, Tokyo, Japan² Department of Otolaryngology, Faculty of Medicine, University of Miyazaki, Miyazaki, Japan³ Department of Otolaryngology, Faculty of Medicine, Niigata University, Niigata, Japan⁴ Department of Otolaryngology, Ehime University School of Medicine, Ehime, Japan⁵ Department of Otolaryngology, Hyogo College of Medicine, Kobe, Japan⁶ Department of Otolaryngology Head and Neck Surgery, Nagasaki University, Nagasaki, Japan

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 clinical practice. After the initial proposal of the principal staging system in 2008, the JOS staging system for middle ear cholesteatoma has been developed over the past 7 years through a consensus-based process. In 2015, we proposed the latest version of the staging system for four main types of cholesteatoma; retraction pocket type (*pars flaccida* type, *pars tensa* type, and combination type), non retraction pocket type (secondary to a *chronic tensa* perforation type, transplanted cholesteatoma type), congenital type, and unclassifiable type. 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. From 74 hospitals, 1791 cases have been registered. Following shows the results of cholesteatoma classification; *pars flaccida* cholesteatoma were 1133 cases (63.3%), *pars tensa* cholesteatoma were 233 cases (13.0%), cholesteatoma secondary to a *chronic tensa* perforation were 100 cases (5.6%), congenital cholesteatoma were 234 cases (13.1%), and unclassifiable cholesteatoma were 91 cases (5.1%). Postoperative survey on those cases was carried out in 2017. The available data was 1456 cases from 49 hospitals. Rediviation rate, hearing results were evaluated with respect to each classification and stage. Total rediviation rate including residual and recurrence was 7.1 %. The rediviation rate increased with increased stage of the cholesteatoma. Hearing result was evaluated based on the criteria of successful ear by JOS. Rate of the successful ear was 61.9% in total. The successful rate decreased with increased stage of the cholesteatoma. The JOS staging system was very useful for standardizing the reporting of middle ear cholesteatoma and for adjusting for severity in evaluating outcomes. In 2016, the JOS and European Academy of Otolaryngology & Neuro-Otology (EAONO) published Joint Consensus Statements on the Definitions, Classification, and Staging of Middle Ear Cholesteatoma, which is very similar to the JOS 2016

system. These classifications may be broadly implemented to discuss etiological differences, pathogenesis, and surgical outcomes in cholesteatoma.

R-115 Session S15

Necrotising otitis externa: a new management paradigm

Trinidad A., Wahid N., Meghji S.

Department of Otolaryngology, Southend University Hospital NHS Trust, Southend-on-Sea, UK

Introduction: Necrotising otitis externa (NOE) is a locally aggressive infection of the external auditory canal, involving soft tissue and bone. It is most commonly seen in the elderly, diabetic and immunocompromised patients. Treatment often requires six or more weeks of culture-directed antibiotic therapy. Whilst a peripherally inserted central catheter (PICC) line and community-directed antibiotic therapy would be ideal, most patients remain in the hospital for the duration of treatment. This incurs additional costs due to an extended acute hospital stay and increases the risk of nosocomial infections.

Objectives: To assess the factors that contribute to the extended length of hospital stay and its financial implication in the treatment of NOE.

Materials and Methods: A retrospective review and service evaluation were conducted of ten patients admitted in 2017 to a hospital in the UK. Data collection included patient characteristics, clinical features, investigations, antibiotic choice, waiting time for computed tomography (CT) scan and PICC line and duration of hospital stay. The cost of each hospital episode was obtained from the hospital finance department.

Results: Of the ten patients, 8 were male and 2 were female. The mean age was 79 years with an age range of 65–87 years old. Diabetes mellitus was present in 90%. *Pseudomonas aeruginosa* was grown in 50% of patients; 60% were treated with monotherapy and 40% had combination antibiotic therapy. The mean time from admission to CT request was 2.2 days. The average waiting time of PICC insertion from request date was 9.3 days and time to discharge was 13 days. The average length of stay was 32.5 days with the mean hospital admission cost of £1499 per day. This resulted in an average net loss of £1264 per day. The Hospital-at-Home service was initiated as a cost-effective approach to reduce unnecessary prolonged acute hospital stay. It allows delivery of intravenous antibiotic treatment without the cost of inpatient stay. The financial cost was calculated for the Hospital-at-Home service with an average cost of £1145 per day with a cost-saving of £1354 per patient per day.

Conclusions: The service evaluation highlights the exorbitant cost of inpatient antibiotic therapy in NOE. Financially, hospitals would benefit from introducing our Hospital-at-Home, resulting in improved patient-centered care.

R-116 Session Panel: Otolaryngology in Taiwan

Noise reduction based on fully convolutional network to enhance speech intelligibility for hearing aid users

Tsao Y.

Associate Research Fellow, Academia Sinica, Research Center for Information Technology Innovation, Taiwan

Noise reduction is a crucial unit in hearing aid (HA) devices. Traditional noise reduction approaches cannot effectively suppress noise components and thus may provide speech signals with unsatisfactory intelligibility. With the recent advances of deep learning (DL), numerous DL-based noise reduction methods have been proposed and confirmed to yield revolutionary performance over conventional counterparts. Recently, we have proposed a novel DL-based noise reduction approach, which combines the advanced fully convolutional network (FCN) model with a human-perception-based objective function – the proposed approach is termed FCN(P). Experimental results have confirmed the effectiveness of FCN(P) of improving speech intelligibility on normal hearing individuals. In this study, we present the evaluation results of applying the FCN(P) approach on subjective listening tests conducted by HA users. Experimental results demonstrate that the FCN(P) approach yields notable higher recognition results as compared to another DL-based and several conventional noise reduction approaches.

R-117 Session S04

Novel variants in known genes – results of genetic testing in families with autosomal dominant hearing loss

Olidak M.¹, Oziębło D.^{1,2}, Leja M.^{1,2}, Sarosiak A.^{1,2}, Skarżyński H.³

¹ *Department of Genetics, Institute of Physiology and Pathology of Hearing, Warsaw, Poland*

² *Postgraduate School of Molecular Medicine, Medical University of Warsaw, Warsaw, Poland*

³ *Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland*

Introduction: Hearing loss (HL) is the most common disability of human senses and genetic factors play an important role in its development. Autosomal dominant HL (ADHL) is usually characterized by postlingual age of onset and progression. To date, 63 loci with 45 different genes were causally involved in the pathogenesis of ADHL.

Materials and Methods: Multigenerational families with ADHL were recruited in the study ($n = 19$). Genomic DNA was isolated from whole blood and buccal swabs samples. In probands' DNA samples a multigene high throughput sequencing was performed. Family segregation analysis of the identified variants was conducted using Sanger sequencing. All detected variants were analyzed in the context of population databases and literature. Pathogenicity of identified variants was predicted by different computational approaches.

Results: Genetic testing revealed probably pathogenic variants in almost 63% (12/19) of the analyzed families. The majority of identified variants were novel, previously not reported and hitherto not linked to the disease (7/12). Novel variants were missense changes and all of them (except for two genetic changes located in MYO6) were found in different genes.

Conclusions: Our study revealed a high involvement of novel probably pathogenic variants in the development of ADHL and confirmed a high heterogeneity of the identified genetic changes. High throughput sequencing in HL patients generates a large amount of data that should be interpreted carefully and confirmed by family studies. There is also a need for functional validation of the detected novel variants.

Supported by: NCN Research Grant no. 2016/22/E/NZ5/00470 SONATA BIS6.

R-118 Session S06

On optimizing directional hearing with bilateral bone-conduction devices

Caspers C.J.I.¹, Janssen A.M.¹,
Agterberg M.J.H.^{1,2}, Hol M.K.S.¹, Bosman A.J.¹

¹ Department of Otorhinolaryngology, Radboud University Medical Center, Nijmegen, Netherlands

² Department of Biophysics, Donders Institute for Brain, Cognition and Behavior, Radboud University Nijmegen, Netherlands

Objectives: The aim of this study was to investigate and to optimize sound localization in patients with a bilateral mixed or conductive hearing loss fitted with two Bone Conduction Devices (BCDs).

Methods: Fifteen adults with two BCDs were included in this study, and fourteen patients completed all visits. A baseline visit was scheduled with follow-up visits at 1 and 3 months. Outcome measures were sound localization performance, device use and scores on the *Speech, Spatial and Qualities of Hearing Scale* (SSQ) and the *York questionnaire*. At the first visit, baseline measures consisted of unaided and aided pure-tone thresholds, speech perception in quiet and in noise, SSQ, and *York questionnaires*, device use, and sound localization with one or two BCDs. At the end of the first visit, a second listening program was added to both BCDs with optimal settings for localizing sounds and patients were instructed to use this program as often as possible. At the second visit, sound localization, speech perception in noise and device use were evaluated again. Then a short localization training was given by presenting a series of sounds with visual feedback together with instructions on how to utilize localization cues in daily life. At the third visit, the combined effects of device settings and training were evaluated again by sound localization performance, device use and also SSQ and *York questionnaires*.

Results: At baseline, all patients were either satisfied (33%) or very satisfied (67%) and used their devices on a daily basis. Sound localization performance improved significantly

when listening with two devices instead of one. Remarkably, there was a large variation in localization performance among patients in the bilaterally aided condition. Six patients were able to localize sounds, whereby two patients showed near-normal localization performance. Six other patients were only able to lateralize sounds and three patients were bad performers who had difficulty in lateralizing sounds correctly. After optimizing device settings, device satisfaction increased significantly, whereas device use remained stable. At the third visit, scores on the SSQ domains spatial hearing and quality of hearing were significantly higher than at baseline. Scores on the *York questionnaire* were not significantly different at the first and third visit. There were no significant effects of the extra listening program and the short training session on sound localization performance.

Conclusions: This study shows large variability in sound localization abilities in patients with bilateral bone conduction devices with two patients even exhibiting near-normal sound localization performance. A listening program tailored for localizing sounds and a short training session did indeed improve device satisfaction and scores on the SSQ questionnaire but did not improve sound localization performance.

R-119 Session S17

Outcomes of the Oticon Neuro Zti EVO electrode insertion: radiological perspectives

Hill E., Pai I., Connor S.

Hearing Implant Center, Guys and St Thomas Trust, London, UK

Objectives: We review the radiological outcomes following insertion of 'Oticon' cochlear implants in 9 patients.

Methods: Nine patients underwent unilateral implantation with the Oticon Zti EVO at St Thomas Hearing Center between February 2018 and May 2019. Cone beam computerized tomography was routinely performed on all patients in the post-operative period. Depth of insertion and the rate of implant translocation was assessed by a specialist radiology consultant.

Results: The mean depth of angular insertion degrees was 443 degrees (median 450 degrees and range 390–480 degrees). Eight of nine implants remained in the scala tympani throughout, while one implant had an indeterminate position in the cochlear lumen. No implants were seen to clearly translocate from the *scala tympani* to *vestibuli*. Full insertion was achieved in eight of nine cases with one extra-cochlear electrode in one case. Five patients had a measurable hearing at time of implantation, surgery was performed using a hearing preservation approach, complete hearing preservation was achieved in one case, partial hearing preservation was achieved in three cases and no hearing preservation was achieved in one case.

Conclusions: Oticon implants achieve a relatively consistent depth of insertion and have an excellent rate of *scala tympani* retention.

R-120 Session S04

Overinterpretation of high throughput sequencing data in medical genetics: first evidence against TMPRSS3/GJB2 digenic inheritance of hearing loss

Olđak M.¹, Lechowicz U.¹, Pollak A.¹,
Oziębło D.^{1,2}, Skarżyński H.³

¹ Department of Genetics, Institute of Physiology and Pathology of Hearing, Kajetany/ Warsaw, Poland

² Postgraduate School of Molecular Medicine, Medical University of Warsaw, Warsaw, Poland

³ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Hearing loss (HL) is the most common disability of human senses characterized by a great allelic heterogeneity. GJB2 and TMPRSS3 are two well-known HL genes typically underlying its monogenic form. Recently, GJB2/TMPRSS3 digenic inheritance has been proposed. As results of genetic testing can be easily overinterpreted, we aimed to verify the hypothesis.

Materials and Methods: From a genetic database of HL patients with at least one TMPRSS3 pathogenic variants we have selected individuals with additional GJB2 pathogenic variants. All of the available family members were recruited for the study. Segregation analysis of the respective TMPRSS3 and GJB2 pathogenic variants was performed within the families.

Results: The strategy has allowed identifying four individuals who were double heterozygous for known pathogenic TMPRSS3 and GJB2 variants. Two individuals from different families had GJB2 c.35delG and TMPRSS3 c.208delC and in two other individuals from one family GJB2 c.35delG together with TMPRSS3 c.1343T>C variants were found. None of these subjects has ever reported hearing problems and their hearing status was normal.

Conclusions: Our data provide evidence against TMPRSS3/GJB2 digenic inheritance of HL. As high throughput sequencing is increasingly used for genetic testing, particular caution should be taken to provide the patients with accurate genetic counseling.

This study was supported by the Polish National Science Centre grant no. 2012/05/N/NZ5/02629.

R-121 Session S13

Patients life quality after cochlear implantation

Klimczak-Gołąb L., Przytula-Kandzia K.,
Markowski J.

ENT Department, School of Medicine, Medical University of Silesia, Katowice, Poland

Objectives: Cochlear implantation (CI) is a standard treatment method in case of severe to profound hearing loss in adults. Our goal was to find, how the implantation influenced the life of our patients.

Materials and Methods: We have 73 adult patients with CI (Cochlear Ltd.) in our database. Each patient was implanted with one of the following implants: CI24R (CA), CI24R (ST), CI24RE (CA), CI24M, CI512 or CI522. We sent to all the patients from our database a questionnaire prepared by ourselves, to assess their activity and quality of life after the surgery. The questionnaire contains questions concerning e.g.: demographic data, professional activity, social contacts, rehabilitation aspects, and self-perception. The questionnaire was divided into two parts: the first one containing closed-ended questions, and the second one containing an open-ended question, in which patients were asked about their personal feelings, opinions, and changes in their life after cochlear implantation.

Results: General information: Among 73 questionnaires, we have received back 21 – 15 females and 6 males patients responded. The average age was 60.5 (min 27, max 81). Patients are CI users from average of 6.1 years (min 1.5 months, max 15 years). 65% of patients use their sound processor more than 12 hours per day. 23% of patients use Nucleus Freedom processor, 11% use Nucleus 5, 55% of patients are the users of Nucleus 6 processor and 11% use Nucleus 7. Among all patients who responded to our questionnaire, only 10% use any of accessories (5% are the users of MiniMic, and 5% use PhoneClip). Patients activities: Results show the differences between patients' activities before and after cochlear implantation. 71% of patients emphasized, that the contact with their family members is better after cochlear implantation in comparison to the situation before the surgery. 76% of recipients declare that after cochlear implantation they have better speech understanding and better contact with other people. 72% of implanted patients indicates that their self-confidence is higher after receiving the implant.

Conclusions: Cochlear implantation helps patients to increase their life quality and is strongly recommended by recipients as a good solution in case of profound hearing loss or deafness.

R-122 Session S10**Patterns of failure with different manufacturers implants: a 35-year retrospective**

Lavy J.A.

Royal National Throat, Nose and Ear Hospital, London, UK

Objectives: To look at the different patterns whereby cochlear implants fail, how this differs between different devices **Materials:** The database of implanted patients dating back to the start of our implant programme in 1983.

Methods: Analysis of database including patient-reported symptoms and objective measurements.

Results: The failure rate in over 2200 implants is in the region of 5.5%. Failures can be divided into early and late with differing patterns of failure.

Conclusions: A device-specific pattern of symptoms can alert the clinician early to potential hardware failure.

R-123 Session S01**Phase I trial of caudate deep brain stimulation for treatment-resistant tinnitus**

Cheung S.W.^{1,2}, Racine C.A.³, Henderson-Sabes J.¹, Demopoulos C.^{4,5}, Molinaro A.M.³, Heath S.², Nagarajan S.S.^{1,5}, Bourne A.L.⁶, Rietcheck J.E.⁶, Wang S.S.⁷, Larson, P.S.^{2,3}

¹ Department of Otolaryngology-Head and Neck Surgery, UCSF, San Francisco, USA

² Surgical Services, Veterans Affairs Health Care System, San Francisco, USA

³ Department of Neurological Surgery, UCSF, San Francisco, USA

⁴ Department of Psychiatry, UCSF, San Francisco, USA

⁵ Department of Department of Radiology and Biomedical Imaging, UCSF, San Francisco, USA

⁶ Audiology and Speech Pathology Service, Veterans Affairs Health Care System, San Francisco, USA

⁷ Department of Neurology, UCSF, San Francisco, USA

Objectives: The object of this open-label, nonrandomized trial was to evaluate the efficacy and safety of bilateral caudate nucleus deep brain stimulation (DBS) for treatment-resistant tinnitus.

Methods: Six participants underwent DBS implantation. One participant was removed from the study for suicidality unrelated to brain stimulation. Participants underwent a stimulation optimization period that ranged from 5 to 13 months, during which the most promising stimulation parameters for tinnitus reduction for each individual were determined. These individual optimal stimulation parameters were then used during the 24 weeks of continuous caudate stimulation to reach the endpoint. The primary outcome for efficacy was the Tinnitus Functional Index (TFI) and executive function safety was a composite z-score from

multiple neuropsychological tests (EF-score). The secondary outcome for efficacy was the Tinnitus Handicap Inventory (THI), neuropsychiatric safety was the *Frontal Systems Behavior Scale* (FrSBe), and hearing safety was pure tone audiometry at 0.5, 1, 2, 3, 4, and 6 kHz and word recognition score (WRS). Other monitored outcomes included surgical and device adverse events. Five participants provided full analyzable data sets. Primary and secondary outcomes were based on differences in measurements between baseline and endpoint.

Results: The treatment effect size of caudate DBS for tinnitus by TFI mean $SE = 23.3$ (12.4) and $THI = 30.8$ (10.4), both were statistically significant (Wilcoxon Signed Rank Test, one-tailed, $\alpha = 0.05$). Based on clinically significant treatment response categorical analysis, there were 3 responders by TFI (≥ 13 point decrease) and 4 responders by THI (≥ 20 point decrease). Safety outcomes by EF-score, FrSBe, audiometric thresholds and WRS showed no significant change with chronic caudate stimulation. Surgical and device adverse events were expected, transient, and reversible. There was only one serious adverse event, a suicide attempt unrelated to caudate neuromodulation in a participant who was off stimulation for 2 months prior to the event.

Conclusions: Bilateral caudate nucleus neuromodulation by DBS for severe, refractory tinnitus in this phase I trial showed very encouraging results. Primary and secondary outcomes revealed a highly variable treatment effect size and 60–80% treatment response rate for the clinically significant benefit, and no safety concerns. The design of a phase II trial may benefit from targeting refinement for final DBS lead placement to decrease stimulation optimization period duration and to increase treatment effect size uniformity.

R-124 Session S20**Postauricular abscesses resulting from cholesteatoma associated with congenital aural stenosis: the pathophysiology and treatment**Fu Y., Li C., Xie Y., Zhu Y., Zhang T.

Facial plastic and reconstructive surgery, Eye & ENT Hospital of Fudan University, Shanghai, China

Objectives: Acquired ear canal cholesteatoma may sometimes occur in patients with congenital aural stenosis. Infection of the cholesteatoma could result in a recurrent postauricular abscess, which is really a challenge. Therefore, a clinical study was performed to investigate the pathophysiology and address the appropriate strategy of the problem.

Materials and Methods: A retrospective study was performed to include a total of 300 patients with congenital aural stenosis who underwent canalplasty from 2008 to 2015 in our hospital. Among the 300 cases, ear canal cholesteatoma was observed in 132 cases. The cases of postauricular abscesses resulting from cholesteatoma were explored. The medical history, high-resolution computed tomography (HRCT) of the temporal bone and surgical videos of

the patients were analyzed. Three-dimensional reconstruction was calculated to analyse the pathophysiology of the abscess and its relationship with the cholesteatoma.

Results: A total of 31 patients who once suffered from postauricular abscess were collected. Regarding the medical histories, 20 cases had abscess incision for one time, and the infection was controlled after repeated dressing. Six cases had abscess incision for two or three times. The remaining 5 cases suffered from a continuous infection in postauricular areas lasting from 4 months to 4 years. The average time between the last incision and canalplasty was 5.5 ± 4.1 months. All of the 31 patients were proved to have ear canal cholesteatoma and broken of the inferior wall of the ear canal in surgical videos. And 3D reconstruction of HRCT also showed broken of the inferior part of the tympanic bone. All patients were followed up for 1–2 years after canalplasty. The implanted skin survived, and no restenosis occurred.

Conclusions: Postauricular abscess, which is recognized as one of the complications of congenital aural stenosis and canal cholesteatoma, is formed because the inferior wall of ear canal is easily destroyed by cholesteatoma and then the infection spreads backward and downwards. The principle to address this challenge was to perform abscess incision and drainage. After a period of dressing, canalplasty was performed a second time after the infection was completely or relatively controlled.

R-125 Session S08

Postauricular periosteal – pericranial flap for mastoid obliteration

Monobe H., Nakanishi W., Uchiyama M., Kawawaki W.

Department of Otolaryngology, Japanese Red Cross Medical Center

Objectives: In the current study, we describe an effective technique for mastoid cavity obliteration in canal wall down (CWD) tympanomastoidectomy and review its efficacy in producing a dry, low-maintenance, small mastoid cavity.

Materials: Our study examined the outcomes of seven consecutive procedures conducted between 2017 and 2018 for patients with active chronic otitis media, mainly with cavity problems with or without cholesteatoma, and a minimum follow-up of 6 months. All patients had had previous CWD mastoidectomy, which means that these were revision cases.

Methods: Surgical technique – our surgical technique for obliterating a CWD mastoid cavity consists of an inferiorly based pedicled flap of the mastoid periosteum and the squamous pericranium in conjunction with bone pate, bone chips, and cartilage. The additional length provided by the pericranial extension of the flap permits it to reach superior to the lateral canal to better reduce cavity size. Outcome measures – the primary outcome measures were control of suppuration and creation of a dry, low-maintenance mastoid cavity, which was assessed by

using a previously developed semiquantitative scale. This scale includes a temporal dimension to assess control of infection. Secondary outcome measures included postoperative complications (e.g., hematoma, infection, flap necrosis, and meatal stenosis) and incidence of recurrent or residual cholesteatoma.

Results: Six ears (86%) maintained a small, dry, healthy mastoid cavity. One ear had a recurrence of cholesteatoma from a retraction pocket in the epitympanum. There were no instances of postoperative hematoma, flap necrosis, or graft perforation.

Conclusions: Obliteration of a canal wall down mastoid cavity by a postauricular periosteal – pericranial flap with autologous bone pate and bone chips is a reliable and effective technique that results in a dry, trouble-free mastoid cavity in 86% of patients.

R-126 Session Panel: Otology in Taiwan

Precision medicine in cochlear implantation: the Taiwan experience

Wu C-C.

Department of Otolaryngology, National Taiwan University Hospital

Cochlear implantation is currently the treatment of choice for children with severe to profound sensorineural hearing impairment (SNHI). However, the outcomes with cochlear implants (CIs) vary significantly among recipients. In the past decade, we have been exploring the correlation between genetic results and the outcomes with CIs. In 2007, we prospectively performed genetic testing in 67 consecutive patients who underwent cochlear implantation at National Taiwan University Hospital. Our results revealed that genetic diagnoses and imaging results are the two predominant factors determining the outcomes with CIs. In collaboration with Chang Gung Memorial Hospital, we then confirmed mutations in common deafness genes, including GJB2 and SLC26A4 mutations, were associated with excellent long-term auditory and speech performance with CIs, probably because the pathology is confined to the inner ear and the auditory nerve is preserved. Subsequently, we applied the next-generation sequencing (NGS) technology to perform the comprehensive genetic examination in CI patients and identified that mutations in PCDH15 and DFNB59 were associated with unfavorable CI performance. The unfavorable CI performance associated with these specific mutations, as evidenced in our recently-generated CRISPR mouse models, might result from pathologies in the auditory neural pathway. Of note, children with PCDH15 or DFNB59 mutations might exhibit clinical features indistinguishable from those of other typical pediatric CI candidates. As such, comprehensive genetic examination might be indicated in all CI candidates prior to operation and could be included in the pre-CI evaluation battery.

In addition to outcome prediction, genetic testing might also help in clinical decision making. For instance, auditory neuropathy patients with OTOF mutations do not

experience spontaneous recovery of auditory phenotypes with age, but they usually demonstrate favorable outcomes with CIs. Therefore, cochlear implantation should be performed in patients with OTOF mutations whenever indicated, without unnecessary delay. Patients with MYO15A or TMPRSS3 mutations might present severe-to-profound SNHI with low-tone residual hearing initially, but the residual hearing could deteriorate gradually. Special considerations in the electrode selection are thus necessary for these patients. Our experience with regards to the application of genetic examination in cochlear implantation will be presented.

R-127 Session S15

Predictors of distant metastasis and survival in adenoid cystic carcinoma of the external auditory canal

Zhang Y.¹, Liu H.², Wu Q.¹, Dai C.¹

¹ Department of Otolaryngology & Skull Base Surgery, Eye Ear Nose & Throat Hospital, Fudan University, Shanghai, P.R. China

² Department of Otolaryngology, Second Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, Zhejiang Province, P.R. China

Objectives: To analyze the predictors of both distant metastasis and survival in patients with adenoid cystic carcinoma of the external auditory canal. Study design: a Retrospective patient review. Setting: A single university hospital. Patients: Eighty-two cases with adenoid cystic carcinoma of the external auditory canal were referred to our institution between 2004 and 2016. Main Outcome Measures: Distant metastasis was detected by lung computed tomography, proton emission tomography-computed tomography or histopathologic examination of tissue samples. Distant metastasis predictors were analyzed using Student's *t*-tests and Chi-square tests. The log-rank tests of Kaplan-Meier survival curves were used to evaluate survival differences.

Results: During a median follow-up of 36 months (range, 6–162 months), distant metastasis developed in 25 patients. The occurrence of distant metastasis was significantly associated with histopathologic subtype, T classification, and local recurrence ($P < 0.05$). The 1-, 10-, 20-, and 25-year cumulative survival rates in the patients with DM were: 95.7%, 95.7%, 71.7%, and 0%, respectively, and all survival rates were 100% for the 57 patients without distant metastasis ($P = 0.115$). Median survival time after the occurrence of distant metastasis was 13 months (range, 1–120 months). The prognosis was better with solely lung metastasis than with metastases to other visceral organs or bone ($P < 0.05$).

Conclusions: Distant metastasis appeared to result in a poorer prognosis, occurrence of distant metastasis was significantly associated with local recurrence, extensive surgery is recommended to achieve local control and reduce distant metastasis risk. Routine follow-up investigations for detecting distant metastasis are warranted for patients with an increased risk for distant metastasis.

R-128 Session S05

Preservation of hearing in patients suffering from partial deafness following cochlear implantation

Skarżyńska M.B.^{1,2}, Skarżyński P.H.^{2,3,4}, Król B.², Gos E.², Rajchel J.², Kordowska K.², Boruta M.², Skarżyński H.²

¹ Center of Hearing and Speech Medincus, Kajetany, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

Objectives: The main aim of the study was to evaluate two different algorithms of administration of dexamethasone or dexamethasone and prednisone to patients suffered from partial deafness after cochlear implant surgery, on hearing preservation.

Materials: Study participants were 18 years-of-age, with a cochlear duct length 27.1 mm measured by computed tomography (CT), with hearing sound levels in the range of 10–120 decibels (dB) and sound frequencies of 125–250 hertz (Hz); sound levels of 35–120 dB and frequencies of 500–1,000 Hz; sound levels of 75–120 dB and frequencies of 2,000–8,000 Hz. Study exclusion criteria included diseases with contraindications for corticosteroid therapy or medications that increased the effects of steroids. 46 patients were enrolled in the trial and divided into 3 subgroups. To patients from the first subgroup (group number 1: i.v., $N = 16$) dexamethasone was administered intravenously (i.v.) in the dose of 0.1 mg per kg body mass 30 minutes before cochlear implant surgery and then in every 12 hours during the next 3 days in the same dose. In the second subgroup (group number 2: i.v. + p.o., $N = 13$) consisting of patients treated with combined oral and intravenously glucocorticosteroid therapy following cochlear implantation, were treated orally with prednisone at the dose of 1 mg per kg of body mass three days prior to surgery. Then, 30 minutes before the cochlear implantation surgery, dexamethasone was administered intravenously to those patients at a dose of 0.1 mg per kg body mass. Similarly, like the first subgroup, the same dose of dexamethasone was administered to the patients intravenously every 12 hours three consecutive days. During the next three days, prednisone was administered orally at the dose of 1 mg/kg body mass. After this period, the dose of prednisone was reduced 10 mg per every day till complete reduction of the dose. The third subgroup was a control group ($N = 17$). Hearing preservation (HP) was evaluated using pure tone audiometry (11 frequencies ranging from 125 to 8000 Hz).

Methods: The impact of administered substances was evaluated by pure tone audiometry during six different periods: before cochlear implant surgery, during activation of audio processor and 1, 6, 9 and 12 months after activation of the audio processor in comparison with the control group. Non-parametric tests were used due to the discrepancies in size between each of the compared groups. The

Kruskal–Wallis test was used to compare hearing thresholds in the three patient subgroups. To determine possible differences in hearing thresholds obtained by patients from each group in selected time intervals, the Friedman non-parametric test was used. In both tests, $p < 0.05$ was considered to be statistically significant. The adjustment for multiple tests, the Bonferroni correction, was applied. Statistical analysis was performed using the IBM SPSS software ver. 24.0.

Results: According to hearing preservation (HP) classification patients from the second group: i.v. + p.o., to whom combined glucocorticosteroid therapy was administered, achieved the best results of hearing preservation. The complete hearing preservation index was observed in the highest percentage of patients from the second group. The dispersion of measured values was lesser in comparison with other subgroups.

Conclusions: According to the results, administration of glucocorticosteroids (dexamethasone and prednisone or dexamethasone only) to the patients who suffered from partial deafness underwent cochlear implantation surgery, may be important in stabilization of hearing thresholds and in the protection of hearing. The dispersion of measured values in the second group (i.v + p.o.) was lesser than in the first and control group.

R-129 Session S07

Prevalence of hearing loss among Polish school-age children from rural areas – results of 10 years-experience hearing screening program

Skarżyński P.H.^{1,2,3}, Świerniak W.¹, Kochanek K.¹, Tarczyński K.¹, Gocel M.¹, Skarżyński H.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

³ Institute of Sensory Organs, Kajetany/Warsaw, Poland

Introduction: Hearing screening is a significant component of secondary prevention. Many countries, including Poland, have implemented newborn hearing screening. In spite of that, there is a significant number of children with hearing disorders. The Institute of Physiology and Pathology of Hearing (IPPH) in collaboration with Polish Agricultural Social Insurance Fund (KRUS) developed and implemented the program of hearing screening in school-children. The screening program is dedicated to children from primary schools living in rural areas. The choice of such a target group was because of the need to equalize the chances of access to medical care for children with villages and areas poorly urbanized. In addition, the goal of the program is the early detection of hearing disorders, especially in children who start school. It allows to early detection of hearing disorders, thus enabling an early start of treatment and eliminating or minimizing the negative consequences associated with this type of dysfunction. Children with hearing impairments often experience delayed speech development and cognitive abilities, which

can result in learning disabilities and reduce school progress. Moreover, during hearing screening specialist from IPPH increase the awareness of parents and the school environment about hearing problems.

Materials and Methods: Program of hearing screening was implemented in eastern Poland in 8 voivodships. A number of children included in the program was 352 362 (49.3% girls and 50.7% boys) from grades 1 aged from 6 to 7 years. Each child was assessed by pure tone audiometry. The examination was performed using the Platform of Sensory Organs Examinations. In addition, all parents or legal caregivers were asked to fill a questionnaire. This tool including question concerning data on the potential causes of the child's hearing problems, medical history, the possible presence of tinnitus, and any presence of learning difficulties.

Results: Analysis of the obtained results of hearing screening showed that the positive result of the audiogram (audiometry in at least one frequency <20 dB HL) was found in 82 530 children (around 23.4% of the surveyed population). It was observed that among all the examined children, 64.5% of the detected hearing loss were one-sided hearing loss. Results of questionnaires demonstrated low awareness of parents/caregivers of their child's hearing impairments – 73% did not notice any problems. Tinnitus has been observed that 12.8% of examined children from all classes experience tinnitus. It is worth noting that 31.3% of children who experience tinnitus very often and often, and 26.1% of students who rarely experience tinnitus had a positive result of hearing screening.

Conclusions: The obtained results confirm that in developing countries awareness about hearing disorders is low. Many school-age children have hearing loss but often are not they are perceived by caregivers and teachers. Meanwhile, even small hearing losses can cause difficulties in communication, emotional or educational. Because early detection of hearing disorders is important. The screening programs allow to quickly select patients with hearing loss and at-risk group and as soon as possible implement appropriate treatment and rehabilitation. That action improves the quality of life of patients and their families.

R-130 changed to poster presentation

R-131 Session S22

Radiologic measurement of cochlea and hearing preservation rate using slim straight electrode (CI422) and round window approach

Matusiak M.^{1,2}, Lorens A.^{1,2}, Furmanek M.^{1,2}, Skarżyński H.^{1,2}

¹ Institute of Physiology and Pathology of Hearing, Warsaw, Poland

² World Hearing Centre, Kajetany, Poland

An essential aspect of successful cochlear implantation, besides provision of electric stimulation, is the preservation

of the low-frequency hearing. Our aim is to evaluate the relationship between the size of a cochlea, insertion depth angle and linear insertion depth and the preservation of hearing assessed according to the Skarzynski classification. The hypothesis was that insertions performed according to the patient's calculated linear insertion depth increase the hearing preservation rate. The analyzed group of 54 patients was implanted with a Nucleus CI422 using the 6-step Skarzynski procedure. Pure tone audiometry was performed up to 24 months after CI activation, and rate of hearing preservation was calculated by using the Hearing Preservation Classification system proposed by Skarzynski et al. CT scans were performed after electrode array insertion to evaluate the size of the cochlea. There was no statistically relevant relation between the individual S values of HP at activation, 12 months follow up and 24 month-follow up and the individual angular insertion depths θ , as well as the individual S value of HP and intra-operatively estimated depth of insertion. Preoperative measurements of cochlea size and application of specifically calculated parameters such as cochlear duct length, angle of insertion and linear insertion depth have no effect on increasing the chances of hearing preservation in cochlear implantation when using slim straight arrays and the round window surgical approach.

R-132 Session S22

Relationship between cochlear nerve cross-sectional area and auditory performance after cochlear implantation in prelingual deaf

Jain S., Goyal A., Patro S.K., Khera P., Yadav T., Choudhury B., Kaushal D., Soni K.

Department of Otorhinolaryngology, All India Institute of Medical Sciences, Jodhpur, Rajasthan, India

Objectives: The aim of this study is to assess whether cochlear nerve (CN) cross-sectional area as measured with parasagittal magnetic resonance imaging (MRI) is correlated with auditory performance after cochlear implantation. Study design: Ambispective cohort study.

Methods: 25 pre-lingual children with bilateral profound SNHL in the age group of 1–6 years who received SONATATi cochlear implant were included in this study. Diameter of cochlear nerve at Internal auditory canal (IAC) fundus and mid-point of IAC was retrospectively measured on parasagittal images of FIESTA sequence magnetic resonance imaging (MRI) by two independent observers. Cross-sectional areas $[(\text{Height}/2)(\text{Width}/2)]$ were then calculated and correlated with post-operative CAP (categories of auditory performance) and IT-MAIS (*Infant-Toddler Meaningful Auditory Integration Scale*) scores.

Results: No significant correlation between the maximal cross-sectional diameters of the cochlear nerve and auditory scores was observed.

Conclusions: There have been no studies in the literature which reveal the correlation of cross-sectional area of cochlear nerve in pre-lingual deaf children and its prognosis

for post-cochlear implant auditory performance. Presence of cochlear nerve in MRI itself is a good indicator of good auditory outcomes after cochlear implantation, regardless of the nerve diameters.

R-133 Session S23

Relationship between Eustachian tube diameter measurements during middle ear surgery and postoperative pneumatization

Yazama H., Yasuomi K., Tasuku W., Hiromi T.

Department of Otolaryngology, Head and Neck Surgery, Faculty of Medicine, Tottori University, Yonago, Japan

Objectives: It has been indicated that causes of middle ear diseases such as cholesteatoma and adhesive otitis media are related to Eustachian tube dysfunction, and can be triggered by either Eustachian tube stenosis or patulous Eustachian tube. Frequently-used methods of Eustachian tube testing include the sonotubometry and tubotympano-aerodynamic graphy (TTAG). Because there is a tendency for objective data to be affected by the bias of the patients providing it, there is demand for a new, highly-precise method of evaluation. In our hospital, to estimate Eustachian tube diameter during middle ear surgery, we physically insert an extradural tube with a diameter of 1 mm into the Eustachian tube and measure the sense of resistance. We investigated whether this correlates with actual Eustachian tube diameter and whether it could be used as supplementary data for predicting postoperative pneumatization. We also collected data about the Eustachian tube function testing with the sonotubometry and the degree of post-operative pneumatization in order to compare this data with the results of the present study.

Materials: Of patients who underwent middle ear surgery at our hospital from 2011 through 2016, we analysed cases that underwent Eustachian tube function testing with the sonotubometry and then computed tomography (CT) at 1 year postoperatively. We excluded cases that did not measure the sense of resistance using an extradural tube during surgery.

Methods: For each case, we examined the etiology, pre-operative Eustachian tube testing results by sonotubometry, intraoperative Eustachian tube resistant measurement results, the lateral diameter of the bony part of the Eustachian tube and postoperative pneumatization. Eustachian tube resistant measurements for extradural tube passage were classified into four groups: passage impossible, passage with strong resistance, passage with appropriate resistance, or passage with weak resistance. Lateral diameter of the bony part of the Eustachian tube was measured using preoperative CT measurements. Postoperative pneumatization was evaluated using CT at 1 year postoperatively. Cases were also classified into two groups depending on whether pneumatization reached the stapes. We totaled the above results and analysed correlations between passage resistance and Eustachian tube diameter, and between passage resistance and postoperative pneumatization.

Results: Our subjects comprised 57 cases, cholesteatoma of the middle ear (23 cases), congenital cholesteatoma (2 cases), chronic otitis media (10 cases), adhesive otitis media (6 cases), tympanosclerosis (7 cases) and postoperative ear (9 cases). Eustachian tube function testing was able to be performed on 42.1% (24/57) of cases, and no correlation was observed between measurement values and postoperative pneumatization improvement. Investigation of passage resistance and Eustachian tube diameter revealed a tendency for significantly more stenosis to be noted in the strong resistance and no passage groups than the other two groups. We also found that pneumatization was maintained around the stapes in all cases in the appropriate resistance group, while the number of cases for which pneumatization was achieved was lowest in the strong resistance group.

Conclusions: Our investigation indicated that it is difficult to predict postoperative pneumatization prognosis with conventional Eustachian tube function testing alone. Meanwhile, results suggested that simply using an uncomplicated method of recording resistance sensation when a tube was passed through the Eustachian tube intraoperatively could be useful in estimating Eustachian tube diameter and the degree of stenosis. The findings obtained could also be used as supplementary data for estimating postoperative pneumatization. While we plan to use this method for some cases as a means of evaluating Eustachian tube function, results should be interpreted with care as technical bias other than Eustachian tube stenosis might affect results for non-passage cases.

R-134 Session S05

Relationships between glucocorticoid sensitivity and prognosis of refractory sudden sensorineural hearing loss

Zhu W.^{1,2}, Gao Z.¹, Qi H.³, Lv L.^{1,2}, Liu Z.^{1,2}, Liu J.³, Hou J.³, Dai Y.^{1,3}, She W.^{1,3}

¹ Department of Otolaryngology-Head and Neck Surgery, Nanjing Drum Tower Hospital Clinical College of Nanjing Medical University, Nanjing, China

² Department of Otorhinolaryngology, affiliated Huaian No.1 People's Hospital of Nanjing Medical University, Huai'an, China

³ Department of Otolaryngology-Head and Neck Surgery, Nanjing Drum Tower Hospital, affiliated Hospital of Nanjing University Medical School, Nanjing, China

Objectives: To explore the relationships between glucocorticoid (GC) sensitivity and the prognosis of refractory sudden sensorineural hearing loss (SSNHL), and to analyze the related factors being affected by the prognosis of SSNHL.

Methods: Ninety-one refractory SSNHL Patients were enrolled in the present investigation in Nanjing Drum Tower Hospital, the affiliated Hospital of Nanjing University Medical School from Jan. 2015 to Aug. 2017. Peripheral blood mononuclear cells (PBMCs) from the refractory SSNHL were extracted to conduct GC proliferation dexamethasone (dexamethasone, DEX) inhibition experiments. All patients accepted comprehensive treatment with

methylprednisolone. Statistical analysis of the treatment effect and prognostic factors were done in SSNHL patients.

Results: Total effective rate was 40.66% in refractory SSNHL patients. Gender, side of ears, sex, age, vertigo, tinnitus and the locally used methods of methylprednisolone were irrelevant to the efficacy. Only the inhibitory rate of DEX and the time from onset to visit were related to GC treatment effect, and the inhibitory rate of DEX was more correlated with the treatment effect. The DEX inhibition rate of the effective group was higher than that of the ineffective group.

Conclusions: DEX inhibition rate can predict GC sensitivity and prognosis of SSNHL. GC sensitivity and the time from onset to treatment are two important factors affecting the prognosis of refractory SSNHL patients.

R-135 Session S18

Relevance of age on mastoid thickness and overall skull width in relation to CI including inner-ear malformation cases

Dhanasingh A.¹, Van de Heyning P.²

¹ MED-EL GmbH, R&D, Innsbruck, Austria

² University Clinic Antwerp, Edegem, Belgium

Objectives: Understand the relationship between mastoid thickness in the temporal bone versus age and skull width for both normal and malformed inner-ear anatomy patient groups. Cochlear size as measured by the 'A' value was plotted against the age, mastoid thickness and skull width to determine if there is any relation.

Materials and Methods: 93 CT image datasets of human temporal bone were made available with normal ($n = 68$) and malformed cochlea ($n = 25$) anatomies with the age of the subjects varied from 0.5 years to 82 years. CE marked OTOPLAN pre-planning otology software was used to load the patient's pre-operative images for making all the measurements including mastoid thickness, skull width, and the cochlear size as measured by the 'A' value. Mastoid thickness was measured both in axial plane starting from the cochlear entrance to the skull surface, with the line in the plane with the basal turn of the cochlea. Skull width was measured from side to side in coronal plane from the image slice that gave the highest width. The cochlear size in terms of basal turn diameter 'A' was measured from 'Cochlear View' in the oblique coronal plane.

Results and Discussions: Mastoid thickness and skull width increased with age in a logarithmic manner. The mastoid thickness increased from a minimum of 17 mm to around 30 mm and the skull width increased from 107 mm to around 135 mm as the age increased from 0.5 years to 15 years. At the age of 15, both the mastoid thickness and skull width reached the plateau. The skull width was linearly correlated with the mastoid thickness conveying the message that bigger the head size is, thicker will be the mastoid. The size of the cochlea as measured by the 'A' value did not have any meaningful correlation with the skull width, mastoid thickness, and the age. This

clearly conveys the message that the cochlear size is independent of the overall size of the head and the age of the patient. With robotic-assisted CI surgery coming into reality as reported by Caversaccio et al in 2017, knowing the thickness of mastoid bone through which the robot has to drill and how it varies with the age of the patient would be very handy for the rough estimation of time needed for the robot assisted drilling. Also for the young surgeons who are emerging in the CI field, knowing this information would be highly educational.

Conclusions: Age of the subjects had a decent logarithmic correlation with mastoid thickness and skull width for both normal anatomy and malformed anatomy cochlear groups. The skull was linearly correlated with the mastoid thickness. On the other hand, the size of the cochlea as measured by the 'A' value had no relations with the skull width, mastoid thickness and the age conveying the key message that the cochlea attains the maximum growth at birth. Mastoid thickness varying with age has a direct implication with the excess electrode lead length that needs to be coiled in the mastoid cavity. For the robotic-assisted surgery, this information could be important in estimating the mastoid drilling time for different age groups.

R-136 Session S05

Revision stapedectomy: cement fixation

Harguindey A., Antoli-Candela E., Olarieta F.J.

Institute of Otorhinolaryngology-Head and Neck Surgery of Madrid, Madrid, Spain

Objectives: In revision stapedectomy, we find different variables which cause the relapsing, hearing loss and vestibular symptoms. The most habitual causes are included here such as: prosthesis displacement, necrosis of the long process of the incus, middle ear adhesions, etc. The surgical findings are evaluated as well as their solutions and results.

Materials and Methods: Sixty-five patients with a history of stapedectomy are studied. Both the variables due to gender and the surgical findings are analyzed (the type of prosthesis, including its placement, the condition the ossicular chain and the middle ear are in, etc.), as well as the solution adopted and the audiological results.

Results: The findings are: prosthesis displacement (82%), distal necrosis of the long branch of the incus (64%), middle ear adhesions (33%), tympanic retraction due to extensive atticotomy (28%). Data are also provided for other findings; cholesteatoma, perforations, or absence of prosthesis and re-obiterated footplates. There is an analysis of the TC findings and their comparison with the intraoperative findings. The solutions available vary from the placement of a new prosthesis, or cement placement and fixation in those cases where the long process of the incus allows for it. TORP is in some cases the only alternative.

Conclusions: The complete closure of the audiometric gap is achieved in 74% of patients, partially in 16%, unchanged in 6% and worsened in 4%. There is also an improvement in 95% of the vestibular symptomatology.

R-137 Session S20

Safe open cavity reconstruction using a sliced cartilage graft to control cholesteatoma recurrence after canal wall-down tympanoplasty

Komori M.^{1,2}, Kobayashi T.¹, Hyodo J.², Hyodo M.¹, Yanagihara N.²

¹ Department of Otolaryngology, Kochi Medical School, Kochi University, Kochi, Japan,

² Department of Otolaryngology, Takanoko Hospital, Ehime, Japan

Objectives: Cartilage tympanoplasty and mastoid obliteration are used to eradicate cholesteatoma with morphological preservation of the ear; however, recurrences have been reported. We describe a surgical procedure creating a safe, dry open cavity for ears with a recurrent disease that would otherwise be very poorly aerated.

Materials: Fourteen ears of 12 patients with recurrent cholesteatomas following canal-wall-down tympanoplasty (CWDt).

Methods: The eardrum and the small tympanic cavity (which are very poorly aerated in patients with recurrent disease) were reconstructed using a single, smooth, sliced cartilage graft (a triple S-C graft). We recorded the extent of preoperative middle ear aeration and postoperative features of the eardrums and tympanomastoids. Middle ear aeration was classified as follows: grade 0, no aeration; and grade 1, only the mesotympanum was aerated.

Results: We encountered no recurrence caused by the formation of a deep eardrum retraction pocket at 5 years postoperatively. In terms of preoperative middle ear aeration, no eardrum retraction or perforation was found in seven ears of aeration grade 1 (100%), or in four of seven ears of aeration grade 0 (57%). Of the remaining three ears in the latter group, one was treated via tympanic membrane tube insertion and two developed shallow eardrum retraction.

Conclusions: Our new surgical procedure can be used to treat recurrent cholesteatoma after CWDt, accompanied by the formation of a deep retraction pocket. This condition is relatively rare, but our procedure will aid in the control of recurrent cholesteatoma. Triple S-C grafting yielded appropriately shaped eardrums. The small tympanic cavity facilitated aeration of grade 1 (mesotympanum aeration only), associated with favorable long-term surgical outcomes. Although tube insertion into grade 0 (no aeration) ears was problematic, and shallow retraction was encountered, cholesteatoma did not recur. In general, cholesteatoma eradication should include morphological preservation of the ear. However, we believe that our new procedure can be used to create a dry, safe open cavity when repeated conventional surgery fails to eradicate cholesteatoma.

R-138 Session S14

Safety, long-term functional outcomes and quality of life after cochlea implantation with a mid-scala electrode array

Ovari A.¹, Nguyen-Dalinger D.^{2,3},
Mandapathil M.¹, Mis U.^{2,3}, Külkens C.^{2,3},
Niclaus O.^{2,3}, Meyer J.E.¹

¹ Asklepios Klinik St. Georg, Department of Oto-Rhino-Laryngology, Head and Neck Surgery, Plastic Surgery, Hamburg, Germany

² Hanseatisches Cochlea Implantat Zentrum (HCIZ), Hamburg, Germany

³ Asklepios Klinik Nord-Heidelberg, Department of Oto-Rhino-Laryngology, Hamburg, Germany

Objectives: Assessment of side effects and complications, audiological performance and measurements of quality of life (QoL) after cochlea implantation using the Advanced Bionics HiRes 90k or HiRes Ultra with the HiFocus mid-scala electrode. Patient characteristics and surgical procedure: twenty-eight patients (w = 21, m = 11) with $n = 32$ operated ears (left: 15, right: 17) were included in this study. Four patients were implanted bilaterally. The duration of deafness was up to 1 year ($n = 13$), 2 years ($n = 2$), 3–4 years ($n = 3$), 5–7 years ($n = 2$) or more than 10 years ($n = 12$). The mean age of patients at implantation was 54.2 years (range: 23–82 years). Cochlear implantations were carried out at the Hanseatisches Cochlea Implantat Zentrum (HCIZ), Hamburg, Germany, from December 2013 to November 2017 using the Advanced Bionics HiRes 90k ($n = 27$) or HiRes Ultra ($n = 5$) with the HiFocus mid-scala electrode. All patients were operated on using a minimal retroauricular incision, extended antrotomy und regular posterior tympanotomy. All presented cases had a round window (RW) insertion and received repetitive intratympanic injections of dexamethasone during surgery and hyaluronic acid to the RW prior to insertion. Electrode insertions were carried out with consistent use of the insertion tool of AB after extended RW approach and with an insertion depth of $1\frac{1}{4}$ turns. Electrode tip fold-over or kinking was ruled out by postoperative Stenvers view radiograph.

Methods: The following side effects and complications of cochlear implantations were documented pre- and post-operatively: vertigo, tinnitus, facial paresis, and dysgeusia. For the assessment of the audiological performance pre-operative unaided speech reception thresholds using the Freiburger speech test were compared with postoperative aided thresholds at 3, 6, and 12 months after cochlear implantation. The *Nijmegen Questionnaire* was used to assess QoL before, 6 and 12 months after cochlear implantation.

Results: Wear time of the cochlear implant was less than 1 year in $n = 2$ ears, between 1 and 2 years in $n = 22$ ears and more than 2 years in $n = 8$ ears. Vertigo was complained preoperatively by $n = 10$ patients (31%) and postoperatively by $n = 11$ patients (33%). Preoperatively $n = 18$ patients (56%) suffered from tinnitus, postoperatively $n = 4$ patients of this patient group had no tinnitus anymore and $n = 11$ patients reported a reduction or

masking of the tinnitus during CI use. There was no post-operative facial palsy. One patient (3%) complained of having dysgeusia after the operation. We saw a good improvement of speech intelligibility for monosyllables at 70 dB SPL, mainly from 3 months ($29.7 \pm 25\%$) to 12 months ($54.8 \pm 29.1\%$). The best improvement of speech reception threshold was recorded after 3 months postoperatively from 94 ± 12.6 dB SPL to 57.6 ± 10.6 dB SPL, and furthermore up to 12 months to 49.3 ± 9.6 dB SPL. There were $n = 3$ patients with a long history (>20 years) of deafness who had no speech intelligibility 12 months postoperatively. However, all three patients had speech intelligibility at the last control (patient ID 7: 45% after 5, patient ID 8: 10% after 4, and patient ID 16: 40% after 3 years of CI use, respectively). If these patients with long-time deafness excluded, speech intelligibility and SRT reached 12 months postoperatively $60.5 \pm 24.1\%$ and 47.5 ± 7.8 dB, respectively. QoL improved not only for audiological items (sound perception, speech production) but also for sociopsychological items (self-esteem, activity, and social interactions).

Conclusions: Cochlear implantation using the Advanced Bionics HiRes 90k or HiRes Ultra with the HiFocus mid-scala electrode led to only minor, no significant side effects and complications in our patient cohort. Audiological performance improves up to several years after implantation. The improved QoL scores show that cochlear implantation led to a step-back into 'normal' life.

R-139 Session S04

Screening for WFS1 gene variants in families with low-frequency hearing loss and development of zebrafish knock-down model of the orthologous gene wfs1

Sarosiak A.^{1,2}, Leja M.^{1,2}, Oziębło D.^{1,2},
Domagała S.¹, Madejska A.¹, Skarżyński H.³,
Oldak M.¹

¹ Department of Genetics, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

² Postgraduate School of Molecular Medicine, Medical University of Warsaw, Warsaw, Poland

³ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Heterozygous, dominant pathogenic variants in the WFS1 gene lead to progressive low-frequency hearing loss (LFHL), which affects hearing at frequencies of 2000 Hz and below. A novel probably a pathogenic variant of the WFS1 gene (NM_001145853.1:c.2140A>C) causative of HL was found in a family with autosomal dominant LFHL. Performing genetic testing in families with LFSNHL may lead to a discovery of novel pathogenic variants of the WFS1 gene. Zebrafish is a prominent animal model to functionally investigate the role of newly discovered genetic variants in the development of HL.

Materials and Methods: Patients with LFHL ($n = 9$) from unrelated families were selected from the internal patient database based on the audiological criteria applied on results of pure tone audiometry test. Their DNA samples

were subjected for amplicon-based next-generation sequencing of the WFS1 exon 8 using the MiSeq platform. Family segregation analysis of the identified WFS1 variants was performed using Sanger sequencing. Pathogenicity of the identified variants was assessed on the basis of population frequencies and in silico predictions. The wfs1-blocking morpholino oligos (MOs) were used to obtain a zebrafish knock-down model of the wfs1 gene – orthologue of the human WFS1 gene.

Results: Screening for WFS1 gene variants in 9 families revealed two potentially pathogenic variants. Identified variants c.2044A>T (p.Asn682Tyr) and c.2581G>A (p.Val861Met) have not been previously related to HL. The analysis of population frequencies and predictive algorithms confirmed the potentially pathogenic character of the identified variants. Variant c.2044A>T fully segregated with HL in the studied family. Different morphological defects and inner ear otoliths malformations were observed within the moderate and severe wfs1 knock-down zebrafish phenotypes.

Conclusions: In patients, without a WFS1 pathogenic variant the use of high throughput DNA sequencing methods should be applied to identify other LFHL causative genes. Phenotype-based characterization of wfs1-knockdown zebrafish enables to establish a model useful for further studies on the involvement of WFS1 mutations in hearing.

R-140 Session S13

Self-reported benefit after cochlear implantation in patients with unilateral hearing loss and no tinnitus

Kruszyńska M.¹, Lorens A.¹, Obrycka A.¹, Pastuszak D.¹, Skarżyński P.H.^{1,2,3}, Skarżyński H.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: Unilateral hearing loss (UHL), a condition where there is a severe to profound hearing loss in one ear and normal or near-normal hearing (mild hearing loss) in the other ear, has been often underestimated. Patients with unilateral hearing loss besides the difficulties in sound localization and speech discrimination in noise also perceived emotional and social/situational consequences of UHL. The emotional and social/situational consequences of UHL seem to be even more severe in patients who have tinnitus. For several years, cochlear implants (CIs) have been successfully applied in UHL situations for suppressing tinnitus. Considering there is a link between the participants' self-reported sound and speech perception and their experience of the psychosocial consequences of unilateral deafness, this provides strong evidence of a reduction in perceived hearing disability after a CI in UHL patients with tinnitus. Nevertheless, little is known on the actual benefit of a CI in UHL patients without tinnitus. The aim of the study was to evaluate self-reported benefit after cochlear implantation in individuals

with unilateral hearing loss and no tinnitus and compare them to those obtained in a similar group who had incapacitating tinnitus.

Materials and Methods: A group of 249 adult patients with UHL was substracted into two groups, in patients who did not experience tinnitus before their operation and with preoperative tinnitus. Patients consecutively implanted at the Institute of Physiology and Pathology of Hearing, Poland, and who achieved 14 months of CI follow-up, were included in the study. UHL patients Self-reported benefit in the study group were evaluated with and an APHAB questionnaire (*Abbreviated Profile of Hearing Aid Benefit*).

Results and Conclusions: All subjects used their cochlear implant more than 10 hours a day, 7 days a week. Patients with UHL and no tinnitus – who are typically not CI candidates – can benefit from using a CI to the same extent as patients with UHL who have incapacitating tinnitus.

R-141 Session S01

Skarzynski Tinnitus Scale – a brief and robust tool for assessing tinnitus

Skarżyński H.¹, Gos E.², Raj-Koziak D.³, Skarżyński P.H.^{1,4,5}

¹ Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ Audiology and Phoniatrics, Tinnitus Clinic, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

⁵ Institute of Sensory Organs, Kajetany/Warsaw, Poland

Objectives: Many tinnitus questionnaires are available, but all of them have certain limitations. In World Hearing Center we created a new brief and reliable questionnaire that could be used for evaluating tinnitus in adults – *Skarzynski Tinnitus Scale* (STS).

Materials: The study included 125 participants (53 women and 70 men), reporting tinnitus complaints who were consecutive patients attending the Audiology and Phoniatrics Clinic in World Hearing Center. The main eligibility criteria were age over 18 years, tinnitus of at least 1 month's duration which lasted more than 5 minutes at a time, and a lack of mental disorders confirmed in the patient's medical history.

Methods: The patients completed *Tinnitus and Hearing Survey* (THS), *Tinnitus Functional Index* (TFI), *Tinnitus Handicap Inventory* (THI), *Beck Depression Inventory* and an experimental version of *Skarzynski Tinnitus Scale*. For all patients, hearing thresholds for air and bone conduction were determined at frequencies of 0.125–8 kHz using pure tone audiometry. Psychometric properties of the new tool were tested using exploratory factor analysis (EFA),

Pearson bivariate correlation with other tinnitus questionnaires and pure tone audiometry, Cronbach's alpha coefficient, limits of agreement, and floor and ceiling effects. Norms for tinnitus severity were proposed.

Results: The results of EFA and content analysis of the wording of the items justified the three-factorial structure. *Skarzynski Tinnitus Scale* has three subscales: *psychological distress*, *functional* and *coping*. The tool has excellent reliability ($ICC = 0.94$) and good internal consistency ($\alpha = 0.91$). The convergent validity was proven by a significant positive correlation with THI, TFI and THS subscale A scores, also divergent validity was confirmed. Additionally, the authors proposed norms dividing the results into four tinnitus severity grades – scores above 72 points indicate very high tinnitus severity.

Conclusions: *Skarzynski Tinnitus Scale* is a brief but robust tool well-suited to clinical practice. A feature of STS is that it takes into account the impact of tinnitus on the patient's psychological and functional domains as well as their ability to cope with tinnitus-related distress.

R-142 Session S13

Socio-emotional adjustment of adolescents with cochlear: loneliness, emotional autonomy, self-concept, and emotional experience at the hospital

Majorano M.¹, Maes M.², Morelli M.¹, Bastianello T.¹, Guerzoni L.³, Murri A.³, Cuda D.³

¹ University of Verona, Department of Human Sciences, Verona, Italy

² School Psychology and Development, KU Leuven, Leuven, Belgium

³ Guglielmo da Saliceto Hospital, Emilia-Romagna, Italy

The aim of the present study is to explore the relationship between the socio-emotional adjustment of adolescents with CIs, the quality of their hospital stay, and their age at CI activation. The participants were 29 adolescents with CIs (CI group) and 29 typically developing adolescents (TD group). The *Emotional Autonomy Scale*, the *Loneliness and Aloneness Scale for Children and Adolescents*, and the *Multidimensional Self-Concept Scale* were administered to each participant. The emotional experience reported during the hospital stay was considered for each participant in the CI group. Results The adolescents with CIs displayed significantly higher levels of loneliness and lower levels of aversion toward aloneness than the TD group participants. Adolescents who had received the CI in preschool displayed a higher level of physical self-concept than adolescents who had received it later. The adolescents' emotional experiences at the hospital were reported to be quite complex and related to their relationships with parents.

R-143 Session S03

Spontaneous closure of traumatic tympanic membrane perforation following long-term observation

Tachibana T.¹, Kariya S.², Haruna T.¹, Matsuyama Y.¹, Komatsubara Y.¹, Naoi Y.¹, Nishizaki K.²

¹ Otolaryngology, Japanese Red Cross Society Himeji Hospital, Himeji, Japan,

² Otolaryngology, Head and Neck Surgery, Okayama University, Okayama, Japan

Introduction: Traumatic tympanic membrane perforation (TTMP) is usually managed conservatively because most close spontaneously within a few months. Nevertheless, spontaneous closure of TTMP during long-term observation has not been well described in the literature.

Objectives: The present study investigated factors associated with spontaneous closure of TTMP, and the characteristics of cases exhibiting spontaneous closure following long-term observation.

Materials and Methods: The medical records of 40 patients with TTMP who visited the authors' hospital between 2007 and 2018 were retrospectively reviewed. Cases in which follow-up was discontinued within 6 months in whom the perforation was not closed, or those treated surgically within 6 months, were excluded.

Results: The 40 patients comprised 24 men (60.0%) and 16 women (40.0%), with a mean age of 20.6 years (range, 1–63 years). The cause of TTMP was direct injury in 21 (52.5%) patients, and indirect injury in 19 (47.5%). Twelve of 39 (30.8%) patients had a dry perforation, and 27 (69.2%) were wet. Fourteen (35.0%) perforations were located in contact with the malleus. Spontaneous closure was observed in 27 (67.5%) patients. The healing period was <2 weeks in 6 cases (15.0%), <4 weeks in 9 (22.5%), <3 months in 5 (12.5%), <6 months in 3 (7.5%), and ≥6 months in 4 (10.0%). In the 4 cases in which spontaneous closure took ≥6 months, the closure was observed at 7–10, 8–11, 9–12, and 10–11 months following injury, respectively. All 4 cases exhibited a sign of spontaneous closure at 6 months following injury. In multivariate analysis, perforation in contact with the malleus was associated with a lower frequency of spontaneous closure ($p = 0.027$).

Conclusions: In TTMP, surgery should be considered in patients who exhibit perforation in contact with the malleus. However, it has also been suggested that long-term observation may be a viable treatment option when a sign of spontaneous closure is observed within 6 months following injury. Further investigation of factors predicting spontaneous closure following long-term observation is warranted.

R-144 Session S06

Standardization of the Punch Technique for the implantation of Bone Anchored Auditory Devices: evaluation of the MIPS Surgical Set

Kim H.H.¹, Kari E.², Copeland B.J.³, Moore G.F.⁴, Shaia W.T.⁵, Cosetti M.K.⁶, Wazen J.J.⁷, Wanna G.B.⁶, Chang C.Y.J.⁸

¹ NW Ear Institute, PC., Portland, OR, USA

² Department of Surgery, University of California-San Diego School of Medicine, San Diego, CA, USA

³ Otolaryngology Associates, LLC, Indianapolis, IN, USA

⁴ Central Plains ENT and Audiology, Omaha, NE, USA

⁵ Virginia Hearing Center, Richmond, VA, USA

⁶ Department of Otolaryngology, NY Eye and Ear Infirmary, New York, NY, USA

⁷ Silverstein Institute, Sarasota, FL, USA

⁸ Texas Ear Center, Houston, TX, USA

Objectives: Describe and assess intraoperative and post-operative outcomes in the insertion of osseointegrated auditory implants with a newly designed surgical instrumentation set through a punch type technique. Study design: retrospective case series.

Methods: Patients who underwent bone-anchored auditory implant surgery using the MIPS (Oticon Medical, Somerset, NJ) surgical set through a punch technique at 9 neurotology tertiary referral based practices were identified. Demographic data, skin thickness at the implant site, an implant used, duration of surgery, adverse intraoperative events and postoperative outcomes were recorded.

Results: Seventy-five patients comprised the study cohort (32 males, 43 females). Most patients (57.3%) were aged 51–75 years while 30.7% of the cohort comprised those aged 18–50 years and 12% were over 75 years. All but 2-patients received 4 mm fixtured implants and 68% received the Oticon Medical BTX implant. Two patients received 3 mm fixture implants and 32% received the Oticon Medical Wide Ponto implant. Mean surgical time was 12.2 minutes (6–45 minutes, standard deviation of 6.88 minutes). In 3 instances, surgery was converted to a linear incision to control brisk bleeding. Skin condition was Holgers 0–1 in 91.8%, while 5.5% had Holgers 2, and 2.7% had Holgers 3 at the first postoperative visit. At the second postoperative visit, 94.3% had Holgers 0–1, 4.3% had Holgers 2, and 1.4% had Holgers 3. All instances of adverse skin reactions were treated with topical or systemic antibiotics and/or local debridement. There were no instances of implant loss. One patient had his implant traumatically displaced to a 45-degree angle necessitating implant replacement at a second site.

Conclusions: Punch technique placement of osseointegrated auditory implants using the MIPS surgical set represents a safe technique that further simplifies a progressively minimally invasive surgery.

R-145 Session S23

Stapes surgery

Delwar Hossain M.

Combined Military Hospital, Dhaka, Bangladesh

Objectives: This study was focused on the assessment of patient's improvement in hearing, as measured by pure tone audiometry after stapedotomy for primary otosclerosis.

Materials and Methods: This prospective clinical study was performed in a total of 156 patients diagnosed with primary otosclerosis, who underwent stapedotomy at the Department of ENT & Head-Neck Surgery, Combined Military Hospital, Dhaka between January 2013 to June 2018. All patients were evaluated as per the candidacy criteria for stapedotomy and selected patients underwent surgery during the study period and were followed up for a period of 12 months in the Otology Clinic. Pre and post-operative audiometric evaluation were done using conventional pure tone audiometry with standard calibrations. Post-operative audiometry was performed at 3 months, 6 months and 12 months. The bone-conduction and air conduction thresholds and the air-bone gap (ABG), were documented and analyzed at 0.5, 1, 2 and 4 kHz frequencies respectively. The subjective outcomes in the hearing were also recorded with a patient satisfaction questionnaire to assess improvement in the quality of hearing after stapedotomy.

Results: Overall, the frequency specific pre-operative mean averaged air conduction thresholds were 63.3 dB at 500 Hz, 47.5 dB at 1 kHz, 55.1 dB at 2 kHz and 41.7 dB at 4 kHz respectively. The frequency specific post-operative mean averaged air-bone gap (ABG) closure was achieved by 24.8 dB at 500 Hz, 31.2 dB at 1 kHz, 13.6 dB at 2 kHz and 12.4 dB at 4 kHz, respectively by the time of completion of the study at 1 year. Successful closure of AB gap to less than 10 dB was achieved in the speech frequencies of 2 kHz and 4 kHz in 65% of cases. Overall, the frequency specific bone-conduction thresholds were unchanged postoperatively, showing that no sensorineural impairment had occurred due to the stapedotomy procedure. Five patients developed post-op vertigo which was self-limiting after six weeks. A few interesting cases with anomalous intra-operative findings were also documented and reported herewith. These included monopodal stapes ($n = 1$), anomalous facial nerve ($n = 1$), laterally placed chorda tympani nerve ($n = 1$), high jugular bulb, Malleus ankyloses ($n = 1$) and persistent stapedial artery ($n = 1$). All patients included in our study had significant subjective audiological improvement and responded satisfactorily to the questionnaire formulated to assess their hearing quality after stapedotomy.

Conclusions: Our case study confirms that stapedotomy is a safe and successful procedure providing long-term hearing improvement in primary otosclerosis. Obliterative otosclerosis, biscuit or floating footplate, monopodal stapes, anomalous facial nerve, laterally placed chorda tympani, and persistent stapedial artery may be special scenarios encountered during stapedotomy and they need judicious

management by an experienced surgeon. Our study shows that a meticulous selection of cases for stapedotomy will result in highly successful audiological outcomes.

R-146 Session Panel: NES India

Status of cochlear implants in India

Goyal A.

Department of Otorhinolaryngology, All India Institute of Medical Sciences, Jodhpur, India

Objectives: India is a vast country with a growing economy. A large number of patients fulfill the criteria for cochlear implant surgery. Since it is a costly intervention, both in terms of finances as well as time required for complete rehabilitation, it is largely governed by the economic condition of the country as well as its social and educational parameters. We try to evaluate the current status of cochlear implant surgery in India.

Materials and Methods: We will discuss the start of the cochlear implant surgery in India along with current funding and rehabilitative opportunities available. We will also try to evaluate the difference in surgical preferences amongst various surgeons.

Results and Conclusions: There are different funding mechanisms available in India which makes it a suitable place with regards to a number of surgeries per year. It has also caused the cost of cochlear implant surgery and rehabilitation to be amongst the minimum cost countries of the world. With a growing economy, we expect a much wider coverage of patients and an exponential increase in opportunities and options available to needy patients.

R-147 Session S11

Subjective Visual Vertical evaluation using a smartphone-based test

Oron Y., Wengier A., Handzel O., Cavel O., Ungar O.J.

Department of Otolaryngology Head and Neck Surgery and Maxillofacial Surgery, Tel-Aviv Sourasky Medical Center, Tel-Aviv, Israel, affiliated to the Sackler School of Medicine, Tel-Aviv University, Tel-Aviv, Israel

Introduction: Perception of vertical is provided by input from various sensorineural organs and pathways: vision, eye-movements, and proprioceptive and vestibular cues. Subjective visual vertical (SVV) abnormalities may be observed due to peripheral vestibular loss (PVL), and are presumably related to a lesion of the otolithic organs and to changes in the afferent graviceptive pathways. The static SVV test can effectively detect PVL, but requires either specialized equipment or a bucket test evaluation.

Objectives: The objective of this prospective study was to measure the SVV in patients suffering from peripheral vestibular diseases using a smartphone-based test

designed to simulate the bucket test, and to validate it as an examination tool.

Methods: 45 adult patients were recruited to the study, twenty-five of them had the peripheral vestibular disease (PVD) and 20 controls. All patients underwent conventional SVV and smartphone-based SVV testing. Pearson correlation test was used to compare between study group and controls. Receiver operating characteristic curves of both examinations were compared.

Results: Excellent interclass correlation coefficient was found within the study group between the two methods, and a significant correlation was found between the two test methods. An average measurement difference of 1.088 degrees was found when using the application, compared to the bucket test.

Conclusions: Smartphone-based SVV testing is a simple, useful and reliable office-based method for detecting PVL compared to conventional tests.

R-148 Session S23

Superior semicircular canal dehiscence concomitant with otosclerosis: case and literature review

Simonetti G., Sanz J., Pedemonte G., Clemente I., Viscasillas G., Asarta, I., Lao X.

ENT Head and Neck Surgery, University Hospital Mutua de Terrassa, Spain

Objectives: to report a case and review the literature of superior semicircular canal dehiscence coexisting with otosclerosis.

Methods: A 23-year-old woman presenting with hearing loss and suspected otosclerosis underwent stapedectomy. Right-sided conductive hearing loss persisted and Weber test still lateralized to the right so it was decided to perform a revision surgery without improvement for the second time. After surgery, the patient developed post-operative vertigo in addition to persisting hearing loss. A CT scan with a reformatted Pöschl's view after second surgery revealed superior semicircular canal dehiscence (SSCD).

Results: Superior semicircular canal dehiscence and otosclerosis are two pathological conditions with overlapping clinical presentation. In the differential diagnosis workup, slight distinctive features can be made between the two entities: the relative difference between air-bone gaps was described to be more prominent in SSCD patients. Present stapedial reflexes can be found in SSCD while absent in otosclerosis. Positive VEMP excludes important middle-ear pathology such as otosclerosis-type stapes fixation. CT scans can find fenestral otosclerosis and with reformatted Pöschl's and Stenver's view identify SSCD with high sensitivity and specificity. The prevalence reported a combination of otosclerosis with SSCD was 5.3% of temporal bone dissected. Symptoms of SSCD can be masked by an otosclerotic stapes and unmasked after removing the fixation in stapes surgery. The most common postoperative

complaint in stapes surgery with unknown SSCD is the absence of hearing gain and vestibular symptoms.

Conclusions: SSCD concomitant with otosclerosis should be ruled out in all patients performing pre-operatively CT scan in order to decide the better option of treatment for the patient.

R-149 Session S18

Surgical indications for the inner ear malformation associated with bacterial meningitis

Shimada Dias M.¹, Hasegawa T.¹, Nakamura K.¹, Kase K.¹, Ito M.²

¹ Otolaryngology Department, Jichi Medical University Hospital, Japan

² Pediatric Otolaryngology Department, Jichi Medical University Hospital, Japan

Introduction: Childhood bacterial meningitis is a life-threatening infection with high mortality. Especially recurrent bacterial meningitis is mostly associated with inner ear malformations and cerebrospinal fluid (CSF) leaks. Inflammation in bacterial meningitis can spread to healthy ears and cause bilateral deafness in some cases. In recent years, newborn hearing screening made it possible to detect the congenital hearing loss. With the help of further imaging inspections, inner ear malformations have been increasingly diagnosed without any signs of meningitis. Early diagnosis of the underlying pathology is vital to prevent the occurrence of bacterial meningitis.

Objectives: We would like to discuss the surgical indications to prevent bacterial meningitis secondary to malformation of the inner ear.

Methods: We present two cases of congenital inner ear malformations wherein surgical repair of the CSF leak was performed.

Results: Case 1 was a bilateral case of hearing impairment due to inner ear malformations, while Case 2 was a unilateral case (both TP-I). Case 1 was diagnosed as having an inner ear malformation on CT at 2 years of age, and a CSF leak in the right ear was suspected. The patient developed bacterial meningitis at 5 years and 4 months. He underwent surgical repair of the CSF leak of the right inner ear by stapedectomy. The CSF leak stopped after surgery, but unfortunately, hearing loss of the good hearing ear due to bacterial meningitis was observed, and cochlear implant surgery was performed. On the other hand, in Case 2, an inner ear malformation (TP-I) was diagnosed during an examination for unilateral hearing loss. There was no history of meningitis or any findings of CSF leak on preoperative CT, but the patient underwent exploratory surgery. Since there was a small hole in the stapes footplate, surgical repair of the CSF leak was performed in Case 2.

Conclusions: Early identification of the specific types of inner ear malformations and determining the associated risk of meningitis are very important. In cases of inner ear

malformations with a high risk of CSF leakage and bacterial meningitis, surgical repair of the CSF leak should be considered before bacterial meningitis develops.

R-150 Session S24

Surgical treatment for intratemporal tumors of facial nerve

Diab K.M., Nazhmudinov I.I., Karayan A.S., Kondratchikov D.S., Mikhalevich A.E.

Federal Scientific-Clinical Center of Otorhinolaryngology of Federal Medical Biological Agency of Russia, Moscow, Russia

Introduction: Neuroma and hemangioma are the most common primary tumors of the facial nerve. Neurofibroma, granular cell tumor, meningioma, and primary glomus tumor are less common. The management of patients with intratemporal tumors of the facial nerve has evolved from performing microsurgical excision with the restoration of the facial nerve to more conservative techniques as nerve preservation. It includes expectant management with careful observation, nerve decompression, and stereotactic radiosurgery.

Objectives: To improve the effectiveness of surgical treatment of patients with intratemporal tumors of the facial nerve.

Materials and Methods: 23 patients with facial nerve neoplasms were operated. 11 cases consist of nerve plasty by either direct neuroraphy end-to-end. If it was impossible to compare the ends of the nerve, an autograft from a great auricular nerve or sural nerve were used.

Results: A direct neuroraphy and plastics autograftom conduction allowed to improve the function of mimic muscles by 1 step on the House-Brackmann scale. During the observation period, the tumor recurrence was not detected in all 22 patients cases, who have benign neoplasms of the facial nerve. This is what the MRI results confirmed.

Conclusions: The efficiency to the surgical treatable of facial nerve tumor and neoformation functions are linked to its on-time definition based on modern X-ray examination, the prevalence rate of tumor stage and time duration of paresis.

R-151 Session S23

Ten-year outcomes of middle ear surgery

Watanabe T., Kunimoto Y., Yazama H., Takeuchi H.

Department of Otolaryngology, Head and Neck Surgery, Faculty of Medicine, Tottori University

Objectives: There are few reports of long-term outcomes, including pure-tone audiometry, for 10 years after middle ear surgery. The goal of middle ear surgery is to reduce recurrent cholesteatoma associated with postoperative retraction pockets and to improve hearing outcomes. Hence,

in our department, for cases requiring reconstruction of the scutum and posterior wall of ear, the cartilage plate or thinly sliced cartilage is used. In this study, we investigated pneumatization, retraction pockets, containment of cartilage reconstruction, and hearing results. The necessity of follow-up was confirmed up to 10 years after surgery.

Materials: Patients who underwent middle ear surgery at our hospital from 2003 to 2008 with evaluable outcomes for more than 10 years after the last surgery were included. This evaluation of hearing results was possible in 24 patients.

Methods: The reasons and frequencies of visits, retraction of the tympanic membrane, and ear condition were investigated retrospectively from the medical records 10 years after surgery. The frequency of the procedure was assessed at 10 years postoperatively. Hearing results were compared based on the disease. A four-tone average according to the AAO-HNS guideline was used for evaluation of the hearing results. Values of 2 kHz and 4 kHz were averaged and substituted by 3 kHz. The frequency, which was the scale out, was calculated as the maximum threshold + 5 dB. The difference between the preoperative bone conduction threshold and postoperative air conduction threshold was used to calculate the air-bone gap. We examined short-term (6–24 months) and long-term (10 years) outcomes after surgery. Hearing results were considered satisfactory if the air-bone gap was within 20 dB.

Results: The patients included 11 with cholesteatoma, 5 with congenital cholesteatoma, 6 with chronic otitis media, 5 with adhesive otitis media, 4 with tympanosclerosis, 7 with postoperative ear infections after procedures performed at other institutions, and 1 with otosclerosis. The surgical procedures included tympanoplasty type I (6 cases), tympanoplasty type III (26 cases), tympanoplasty type IV (2 cases), stapes surgery (1 case), radical mastoidectomy (2 cases), and modified radical mastoidectomy (2 cases). Eighteen (46.1%) cases required continuous treatment. The average frequency of hospital visit was 6.7 months. Seventeen (43.5%) cases underwent no treatment. The retraction was confirmed in 3 (7.7%) cases and erosion of the tympanic membrane was noted in 2 (5.1%) cases. The reconstructed cartilage was dislocated in a few cases, but there was no case of cartilage absorption or defluxion. The short-term postoperative hearing was satisfactory in 12 (50%) patients, and a long-term postoperative hearing was successful in 8 (33.3%) patients.

Conclusions: In this survey, the results were acceptable because cartilage engraftment was satisfactory even after 10 years with the negligible incidence of tympanic membrane retraction.

R-152 Session S19

The accuracy of diagnostic methods for Eustachian tube dysfunction: time to revise how we diagnose ETD?

Smith M.E.¹, Takwoingi Y.², Deeks J.², Alper C.³, Bance M.L.¹, Bhutta M.F.⁴, Donnelly N.¹, Poe D.⁵, Tysome J.R.¹

¹ Cambridge Ear Institute, University of Cambridge, Cambridge, UK

² Institute of Applied Health Research, University of Birmingham, Edgbaston, Birmingham, UK

³ Children's Hospital of Pittsburgh, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA

⁴ Brighton & Sussex University Hospitals NHS Trust, Brighton, UK

⁵ Boston Children's Hospital, Boston, Massachusetts, USA

Objectives: Eustachian tube dysfunction (ETD) is usually diagnosed via clinical history, examination, and tympanometry, as no gold-standard diagnostic test exists. We explored the role of objective tests of ET function and patient-reported outcome measures (PROMS) in diagnosis, and the relationship between ET function, patient symptoms and expert diagnosis. We aimed to 1. Generate different diagnostic reference standards for ETD using expert panel consensus and latent class analysis; 2. Calculate diagnostic accuracy of ET-opening tests ($n = 14$), patient-reported outcome measures (PROMS, $n = 2$) and the expert panel for ETD.

Materials and Methods: 116 participants with symptoms or findings suggestive of ETD underwent all tests and PROMS. Participants were diagnosed by an international expert panel blinded to the test results. Test results, PROM results, and diagnoses were assessed for correlation. Test and PROM diagnostic accuracy was calculated using both the expert panel consensus diagnosis and latent class analysis (removing the requirement for an established reference diagnosis).

Results: The results of different tests of ET opening correlated strongly. PROMs and expert panel diagnoses correlated poorly with measured ET opening. Latent class modeling suggested obstructive ETD is overdiagnosed clinically, while PROMs and opening tests may be a more reliable model for diagnosis. Tubomanometry and sonotubometry had the highest diagnostic accuracy, and tympanometry was highly specific.

Conclusions: Current clinical diagnostic methods for ETD appear flawed. PROMs and objective tests should be used alongside PROMS when selecting patients for interventions or measuring treatment outcomes.

R-153 Session S17**The Advanced Bionics Naida Link UP and CROS: our experience at a single United Kingdom Centre****Vithlani R.H., Baillieu K., Hill F., Nunn T., Jiang D., Powell H., Pai I.***Hearing Implant Centre, Ear, Nose and Throat (ENT) Services, St Thomas' Hospital, London, UK*

Objectives: To describe our experience and patient-reported outcomes of the Naida Link UP (NL-UP) and Naida Link CROS (NL-CROS) in adult patients with bilateral sensorineural hearing loss, who received a unilateral Advanced Bionics cochlear implant (CI).

Materials and Methods: All patients implanted with an Advanced Bionics cochlear device using a Naida Q70 or Q90 were offered a trial with either the NL-UP or NL-CROS. Data were collected prospectively from those patients fitted with NL-UP or NL-CROS between December 2017 and February 2019, using two questionnaires: the Bern Benefit for Single-Sided Deafness (BBSSD) and the St. Thomas' CROS or Link UP Questionnaire. The questionnaires were administered after at least four weeks of device use.

Results: Over the study period 58 patients were fitted with NL-CROS aid and 30 patients with NL-UP. 19 patients with the NL-CROS and 17 patients with the NL-UP completed both questionnaires giving an overall response rate of 40.9% (NL-CROS 32.7% and NL-UP 56.7%). Over the follow-up period 5 (16.7%) patients converted from the NL-UP to the NL-CROS as all of them had stopped wearing the hearing aid in the contralateral ear after CI activation. 5 (16.7%) patients requested a change from the Phonak Adaptive Bimodal Digital prescription. They reported the bimodal prescription to be too boomy and drowning out the sound from the CI. 1 (3.3%) patient returned her NL-UP as it detracted from the clarity of the CI and she did not enjoy the ear mold. 4 (6.9%) patients returned the NL-CROS they did not perceive any benefit. 1 (1.7%) patient returned the NL-CROS as he could not put it in his ear and 1 (1.7%) patient lost the NL-CROS after 2 months. In general, patients preferred to wear either device: NL-CROS 52.6% (10/19) and NL-UP 76.5% (13/17) than to not wear it: NL-CROS 10.5% (2/19) and NL-UP 5.9% (1/17). However, both sets of patients reported that the implant battery does not last as long when wearing either device. Specifically, the CROS battery lasts about 3 days with average use. Our patient reported outcome measures (PROMs) demonstrate that the overall benefit (BBSSD on a scale of -5 to 5) of using either device is 2.61 (NL-UP 2.73 and the NL-CROS 2.5). Specifically, the NL-UP was much more useful when using the TV or Radio (2.03 vs 1.22) or when listening to music (1.85 vs 0.41). However, the NL-CROS was much more useful when having a conversation in the car (2.11 vs 1.81). Interestingly both seemed to only have a limited benefit on following a conversation in background noise (NL-UP 1.27 vs NL-CROS 1.13).

Conclusions: We found that patients enjoy using both devices. Patients found the NL-UP much more useful when listening to music or watching TV, whereas patients with the NL-CROS found it much more useful having a conversation in a car. If a patient had stopped wearing a hearing aid after activation of the cochlear implant, they were more likely to adapt to the NL-CROS. Both devices accelerate the rate of battery depletion. Our study is limited by numbers, response rate and follow-up period however we are continuing to collect prospective data in order to determine the significance of our findings.

R-155 Session Panel: Otology in Taiwan**The cutting edge development of endoscopic ear surgery in Taiwan****Chen C.-K.***Department of Otolaryngology, Chang-Gung Memorial Hospital, Chang-Gung Hospital, Taipei, Taiwan*

Minimally invasive surgery with better or equal outcomes has become the mainstream. Therefore, there are diverse techniques developed, such as the da Vinci robot system and endoscope. However, the equipment and cost of da Vinci robotic surgery is bulky and very high. Compared to conventional surgery, endoscopic surgeries have been proven that it can minimize the surgical wound and was widely applied in several specialties. In recent decades, the endoscope has been incorporated into ear surgery, namely, myringoplasty, tympanoplasty, cholesteatoma surgery, benign neoplasms of the middle ear, stapedectomy, and neuro-otological procedures. Furthermore, it has been suggested that preservation of as much normal middle ear mucosa with the endoscope can promote the reoperation of the mastoid cavity leading to better hearing outcomes in surgery. However, the endoscope remains a new tool for most otologists in the world. Most ear surgeons performed surgeries under the microscope and through the endoscope as a tool to observe. In this viewpoint, there is similar work to follow the microscope. We started a totally endoscopic tour more than 7 years ago. The modern endoscopic technique has been improved and changed our ways including diagnosis and treatment to patients. Different angles the endoscope supplies, different perspective anatomies come out. The result may be similar, but the process is different. Moreover, the endoscopic technique and advanced monitor are still developing year by year. Many instruments and smaller devices are also under-researched by many companies. The endoscopic ear surgery had become more popular between otologists in Taiwan in these years. We had many outstanding works and researches contributed in the endoscopic fields, such as anatomic studies, 3D endoscopic ear surgery, cochlear implant, stapes surgeries, comparison between endoscopic and microscopic surgeries and new techniques. In the conference, I will present some experience applying the endoscope to ear surgeries and focus on how the endoscope change clinical otologic practice. Our present is not only to offer a successful way to extend using the endoscope in ear surgery but also a reference in the development of endoscopic ear surgery.

R-156 Session Panel: Otology in Taiwan**The deep learning-based noise reduction technology for cochlear implant recipients**

Lai Y.-H.

Department of Biomedical Engineering, National Yang-Ming University, Taipei, Taiwan

The cochlear implant (CI) is one of the popular assistive listening devices for deaf hearing loss individuals. The CI is surgically implanted electronic devices that provide a sense of sound in patients with profound to severe hearing loss. The considerable progress of CI technologies in the past three decades has enabled many CI users to enjoy a high level of speech understanding in quiet. For most CI users, however, understanding speech in noisy environments remains a challenge. In this talk, I will present the proposed approach, called NC+DDAE, to improve the performance of speech intelligibility in noisy listening conditions for CI recipients. In a series of extensive experiments, we conduct qualitative and quantitative analyses of the NC module and the overall NC+DDAE approach. The results of this study suggest that the proposed deep-learning based NR approach can potentially be integrated into existing CI signal processors to overcome the degradation of speech perception caused by noise. Then, I will share further ideas for the future of this technology at the end of this talk.

R-157 Session S14**The development of discrimination abilities in infants and toddlers with CI**

Paluch P.¹, Kochański B.¹, Ganc M.², Wojciechowski J.¹, Pluta A.¹, Milner R.², Skarżyński H.³

¹ Bioimaging Research Center, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

² Department of Experimental Audiology, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

³ World Hearing Center, Warsaw, Poland

Introduction: Nowadays, children that are congenitally deaf can regain their hearing at a very young age via a cochlear implant (CI). The knowledge about the neural development of children's auditory and linguistic skills after the implantation remains, however, scarce. Cortical auditory evoked potentials (CAEPs) allow for measuring the neural correlate of preattentive auditory discrimination – mismatch response (MMR). There are only a few studies that examine how mmRs in response for speech-like stimuli develop in time in a group of early implanted children. Thus, it is not much known how discrimination abilities develop in such clinical group.

Materials and Methods: Twenty-four children with bilateral congenital hearing loss that received a unilateral CI between 0.7 and 2.5 years, participated in a longitudinal CAEPs study. The passive oddball paradigm with /ga/ and /ba/ phonemes as auditory standard and deviant

stimuli were used to record mmR wave. The mismatch responses' amplitudes and latencies at each time interval were analyzed. Measurements were undertaken at three-time points after cochlear implantation (approximately 5, 9 and 14 months after switch-on).

Results: In the studied group of children with CI the mismatch responses with proper morphology and explicit amplitude were identified at each time interval. During the first months after implantation the significant increase of mmR amplitude was reported ($p < 0.05$). Its amplitude was the highest at the last time interval (14 months after CI).

Conclusions: The gradual increase in mmR amplitude in the first 14 months after cochlear implantation show in an objective way that children's auditory discrimination abilities systematically improve. Further research is needed to establish how their development differs from their typically hearing peers.

This research is funded by the National Science Centre (2013/08/W/HS6/00333).

R-158 Session S03**The dose and commencement time-dependent manner of application of EGF on the regeneration of traumatic eardrum perforation**

Zheng-Cai L.

Department of Otorhinolaryngology, Yiwu Central Hospital, Yiwu City, China

Objectives: To determine the optimal dose and commencement time of application of epidermal growth factor (EGF) for the regeneration of traumatic tympanic membrane perforations (TMPs).

Materials and Methods: Patients with traumatic TMPs involving more than 25% of the eardrum were first randomly assigned to low-dose EGF, high-dose EGF, and spontaneous healing groups. Then, the same patients were retrospectively analyzed based on the start time of treatment at 6 months. These participants of EGF group were then subdivided into Group A (duration of perforation \leq Day 3) and Group B (duration of perforation $>$ Day 3), while the spontaneous healing group was divided into Group C (duration of perforation \leq Day 3) and Group D (duration of perforation $>$ Day 3). The closure times, closure rates, infection rate, and hearing gain were compared among the groups at 6 months.

Results: The closure rates in the low-dosage EGF, high-dosage EGF and spontaneous healing groups were 93.8%, 89.1%, and 83.3%, respectively, and the difference was not significant ($P = 0.315$). The mean closure time was 10.20 ± 5.13 days in the low-dosage EGF group, 14.39 ± 6.20 days in the high-dosage EGF group, and 33.17 ± 16.37 days in the spontaneous healing group; the difference was significant ($P < 0.001$). In addition, there was no significant difference in closure rate among Groups A, B, C, and D.

However, the mean closure time was significantly different ($P < 0.001$). **Conclusions:** Daily application of EGF shortened the closure time of traumatic TMPs compared to those that healed spontaneously. It was found that daily application of EGF produces a moist, but not wet, perforation edge and middle ear environment. In addition, the best commencement time to EGF treatment for traumatic large TMPs is more than 3 days after perforation, which is the proliferative stage of eardrum healing.

R-159 Session S03

The EarWay™ PRO a novel device for evaluation of cerumen

Katzenell U., Bartov N.

Department of Otolaryngology Head and Neck Surgery, Kaplan Medical Center, Rehovot, Israel

Objectives: The EarWay™ PRO is a device for the evacuation of cerumen from the external auditory canal. It offers a novel approach for the evacuation of cerumen in the office. The coiled tip engulfs the cerumen which is then pulled out of the ear. The device is made of flexible soft low-density polyethylene which is intended to minimize pain and prevent injury to the external auditory canal. The objective of this study is to assess the efficacy and safety of the device.

Methods: The research was conducted in the Department of Otolaryngology Head and Neck Surgery in Kaplan Medical Center which is a secondary hospital and was approved by the institute's ethical comity. Patients with cerumen were treated with the EarWay™ PRO device. The efficacy, safety, and pain were evaluated by scales developed for the purpose of this experiment. The wax obstruction scale was assessed before and after the procedure. Improvement in two grades was calculated as a success. Grade 0 is total obstruction of the canal with cerumen and the tympanic membrane (TM) cannot be seen. Grade 1 is one-quarter of the TM can be seen, grade 2 is 2 quarters, grade 3 is three quarters, grade 4 is four quarters and grade 5 means that the canal is completely clean of cerumen.

Results: A total of 59 ears in 46 patients were treated with the EarWay™ PRO device. There were 24 males and 22 females. 17 (37%) of them suffer from recurrent cerumen impaction and 15 (32.6%) use cotton swabs frequently. 13 (28.3%) complain of hearing loss. 52 (88%) of the ears had hard cerumen and 7 (12%) ears had soft to liquid cerumen. The procedure was successful as defined by the cerumen obstruction scale improvement in 51 (86.4%) ears. In 48 (83%) ears there was no pain or mild pain and 9 (20.4%) patients had pain which was substantial. In 40 (70%) patients the cerumen was evacuated easily and in 17 (29%) patients the procedure was more difficult and 2 (3%) patients asked for abortion of the procedure due to sensitivity in the ear canal. All patients had the ear canal and tympanic membrane inspected with a microscope at the end of the procedure. 56 (95%) ears had no injury what so ever to ear. 3 (5%) patients had a mild irritation and redness of the ear canal, but there were no cases of lacerations or haematoma. The median time of treatment was

30 seconds (minimum 2 seconds and a maximum 240 seconds, SD 42.1). The median times of insertion of an EarWay™ PRO to an ear in one procedure was 2 (minimum 1 and maximum 7, SD 1.3).

Conclusions: The EarWay™ PRO is an effective and safe device for the evacuation of cerumen. Unlike other tools which can be used only by Ear Nose and Throat surgeons under direct inspection to prevent injury and pain. The EarWay™ PRO can be used blindly and therefore can be used by the general practitioner, pediatricians, and audiologists.

R-160 Session S19

The effect of balloon dilatation Eustachian tuboplasty combined with grommet insertion on the structure and function of Eustachian tube

Li L., Fan Z.M., Han Y.C., Wang H.B.

Otology Department, Shangdong Provincial ENT Hospital affiliated to Shandong University, Jinan, P.R. China.

Objectives: To evaluate the effect of balloon dilatation Eustachian tuboplasty (BET) combined with grommet insertion on the function of the Eustachian tube and the opening of the Eustachian tube.

Materials and Methods: 27 patients with refractory otitis media with effusion were enrolled to evaluate the changes of Eustachian tube function before and after BET combined with grommet insertion. Three-dimensional reconstruction of iohexol enhanced CT image was used to evaluate the structural and volume changes of the Eustachian tube at the state of resting and Valsalva maneuver. Grommet was removed one month after the operation and followed up for 6–23 months. The appearance of tympanic membrane, pure tone hearing threshold, Eustachian tube score (ETS), quantitative examination of Eustachian tube function (dynamic observation of tympanogram peak pressure point) and the results of CT examination of the Eustachian tube were observed before and after the operation. The pure tone hearing threshold, air-bone conduction gap and open volume of the Eustachian tube were compared before and after the operation with paired t-test. Spearman correlation analysis was made between the open volume of the Eustachian tube and quantitative examination of Eustachian tube function.

Results: The pure tone auditory threshold at the time of 1,3,6 months after the operation was significantly lower than those before the operation, respectively (all $P < 0.05$). There was no significant difference between the pure tone auditory threshold at the time of 3 months and 6 months after the operation. So was the air-bone conduction gap. The quantitative examination peak pressure deviation of Eustachian tube function was significantly increased at the time of 3,6 months after operation compared with that before the operation, respectively (all $P < 0.05$). The peak pressure deviation at the time of 6 months was higher than 3 months after operation ($P < 0.05$). The ETS at the time of 1, 3, 6 months after the operation was significantly higher

than that before operation (all $P < 0.05$). There was also a significant difference between 3 months and 6 months post operation of ETS ($P < 0.05$). The quantitative examination peak pressure deviation of Eustachian tube function and ETS score were both correlated with the change of open volume of the Eustachian tube according to three-dimensional CT reconstruction ($P < 0.05$).

Conclusions: After balloon dilatation to the Eustachian tube, the Eustachian tube orifice was enlarged and the open volume of the Eustachian tube was increased. Eustachian tube balloon dilation can effectively improve the active and passive opening function of the Eustachian tube. Eustachian tube balloon dilatation combined with grommet insertion is an effective treatment for refractory otitis media with effusion.

R-161 Session S24

The effect of surgical repairment on facial nerve function reconstruction

Li L., Fan Z.M., Han Y.C., Wang H.B.

Otology Department, Shangdong Provincial ENT Hospital affiliated to Shandong University, Jinan, P.R. China.

Objectives: To evaluate the effect of nerve repairment after resection of facial nerve lesion and the feasibility of using facial electromyogram motor unit potential (MUP) as a predictor for successful facial nerve reconstruction.

Materials and Methods: Data were collected for 28 patients undergoing nerve repairment after excision of facial nerve lesion regarding age, sex, the situation of facial nerve lesion, the defect degree of the facial nerve, the methods of nerve repairment, and facial electromyogram MUP. Facial nerve function was evaluated via the House-Brackmann grading system pre and 21 months post operation.

Results: The preoperational facial nerve function of the patients was grade I in 2 cases, grade II in 1 case, grade III in 2 cases, grade IV in 6 cases, grade V in 11 cases, and grade VI in 6 cases according to the House-Brackmann system. Facial electromyogram indicated that duration of MUP was prolonged in 23 cases compared with the healthy side. The MUP amplitude decreased on the ill side in 23 cases. MUP disappeared in 5 cases. Surgical methods for the patients who undertook partial facial nerve resection included great auricular nerve transplantation for 15 cases, sural nerve graft for 7 cases, hypoglossal nerve graft for 6 cases. Facial nerve function was grade III in 16 patients, grade IV in 10 patients, grade V in 1 patient, and grade VI in 1 patient after the operation. The first clinical movement was observed at the time of 4.76 ± 1.85 months (mean \pm SD). The maximal movement was seen at the time of 14.13 ± 5.30 months. With the use of electromyography, the first regeneration potentials were seen at the time of 4.06 ± 1.72 months. First MUPs were recorded after the third-month post operation. The MUP amplitudes of the facial muscles pre-operation were lower than that of post-operation. The MUP duration increased from 3 to 15 months post-operation but decreased at the time of 21 months post-operation. There was a significant difference

before and after the operation. The nerve function was significantly improved after the operation ($P < 0.05$). There was no correlation between the pre-operation and post-operation facial nerve function ($P > 0.05$). There was also no correlation between the time of facial paralysis preoperative and nerve function after the operation ($P > 0.05$). There was a correlation between MUP preoperative and nerve function after the operation ($P < 0.05$).

Conclusions: After the resection of facial nerve lesion, the facial nerve was interrupted or partial defect. As long as facial electromyogram indicated there was still existing motor action, facial nerve repairment should be performed, which could effectively prevent facial muscle atrophy. To avoid irreversible atrophy of the muscle and loss of nerve function, facial nerve transplantation or hypoglossal nerve bridge connection might be an effective rescue method when the facial nerve could not be reserved and directly rebuilt. Even if the facial muscle function recovered poorly, they could also provide the condition for the delaying repairment.

R-162 Session S19

The effect of topical xylometazoline on Eustachian tube function

Joshi K.S.¹, Ho V.W.Q.¹, Smith M.E.^{1,2}, Tysome J.R.^{1,2}

¹ University of Cambridge School of Clinical Medicine, Cambridge, UK

² Cambridge Ear Institute, Cambridge, UK

Introduction: Eustachian tube dysfunction (ETD) is a common but poorly understood cause of otological symptoms and an important predisposing factor in the development of middle ear pathology. Topical nasal decongestants are frequently used as part of the medical management of ETD, and for the prevention of baro-challenge induced aural symptoms when flying. However, there remains a lack of evidence surrounding the effects of decongestants on Eustachian tube function. Using an array of previously-documented techniques, we obtained objective measures of ET function before and after the nasal administration of xylometazoline in a healthy cohort to assess whether this nasal decongestant has an effect on ET opening in this group.

Objectives: To assess the effect of topical xylometazoline hydrochloride sprayed in the anterior nose on ET active and passive opening in healthy ears.

Materials and Methods: Volunteers were recruited from student and staff cohorts, with written consent obtained. All participants completed the Cambridge ETD Assessment (CETDA) patient-reported outcome measure to screen for ETD-associated symptoms. Baseline Eustachian tube function was assessed with: tympanometry, video assessment of tympanic membrane movement, sonotubometry, tubo-tympano-aerodynamic-graphy (TTAG), and tubomanometry. Together, these tests allowed measurement of both passive and active Eustachian tube opening. Following baseline recordings, volunteers self-administered

xylometazoline hydrochloride 0.1% as a spray in the anterior nose. Following a 15-minute interval, all function tests were repeated. Statistical analysis was performed using IBM SPSS Statistics (version 25.0) to assess any change in measures of ET function following the use of the decongestant spray.

Results: The final analysis included 21 ears from 21 subjects (13 males, 9 females). Resting middle ear pressure as measured through tympanometry was not significantly different from baseline following application of the decongestant (−13 daPa before, −9 daPa after; $p = 0.298$, Wilcoxon's signed-rank test). The rate of ET opening was not significantly different after the intervention, as measured by all function tests used (opening rate before/after xylometazoline: tympanometry 100%/95%; video assessment 81%/81%; sonotubometry 90%/90%; TTAG 81%/71%; tubomanometry 81%/80%). Analysis of continuous variables relating to ET opening did, however, reveal a difference between ET opening before and after xylometazoline, with a significant increase in the duration of ET opening as measured through sonotubometry ($p = 0.040$, Wilcoxon's signed-rank test). No difference was found in sonotubometry magnitudes (dB) or tubomanometry R values.

Conclusions: Our findings suggest that the normal rate of ET opening in healthy individuals is not altered with xylometazoline spray applied to the anterior nasal cavity. However, sonotubometry data suggest that xylometazoline spray reaches the Eustachian tube resulting in opening for longer. These findings suggest further investigation is warranted into the effect of xylometazoline in patients with obstructive Eustachian tube dysfunction.

R-164 Session Panel: Otology in Taiwan

The experience of Bonebridge implantation for microtia patients at Chang Gung Memorial Hospital in Taiwan

Chan K.-C.^{1,3}, Wallace C.G.², Chen H.-Y.^{2,3}, Wu C.-M.^{1,3}, Chen Z.-C.^{2,3}

¹ Division of Otology, Department of Otolaryngology, Chang Gung Memorial Hospital, Linkou, Taiwan

² Craniofacial Research Center, Division of Craniofacial Surgery, Department of Plastic and Reconstructive Surgery, Chang Gung Memorial Hospital, Taoyuan, Taiwan

³ School of Medicine, Chang Gung University, Taoyuan, Taiwan

Introduction: Bonebridge (BB) is a newly active transcutaneous bone conduction hearing implant that was first introduced in 2012, and has become commercially available in Taiwan since 2013. Most cases were implanted for microtia patients with congenital aural atresia at Chang Gung Memorial Hospital. Apart from the single BB implantation for hearing restoration, we also performed simultaneous auricular reconstruction for microtia and BB implantation for auditory rehabilitation. Herein we describe, for the first time, combined microtia reconstruction with BB implantation using a total of one or two surgical stages. We also evaluate the efficacy, safety, and morbidity of this dual system approach and highlight the surgical procedures.

Methods: Ten patients with unilateral or bilateral microtia underwent BB implantation combined simultaneously with either total auricular reconstruction using bespoke hand-carved Medpor framework or second stage auricular projection using autologous costal cartilage framework. Auditory aided and unaided sound fields were evaluated using (1) pure-tone average (PTA4), (2) speech reception threshold (SRT), and (3) Speech Discrimination Score (SDS) at a sound level of 65 dB SPL.

Results: No major complications were encountered. One patient developed minor partial skin graft epidermolysis that healed uneventfully and another required prolonged (three months) auditory acclimatization to the BB device. Postoperatively, mean aided PTA4 decreased by 35.35 dB, while SRT was 54.5 dB HL unaided and 28 dB HL with a BB sound processor. SDS increased by 16.4 % to 65 dB SPL.

Conclusions: Simultaneous BB implantation during total auricular reconstruction or framework projection for microtia patients who have aural atresia/stenosis is feasible and safe. This approach reduces operative stages, thereby minimizing schooling/occupational disruption and time to total microtia reconstruction and auditory rehabilitation.

R-165 Session S14

The outcomes of cochlear implantation in elderly patients: a single United Kingdom centre experience

Amin N., Wong G., Jiang D., Pai I.

Hearing Implant Team, Guy's and St Thomas' NHS Foundation Trust, London, UK

Introduction: The average life expectancy in the United Kingdom (U.K.) is currently nearly 80 years for a newborn baby. By 2040, nearly 15% of the population will be over 75 years old. There have been drives to support the ageing population to lead longer and healthier working lives and to address barriers that may limit later life learning. The perception that medical interventions aimed at improving quality of life are not cost-efficient for the elderly population is over simplistic and often inaccurate. Hearing impairment is one of the most common disabilities in the elderly with the prevalence of hearing loss in individuals aged 70–79 years was 55% rising to 81% in those over 80-year-old, of whom 7.5% had severe-to-profound hearing loss. As well as the reliance on hearing due to other reduced sensory perceptions, there has been much research into the negative impact of hearing loss on quality of life, physical activity, mood instability, social isolation, anxiety, depression, and dementia. Hearing rehabilitation in the form of both hearing aids and cochlear implants (CI) has been shown to improve quality of life. Careful consideration should be given to the potential impact of any associated co-morbidities on the perceived long-term benefit of CI in elderly individuals, as well as the potential risks of surgery.

Materials and Methods: A retrospective study of all patients who received a CI at ≥70 years was performed. Pure tone audiometry, speech perception using the

Bamford-Kowal-Bench (BKB) sentence test at 70 dB SPL in quiet conditions (BKBq) and imaging was performed. Additionally, some patients also had BKB in noise (BKBn) at +10 dB SNR and the Arthur Boothroyd (AB) word list speech perception test. There was a minimum of 12 months follow-up. Outcome measures included immediate and delayed surgical complications, post-operative speech perception scores, the ability to use the telephone with familiar speakers and patient-reported outcome measure using the *Glasgow Benefit Inventory Questionnaire* (GBI).

Results: Sixty-four patients aged ≥ 70 years (mean age 77.0 years) received a unilateral CI. Over 75% had significant systemic co-morbidities and three different cochlear implant manufacturers' devices were used. In 75% of the cases, there were no immediate post-operative complications. The most common complaint was dizziness (20%), but it resolved spontaneously in the vast majority. Two patients required explantation and re-implantation of CI and a total of two patients became non-users due to inadequate audiological benefit from their implant. The mean pre-operative scores BKBq scores improved from $19.2\% \pm 26.3$ to $77.9\% \pm 23.0$ ($p < 0.05$), with maximal benefit noted after 3 months. The mean BKBn scores increased from $10.8\% \pm 22.2$ to $55.5\% \pm 26.4$ postoperatively ($p < 0.05$). Following implantation AB words score statistically significant improved from $18.9\% \pm 18.9$ to $69.4\% \pm 15.5$ ($p < 0.05$). With all three tests there was no significant difference between the 70–79 and ≥ 80 s age group. Post-operative telephone significantly improved to 67.9% ($p < 0.05$) with a significant difference in outcomes between the different age groups. The GBI and each sub-domain scores showed a significant positive impact on patients' lives and their health status. The ≥ 80 years old subgroup had significantly less benefit in their overall GBI scores, most notably in the 'physical' domain.

Conclusions: Cochlear implantation is a safe and well-tolerated procedure in elderly patients. Significant improvements are observed both in audiological performance including telephone use, and in patient-reported outcomes using GBI, although the subjective report of improved health status and telephone use appears to be less pronounced in those over 80 years of age. Based on our experience, we recommend that elderly patients should not be discriminated against based on their age alone.

R-166 Session S01

The relationship between severity of hearing loss and tinnitus loudness

Aazh H.

Tinnitus & Hyperacusis Therapy Specialist Clinic, Audiology Department, The Royal Surrey County Hospital NHS Foundation Trust, UK

Introduction: Most people who experience tinnitus also have some form of hearing loss, but not all patients with hearing loss have tinnitus. To complicate matters, some people with normal hearing have tinnitus suggesting that hearing loss per se not be the dominant factor for the induction of tinnitus. Tinnitus patients often ask whether

the loudness of their tinnitus will increase if their hearing gets worse.

Objectives: The aim of this study was to assess whether the loudness of tinnitus is related to the severity of hearing loss.

Methods: This was a retrospective cross-sectional study on 445 consecutive patients who attended a Tinnitus and Hyperacusis Therapy Specialist Clinic in the UK. The results of audiological tests and self-report questionnaires were gathered retrospectively from the records of the patients. The multiple-regression analysis was used to assess the relationship between tinnitus loudness, hearing loss, and other variables.

Results: The regression model showed a significant relationship between the pure tone average (PTA) at the frequencies 0.25, 0.5, 1, 2, and 4 kHz of the better ear and the tinnitus loudness as measured via visual analogue scale (VAS), r (regression coefficient) = 0.022 ($p < 0.001$). This model was adjusted for the effects of anxiety, depression, insomnia, hyperacusis, age, and gender. The regression model explained 52% of the variance of tinnitus loudness.

Conclusions: Tinnitus patients often ask whether the loudness of their tinnitus will increase if their hearing gets worse. Our results indicate that tinnitus will likely get louder, but not by very much.

R-167 Session S13

The subjective assessment of a cochlear implant benefit in adults with the prelingual deafness

Kobosko J.¹, Geremek-Samsonowicz A.¹, Kochański B.², Pankowska A.¹, Barej A.¹, Skarżyński H.²

¹ Rehabilitation Clinic, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

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

Objectives: The perception of a cochlear implant (CI) benefit is an important factor in the assessment of the efficacy of that medical procedure. A considerable majority of studies on this topic focuses on people with the acquired deafness. For this reason, it would be interesting to learn how the CI benefits are perceived by adults with the prelingual deafness who have been using the device from childhood, adolescence or adult years. Another question investigated in this study is the relationship between the subjective assessment of CI benefit and the sociodemographic variables, variables related to the CI (e.g. age at the time of implantation) and deafness (e.g. knowledge of the sign language), and patients' psychosocial functioning (e.g. self-acceptance as a deaf person).

Materials and Methods: The study material included 95 persons with prelingual deafness, age between 18 and 45 years, 62% of them were women. Participants had one or two (18.9%) cochlear implants; had the first cochlear implantation at the age between 2 and 42 years. The

CI benefits assessment was done using the *Nijmegen Cochlear Implant Questionnaire* (NCIQ), other information and the measurement of self-acceptance as a deaf person on a VAS-type scale has been taken from the *Information Questionnaire*.

Results: The prelingually deaf CI users obtain the greatest benefits from the CI in the following fields/scales: *activity limitations* (AL – 75,1%), *social interactions* (SI – 74,1%), *basic sound perception* (BSP – 72%), and *speech production* (SP – 69,7%), and the least benefit in the *advanced sound perception* (ASP – 60,6%) and *self-esteem* (SE – 60,9%) scale. In the perception of CI benefit, an important role plays the biological age of the patient and correlated with it age at the time of first cochlear implantation. Younger persons, aged between 18 and 22, have obtained the highest scores in all NCIQ scales. The oldest persons, aged between 30 and 45, had the lowest scores. Age at the time of cochlear implantation is negatively correlated with the ASP, SP, BSP, and AL. The results show that the self-acceptance as a deaf person is positively related with the results in scales SE, AL, and SI, while knowledge of sign language has a weak negative correlation with the ASP and SP scale.

Conclusions: An important role in the subjective assessment of CI benefit plays the biological age of the studied persons and correlated with it age at the time of first cochlear implantation. Also important, especially with regard to the perception of CI benefits in the psychosocial sphere are such factors as self-acceptance as a deaf person, the network of available social support or knowledge of the sign language.

R-168 Session S06

The Upper Silesian Program of treating hearing loss with bone-anchored hearing aid - audiological analysis of implanted patients

Ślaska-Kaspera A., Przytula-Kandzia K., Markowski J.

ENT Department, School of Medicine, Medical University of Silesia, Katowice, Poland

Objectives: Bone-anchored hearing aids are a proven and effective way of treating hearing loss. According to the current state of knowledge, the indications for implanting implants anchored in the temporal bone include conductive hearing loss (one-sided and bilateral), mixed-type hearing loss (one-sided and bilateral) and one-sided deafness. The aim of the work is to present own experiences obtained at the Department of Laryngology, the Medical University of Silesia in Katowice.

Materials and Methods: The authors analyze the results of implants fixed in the temporal bone for bone conduction in 100 patients in 2008–2019 including sex, age, audiological indications, surgical technique, audiological benefits and improvement of quality of life.

Results: The analysis showed significant audiological benefits and improved quality of life among patients after

implantation of an implant anchored in the temporal bone for bone conduction.

R-169 Session S16

The use of the Vibrant Soundbridge with the short process coupler in patients with hearing loss and external auditory canal pathologies

Katzenell U.

Department of Otolaryngology Head and Neck Surgery, Kaplan Medical Center, Rehovot, Israel

Objectives: The of this case study is to describe the use of the Vibrant Soundbridge (MED-EL, Innsbruck) with the short process coupler in the rehabilitation of the hearing in patients with pathologies of the external canal that prevent the use of conventional hearing aids.

Methods: Two patients with canal pathologies that were operated in Kaplan Medical Center, Rehovot, Israel will be described.

Results: The first patient is a 40-year-old patient with a downsloping sensorineural hearing loss and a speech reception threshold of 45 dB in the right ear and 50 dB on the left. Repeated attempts to use hearing aids resulted in severe infections of the ear canals. The second patients is a 59-year-old patient with idiopathic complete stenosis of the external auditory canals that could not use hearing aids. Both patients underwent a Vibrant Soundbridge implantation with a short process coupler. Surgery was uneventful. Both patients are satisfied with the implant and use the processor all day. They report that they hear sounds that they have never heard before and understood speech much better and that the surgery improved their social interactions. They still find it difficult in a noisy environment. The first patient's unaided SRT was 60 dB HL and the aided is 20 dB HL. Monosyllabic aided word recognition test is 5% and unaided is 80% and bisyllabic unaided word recognition test is 15% and aided is 90%. The Second patient SRT improved from 50 dB HL to 35 dB HL, the unaided monosyllabic word recognition test is 25% and the aided is 60%.

Conclusions: This case study demonstrated that the Vibrant Soundbridge is effective in hearing rehabilitation of patients with hearing loss that can not use conventional hearing aids.

R-170 Session S09

Therapeutic effect of personalized vestibular rehabilitation training on refractory vertigo

Wang J., Lin C.J., Zhou Y.J.

ENT Hospital of Fudan University, Shanghai, China

Objectives: Get to know how to develop the strategy of a personalized vestibular rehabilitation program, and

clarify its improvement and treatment effect on subjective symptoms and objective indicators of refractory vertigo.

Materials: SAS, DHI and ABC scales, videonystagmography, dynamic and static posturography.

Methods: Forty patients with refractory vertigo who met the inclusion criteria were randomized into a medicine group and a rehabilitation group. The drug group was treated orally with medicines that promote vestibular function compensation, as well as the rehabilitation group developed a personalized vestibular rehabilitation program based on baseline assessment before the patient was enrolled. The patients were followed up at 2 weeks, 1 month, and 2 months after treatment. The data about symptom change, together with the SAS, DHI and ABC scales, as well as the abnormal results in objective evaluation tests at each treatment point, were collected and compared.

Results: Every group included 20 patients. There was no statistical difference in demographic characteristics such as gender, age, weight, and height. The SAS, DHI, and ABC scales in the rehabilitation group showed that there were statistically significant differences between the baseline scores and those at 2 weeks after treatment (the first follow-up), with *P* values of 0.002, 0.008, and 0.003, respectively. While the SAS scores in the medicine group showed that there were significant statistical differences compared the data at 2 months after treatment (third follow-up) with the baseline data, worthwhile the statistical difference for DHI scales was found at 1 month after treatment (second follow-up). *P* values were 0.011 and 0.002, respectively. There were no statistical differences in each follow-up about the ABC scales. The results of dynamic and static posturography showed that the vestibular sensation of 54.54% patients in the medicine group recovered completely after 1-month treatment, while 71.43% of patients recovered in the rehabilitation group. The data showed a significant statistical difference.

Conclusions: A personalized vestibular rehabilitation program can help rapidly improve the patients' state from the anxiety, the subjective feelings of dizziness and balance disorders, as well as the objective balance function of patients with refractory vertigo, which can promote the rapid establishment of vestibular compensation.

R-171 Session S12

Three-stage functional ear reconstruction for microtia with congenital aural stenosis

Li C., Fu Y., Zhu Y., Zhang T.

¹ ENT Institute, Eye & ENT Hospital, Fudan University, Shanghai, China,

² Department of Facial Plastic and Reconstructive Surgery, Eye & ENT Hospital, Fudan University, Shanghai, China

Objectives: For patients with microtia and congenital aural stenosis (CAS), the reconstruction of the auricle is performed by a plastic surgeon, and meatoplasty is performed by an otologist. There may be some deficiency in both cosmetic and hearing function due to the two

procedures being completed by two different surgeons. We propose a three-stage functional ear reconstruction for microtia with CAS.

Materials: From July 2009 to December 2017, 73 patients with CAS and microtia were enrolled in this study for three-stage functional ear reconstruction. The exact criteria for hearing reconstruction consisted of two items: (1) Jahrsdoerfer's score of no more than 6 based on HRCT of temporal bone; and (2) the normal position of the tegmen, with the lowest level superior to the roof of the superior semicircular canal on the coronal HRCT image.

Methods: We present our novel three-stage functional ear reconstruction for microtia with CAS. First-stage: it was similar to Nagata technique. The crus of the helix cannot too long, for we need the space for the next meatoplasty. Second-stage: it was a modified meatoplasty with endoaural-conchal incision, in which two local rotation flaps and a transposition split-thickness scalp flap were used to widen the stenotic external auditory canal (EAC) and reconstructed the tympanic membrane. Third-stage: it was a modified technique for the firm elevation of the reconstructed auricle by using the retro-auricular fascial flap wrapping a pre-embedded costal cartilage or porous polyethylene (Medpor) wedge as the strut.

Results: There were 73 patients completed the functional ear reconstruction. The mean age at surgery was 11.57 ± 5.24 years (range: 4–30 years). There were 78.0% of patients obtain serviceable hearing (ABG < 30 dB). Post-operation complications were found in 3 patients. Only 1 patient developed soft tissue aural stenosis, 1 patient developed cartilage absorption, and 1 patient developed framework infection.

Conclusions: Our novel three-stage functional ear reconstruction is a feasible strategy for microtia with CAS. The patients can obtain satisfactory auricle and serviceable hearing. The results are stable and can improve the life quality in both aesthetics and hearing functions.

R-172 Session S17

Towards a better understanding of electrocochleography: analysis of real-time recordings

Weder S.^{1,2}, Bester C.², Shaul C.², Briggs R.J.^{2,3}, O'Leary S.J.^{2,3}

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

² University of Melbourne Department of Surgery (Otolaryngology), Melbourne, Australia

³ Royal Victorian Eye and Ear Hospital, Melbourne, Australia

Objectives: Real-time electrocochleography (ECoChG) has been used as a monitoring tool during cochlear implantation (CI), whereby, amplitude drops have been correlated with postoperative acoustic hearing results. However, no consensus has been reached as to how a single event of an amplitude drop should be characterized. The aim of this study was to define ECoChG events by using

a receiver-operator curve (ROC) analysis. It was then investigated if these events lead to findings consistent with existing literature.

Materials and Methods: 55 patients were included in this prospective cohort study. Real-time ECoChG measurements were performed during CI electrode insertion. Single ECoChG events were characterized according to their amplitude loss at a fixed slope steepness. The most efficient cut-off criterion of the ROC analysis defined the threshold of an ECoChG event. Applying this definition, the number of events, the extent of amplitude loss, and the recovery rate were collected and correlated to surgical experience and acoustic hearing outcomes.

Results: The most efficient cut-off criterion was an amplitude loss of 61% of the ongoing signal. Three-quarters of our population had at least one such event during implantation. Most drops occurred shortly before full insertion. With the increasing number of drops, median residual hearing thresholds deteriorated for all frequencies. Larger amplitude drops had a tendency towards worse hearing preservation. Signal recovery after an ECoChG event could not be correlated to acoustic hearing outcomes.

Conclusions: Our data suggest that amplitude drops exceeding 61% of the ongoing signal are correlated with worse acoustic hearing preservation. Multiple such events put the acoustic hearing at greater risk. Spontaneous signal recovery of the real-time signal is a poor predictor of hearing preservation. These results are the first step towards an automated intraoperative feedback tool to guide surgeons during electrode insertion, by describing ECoChG patterns and outcomes. Furthermore, well-characterized ECoChG events provide a framework for the objective definition of ECoChG events, as will be required for comparison between studies and benchmarking.

R-173 Session S07

Transcanal pedicled clip tympanoplasty: a novel technique for closure of central tympanic membrane perforations

Arslan S.

Department of Otorhinolaryngology Head and Neck Surgery, Karadeniz Technical University, School of Medicine, Trabzon, Turkey

Objectives: To describe a novel technique of Type I tympanoplasty to repair central tympanic membrane perforations.

Materials and Methods: Five patients with conductive hearing loss of up to 40 dB in any frequency and central tympanic membrane perforation of 30% to 60% of the pars tensa were operated. All operations were performed under general anesthesia by the same surgeon (the first author, AS) with the operating microscope, Zeiss S88. The external ear canal and ipsilateral tragal donor graft site was infiltrated with lidocaine and adrenaline solution. A canal incision of 12 to 6 o'clock direction was made and a tympanomeatal flap was formed elevating the posterior annulus. The margins of the tympanic membrane perforation

were de-epithelialized circumferentially. Tragal cartilage was used as the graft material to repair tympanic membrane perforation. Tragal cartilage graft of 8 x 8 mm dimensions with intact perichondrial layer on both sides were harvested for each patient. The perichondrium was peeled from the medial side to form a pedicle and that on the lateral side was raised 2 mm from all around the cartilage margin in a circumferential fashion to allow clipping into the tympanic membrane rest. The graft was shaped in size and a notch for malleus handle on the medial cartilage side was created for better fitting. The graft was held from the anterior margin by a fine cup microforceps and introduced under the tympanomeatal flap and over the malleus handle to cover the perforation. The cartilage was placed medial to the tympanic membrane rest and the raised perichondrium on the lateral side was draped over the annulus so as to create the "clipping". The elevated perichondrium on the medial side of the graft remained as a pedicle under the tympanomeatal flap. The graft was supported from the medial and lateral sides by flattened Gelfoam pledgets. The external ear canal was dressed with gelfoam. The final assessment of the surgical outcome was made after 6 months.

Results: The graft success rate of 100 percent. The mean air-bone gap closure was 15 dB in 3 patients and 10 dB in 2 patients.

Conclusions: Transcanal pedicled clip tympanoplasty can be considered as an alternative and less invasive technique for repair of select cases of tympanic membrane perforations. The technique is effective and associated with minimum morbidity.

R-174 Session S15

Tumours of the ear and temporal bone with facial nerve paresis

Chrobok V.¹, Černý M.¹, Dědková J.², Česák T.³, Kanta M.³, Laco J.⁴

¹ Department of Otorhinolaryngology and Head and Neck Surgery, University Hospital Hradec Králové, Charles University, Faculty of Medicine in Hradec Králové, Czech Republic ² Department of Radiology, University Hospital Hradec Králové, Charles University, Faculty of Medicine in Hradec Králové, Czech Republic

³ Department of Neurosurgery, University Hospital Hradec Králové, Charles University, Faculty of Medicine in Hradec Králové, Czech Republic

⁴ Department of Pathology, University Hospital Hradec Králové, Charles University, Faculty of Medicine in Hradec Králové, Czech Republic

Introduction: Tumours of the ear and temporal bone can be divided by different classifications. Primary tumours can be malignant or benign. Facial nerve paralysis is rare, but very important symptom of these tumours.

Case reports: authors demonstrate case reports: schwannoma n. VII and n. VIII, glomus jugulare tumour, adenocarcinoma and carcinoma of the external ear canal. Three tumours were benign and two malignant. Four cases had

preoperative facial nerve paresis; two cases had temporary and three permanent paresis.

Discussion: The most frequent malignant tumour is external ear carcinoma with late preoperative facial nerve paresis. A benign tumour is *glomus jugulare*, facial nerve paresis may result from nerve transposition during surgery. This damage can be called as iatrogenic well founded nerve paresis.

Conclusions: Facial nerve paresis is a very important symptom for prognosis, which should be discussed with the patient before and after surgery.

R-175 Session S23

Universalization of reconstruction the future of otology. UNISPRING – a new system of microprostheses. Coclusions after experimental clinical trial

Konior M.

Chair and Clinic of Otolaryngology, Jagiellonian University, Kraków

Objectives: The ideal operating method should be effective and safe and should be characterized at the same time by simplicity and low-cost application as well. In this spirit, attempts to find effective ways to restore the sound transmission and the possibilities of hearing improvement in ear surgery have been taking place since the idea of tympanoplasty has been implemented. The multiplicity of types of prostheses used in hearing improvement operations indicates the imperfection of the methods developed so far limiting their effectiveness to selected requirements. Units performing such procedures are forced to acquire many usually expensive prosthetic models. Therefore, it was necessary to create a prosthesis with wide adaptation possibilities, allowing for effective hearing improvement in various clinical situations. The heart of the new system is a spring-shaped element replacing completely or partially destroyed ossicular chain. The ease of spatial modeling of this element is the essence of the reconstruction process, for which the limit can only be defined by the imagination of otosurgeon. In addition, the simplicity of the structure is the chance for a significant reduction in manufacturing costs.

Materials: UNISPRING system was developed in the Department of Otolaryngology of the Jagiellonian University, Krakow in cooperation with the Department of Mechanics and Vibroacoustics of the University of Science and Technology in Kraków. Prosthesis UNISPRING was manufactured of biocompatible medical Titanium Grade ELI 5 certified to meet the requirements of the ASTM standard. The research program was divided into two parts: (1) pre-therapeutic phase – developing actions and cadaver exercises, (2) therapeutic phase – an experimental clinical trial.

Methods: The examined population of 13 patients was selected from the group of patients suffering from chronic otitis media (10 males and 3 females). They were qualified to surgical treatment including the reconstruction of

the ossicular chain. Every patient underwent the following procedures: otoscopic assessment, audiometric evaluation, subjective assessment of symptoms, microbiological tests. Additionally, histopathological examination and scanning microscopy were planned. Procedures mentioned above were realized in following terms: pre-surgical examination, surgical treatment, postoperative control in the following time intervals from surgery: 2 weeks, 1 month, 3 months, 6 months, 12 months.

Results: Experimental clinical trial implicated significant hearing improvement as the final result observed 12 months after the operation: average preoperative air-bone gap – 31 dB was reduced to average postoperative air-bone gap – 18 dB (from 23 dB of reduction for 125 Hz and 22 dB of reduction for 250 Hz to 5 dB of reduction for 8000 Hz). There is a significant reduction of the average threshold of understanding in speech test from 60 to 40 dB. Every patient reached 100% of understanding in speech test (sound level from 50 to 90 dB) Average understanding value for 80 dB was 90% – patients' subjective assessment indicates significant improvement (6.7 points) of symptoms perception: preoperatively 2.0 points; postoperatively 8.7 with excellent tolerance of prosthesis. None of the clinical situation was an indication for explantation of the UNISPRING prosthesis.

Conclusions: The evaluation of results presents the UNISPRING system as characterized by effectiveness in sound transmission, the safety of application, intraoperative comfort and ergonomics of modeling, versatility and functionality of the application, low-cost manufacturing. Based on the conducted clinical examination and obtained results, it can be concluded that the UNISPRING prosthesis is a safe and effective solution in the operative treatment of patients in the following surgical problems: incudostapedopexy (incudo-stapedial joint stabilization & reconstruction of the long process of the incus), maleostapedopexy, TORP, PORP, incudoplatinopexy, maleoplatinopexy.

R-176 Session S16

Use of IIOG classification to categorize middle ear surgery in children: evaluation after 3 months of use in 118 tympanoplasties

Denoyelle E., Alvin F., Simon F., Couloigner V., Leboulanger N., Loundon N., Garabédian E.N.

Department of Pediatric Otolaryngology Head and Neck Surgery, Necker-Enfants Malades Hospital, APHP and Paris Descartes University, Paris, France

Objectives: SAMEO-ATO classification is an international consensual classification, created by the International Otolaryngology Outcome Group using a modified Delphi method and published in 2018. This retrospective study in a pediatric otolaryngology department of a tertiary referral center aims to evaluate the reliability and facility of use of SAMEO-ATO middle ear surgery classification in a pediatric population.

Materials and methods: After 3 months of use of the classification in a tertiary referral center (starting in November 2018), the operative charts of all the pediatric middle ear surgeries in which the classification has been used were reviewed. Each surgical procedure was classified independently by both a junior and senior surgeon and compared to the IIOG staging written in the chart. In parallel, all the surgeons having used the classification received a questionnaire to assess their opinion after 3 months of use.

Results: From 1st November 2018 to 31st January 2019, the classification was used in 118 tympanoplasties performed by 11 surgeons (6 senior surgeons, 5 fellows). Surgical indications were tympanic membrane (TM) perforation (26), severe retraction pocket (36), cholesteatoma (55), and ossiculoplasty after temporal bone fracture (1). Staging errors are presented: the main error was confusions between Tn – Tx, T3 – T2 and Ox – On. Six surgeons gave a score of 4 (easy) and 5 surgeons a score of 5 (very easy). Two surgeons found the term «Tn, original tympanic membrane (TM) preserved» confusing when TM had been reinforced in a previous surgery, none of them experienced situations not provided for by the classification.

Conclusions: SAMEO ATO classification is suitable to categorize middle ear surgery in children, with a learning curve, and an error rate that should be reduced with some simple instructions for use.

R-177 Session S17

Use of intraoperative ECoChG in hearing preservation cochlear implant surgery

Cohen-Vaizer M.¹, **Fridman E.**¹, **Federman M.**², **Karawani H.**^{2,3}

¹ Otolaryngology Department, Rambam Health Care Center, Haifa, Israel

² Audiology Clinic, Rambam Health Care Center, Haifa, Israel

³ University of Haifa, Israel

Introduction: Hearing and structural preservation have been strongly associated with better outcomes in cochlear implantation (CI), resulting in lesser impedances and better word and sentences discrimination. Improvements in surgical technique and electrode design have significantly influenced these results. Nevertheless, hearing preservation scores are very variable among surgeons. In an attempt to improve these results and make them more reliable, the use of intraoperative ECoChG has recently been proposed as a mean to provide real-time feedback of the functional state of the cochlea to the surgeon.

Objectives: to test the potential benefits of intraoperative ECoChG to increase the rates of hearing and structural preservation in CI surgery.

Methods: This is a pilot, controlled, observational study. A group of 15 CI patients operated with the aid of intraoperative ECoChG is compared with a similar group of patients that were operated using a standard soft surgical technique without the aid of ECoChG.

Results: We observed differences between these 2 groups in terms of insertion time and strategy, electrical impedances. Hearing preservation was consistently achieved in 90% of patients intraoperatively and in 75% at 4 months follow-up. Additionally, we explored how the use of ECoChG can provide valuable information about the position of the tip of the electrode lead and depth of insertion.

Conclusions: Intraoperative ECoChG provides the most valuable real-time information for the surgeon affecting significantly the performance and results of CI surgery. We speculate that ECoChG should be a standard procedure in CI surgery. Additionally, it may be used to avoid the use of intraoperative imaging.

R-178 Session S10

Vestibular aspects of cochlear implantation in partial deafness treatment

Sosna M.^{1,2,4}, **Tacikowska G.**^{2,4}, **Pietrasik K.**^{2,4}, **Skarżyński H.**^{1,4}, **Lorens A.**^{3,4}, **Skarżyński P.H.**^{1,4,5,6}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

² Department of Otoneurology, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

³ Department of Auditory Implant and Perception, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

⁴ World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁵ Institute of Sensory Organs, Kajetany, Poland

⁶ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objective: The indications for cochlear implantation steadily broaden and now include cases with residual low-frequency hearing, unilateral deafness, already one-implanted ear, elderly patients. It requires a great emphasis to protect not only the cochlear but also the vestibular function. The aim of the study is to assess the impact of cochlear implantation on vestibular function with the application of hearing preservation techniques and to determine whether the type and insertion depth of the electrode has the impact on vestibular status after cochlear implantation.

Materials and Methods: The patients who underwent cochlear implantation procedure were divided into three groups according to the type of the electrode applied in cochlear implantation: straight electrodes, ultrasoft electrodes, and perimodiolar electrodes. Each patient was assessed with cVEMP, oVEMP, caloric tests, vHIT and fulfilled the questionnaire before and 6months after the operation.

Results: The incidence rate of vestibular damage was as follows: saccular damage (15,79%), utricular damage (19,04%), and a horizontal semicircular canal response reduction (15,79%). The best preservation of vestibulum was noticed in the groups with ultra-flexible electrodes (flex group). The group with straight flexible electrodes and pre-curved electrodes did not differ significantly in terms of vestibular preservation postoperatively. The insertion

depth of the electrode had no significant impact on post-operative vestibular function.

Conclusions: Hearing preservation techniques protect the function of the vestibulum. However, the risk of vestibular damage cannot be eliminated, despite using hearing preservation techniques.

R-179 Session S09

Vestibular testing and its relationship to symptoms and falls in 119 patients with bilateral vestibulopathy

Dobbels B., Lucieer F., Mertens G., Moyaert J., Van de Heyning P., Van de Berg R., Van Rompaey V.

Antwerp University Hospital, Maastricht University Medical Center, Netherlands

Introduction: To date, progress in vestibular testing has enabled to evaluate the semicircular canal (SCC) function in different frequency ranges and to assess otolith function. According to the recently established Bárány criteria, a diagnosis of bilateral vestibulopathy (BV) can be made when a bilaterally reduced function of the lateral SCC is measured by means of calorics, rotatory chair test or video head impulse test (vHIT).

Objectives: (1) To prospectively characterize the full pattern of vestibular impairment in patients with (BV), (2) to evaluate disease-specific vestibular patterns and (3) to investigate if the residual vestibular function is associated with the severity of symptoms and the fall incidence in BV patients.

Methods: In total, 119 BV patients were prospectively recruited at the ENT department of two tertiary referential hospitals. All patients had a BV diagnosis based on the diagnostic criteria established by the Bárány society. Calorics, rotatory chair test, vHIT in all six SCCs, and cervical vestibular evoked myogenic potentials (saccular function) were performed in all patients. Symptoms of severity was assessed by the *Dizziness Handicap Inventory* (DHI) and the *Oscillopsia Severity Questionnaire* (OSQ). In addition, patients were asked about experienced falls in the preceding year.

Results: Mean vestibulo-ocular-reflex (VOR) gain during vHIT for the anterior, lateral and posterior SCC was respectively 0.5, 0.41 and 0.4. Overall, a significant sparing of the anterior SCC was observed compared to the lateral and posterior canal ($p < 0.001$). This was disease-specific as no anterior SCC sparing was observed in DFNA9 and Meniere's disease. On the contrary idiopathic, infectious and ototoxic etiology was associated with anterior SCC sparing. The saccular function was bilaterally absent in 70% of BV patients, a unilateral cVEMP response could be measured in 21% of BV patients. There was no significant difference in saccular function between the different etiologies of BV. In 39% of BV patients, one or more falls in the preceding year were noted. Residual vestibular function was not related to the fall risk (nor single vestibular

test results (calorics, vHIT, rotatory chair, cVEMP), neither the sum of impaired vestibular tests). Likewise, vestibular test was not correlated with symptoms severity as captured by the DHI and the OSQ.

Conclusions: (1) BV patients express a very diverse pattern of vestibular impairment. Overall, the function of the anterior SCC seemed to be spared; (2) The pattern of vestibular (dys)function was found to be disease dependent as no anterior SCC sparing was observed in BV patients with DFNA9 disease and Meniere's disease; (3) Residual vestibular function is not a good predictor of symptoms and falls in BV patients.

R-180 Session S11

Virtual reality exercise program for peripheral vestibular deficit

Rosiak O., Gawronska A., Lucas W., Jozefowicz-Korczynska M.

Department of Otolaryngology, Balance Disorders Unit, Medical University of Lodz, Poland

Introduction: Peripheral vestibular loss is the most common cause of severe vertigo and nausea often resulting in absence from work and withdrawal from everyday activities. Vestibular rehabilitation is an established form of treatment for labyrinth dysfunctions. Nowadays, a novel form of therapy is introduced in rehabilitation – Virtual Reality (VR), where the patient can interact with a virtual world by his body movement, which is transferred by two types of sensors: motion trackers and force-plate platforms. Combining these two methods could produce better rehabilitation outcomes. Such devices, encompassing motion trackers and force platforms, are referred to as “hybrid” VR units.

Objectives: To assess the effectiveness of a low-cost hybrid VR vestibular rehabilitation program.

Materials and Methods: A prospective, non-randomized, controlled group study comparing training using a hybrid VR unit (Group 1, $n = 25$) vs static posturography with visual feedback (Group 2, $n = 25$) in patients with peripheral vestibular dysfunction was conducted. The subjects underwent 10 training sessions over 10 days (30-minute sessions). All were examined on a posturography platform at the start and 1 month after rehabilitation and completed the *Vertigo Symptom Scale-Short Form* (VSS-SF) questionnaire.

Results: Both groups demonstrated improvement in posturographic parameters, which were statistically significant, but when comparing results between both groups there were no differences. The patients reported improvement in their subjective perception of symptoms on the VSS-SF scale, which were statistically significant in both groups, but greater in the VR group.

Conclusions: Both methods reduce postural sway, however subjective reduction of symptoms was greater in the VR group.

R-181 Session S08**What can go wrong during stapes surgery – what to do and how to avoid it happening again**

Lavy J.

*Royal National Throat, Nose and Ear Hospital, London London Ear Clinic, UK***Objectives:** To outline specific steps that can go wrong in the course of stapes surgery.**Materials and Methods:** Surgical database.**Results and Conclusions:** The author will draw on his experience of over 2500 stapes procedures to outline the common intraoperative complications, what to do if they occur and how they can be avoided.**R-182 Session S16****Wideband absorbance in patients provided with middle-ear implants: a preliminary study**

Jędrzejczak W.W., Kochanek K., Śliwa L., Skarżyński H.

*Institute of Physiology and Pathology of Hearing, World Hearing Center, Kajetany/Warsaw, Poland***Objectives:** Wide Band Tympanometry is an objective method for assessment of middle-ear immittance

properties. The presence of a middle-ear implant, e.g. FMT, alters ear impedance and energy absorbance, which may influence middle ear functioning. This problem has not been investigated yet.

Materials and Methods: Energy absorbance (EA) was measured, with other characteristics, in the ears of a group of patients qualified for middle-ear implants. The tests were repeated in the postoperative period and the changes in EA properties were assessed.**Results:** The presence of FMT changes middle-ear impedance and influences energy absorbance in a specific frequency range. Low-frequency and high-frequency EA remains virtually unchanged. No significant influence on EA characteristics was observed.**Conclusions:** Middle-ear implant of FMT type, influences acoustic impedance and absorbance characteristic due to the increase of mass of the vibrating ossicular system. The observed effects conform qualitatively well to those predicted with the middle-ear model.**Posters****P-001****Analysis of the microbiome in the adenoids of Korean children with otitis media with effusion**

Hong S.M., Kim S.K., Hong S.J.

*Department of Otorhinolaryngology-Head and Neck Surgery, Dongtan Sacred Heart Hospital, Hallym University College of Medicine, Hwaseong, Korea***Objectives:** The adenoid pad, which is located between the orifice of the Eustachian tube (ET) and posterior nasal cavity, can affect the development of otitis media with effusion (OME) because of its anatomical location. The aim of the present study was to evaluate adenoid microbial colonization through 16S ribosomal RNA (rRNA) pyrosequencing, an advanced molecular-based technique, and to document the relationship with OME.**Materials and Methods:** Adenoid samples were collected using sterile cotton from a total of 32 children during ventilation tube insertion. Sixteen children with OME

who underwent tonsillectomy and adenoidectomy due to obstructive symptoms were assigned to the OME group and sixteen children without OME were assigned to the control group. We performed a 16S rRNA-based culture-independent survey of bacterial communities using the MiSeq platform.

Results: The diversity index, mean operational taxonomic units, and Shannon index were lower in the OME group than in the control group. A taxonomic analysis showed differences in microbiota distribution between the OME and control groups at the phylum, genus, and species levels. The analysis, which was based on weighted UniFrac distances, revealed differences in microbial composition between the two groups.**Conclusions:** Bacterial community analysis using 16S rRNA pyrosequencing allows us to understand the link between the microbial communities of adenoids and the development of OME better.

P-002

Application of detachable magnetic nerve stimulator in intraoperative facial nerve monitoring during ear surgeryOh S.-J., Choi S.W., Lee S., Lee B.J.*Department of Otorhinolaryngology and Biomedical Research Institute, Pusan National University Hospital, Busan, Republic of Korea*

Introduction and Objectives: Iatrogenic facial nerve (FN) damage is a serious complication during ear surgery. Although intraoperative neuromonitoring (IONM) of the FN is essential, repeated shifting between drill, surgical instruments and the nerve stimulating probe is cumbersome, time-consuming and even reducing the concentration of surgery. Therefore, we developed a detachable magnetic nerve stimulator (DMNS) that could be connected to metallic instruments. The aim of this study is to present our experiences of DMNS applying to surgical drill and various microsurgical instruments for the intraoperative neuromonitoring (IONM) of the FN during ear surgery.

Methods: FN in twenty patients that underwent canal wall up mastoidectomy or canal wall down mastoidectomy for chronic ear disease treatment were examined. We developed a DMNS that connected to surgical drill and instruments and assessed the electromyography (EMG) amplitudes of the FN using conventional nerve probes and drill, surgical instruments attached to the DMNS.

Results: The EMG amplitudes of the FNs at the 1.00 mA stimulation during drilling were analyzed. There was no significant difference in the EMG amplitude between nerve stimulating probe and stimulating burr using DMNS (nerve stimulating probe: 198~255µV, detachable magnetic nerve stimulator: 211~260 µV). Next, we compared the nerve stimulating probe and surgical instruments with DMNS with a stimulus of 0.35 mA, which showed no significant difference between the two methods.

Conclusions: The application of continuous FN stimulating burr and surgical instruments using DMNS is a safe, feasible and effective tool for FN stimulation and identification. It provides surgeons with time-saving, confidence and real-time feedback of the EMG response. Therefore, we suggest that this noble nerve monitoring system could be an essential, feasible guide for most otologic surgeons, especially for who is less experienced.

P-003

Application of osseointegrated attachments in managing traumatic auricle lossMrówka M.¹, Skarżyński P.H.^{1,2,3}, Porowski M.¹, Skarżyński H.¹¹ *Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland*² *Department of Teleaudiology and Screening, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland*³ *Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland*

The deformities of the auricle, congenital such as microtia, and acquired resulting from injuries, previous surgical interventions for oncological reasons, or unsuccessful attempts of auricle reconstruction in congenital deformities can be a cause of significant mental discomfort for the patient and a significant challenge for the physician.

Basing on the current state of knowledge in cosmetic medicine, the options include cosmetic reconstruction of the auricle, silicone prosthesis attached to spectacle frames (poorly accepted by patients) or a silicone auricle prosthesis attached to osseointegrated titanium screws.

In patients after trauma or previous surgical interventions, with scarring negatively affecting their local blood supply the chances of successful reconstruction from autogenous costal cartilage are compromised. In such cases, we propose using silicone prostheses fixed to attachments implanted in the temporal bone. The bone-anchored prosthesis is also recommended for elderly patients and for those who have lost their ears due to extensive oncological surgeries.

We present a case report of a patient with a posttraumatic defect in which we describe our technique of implantation of osseointegrated screws and making of a prosthetic auricle.

P-004

Are parents aware of hearing problems in their children? Results of hearing screening program in the Malopolskie voivodshipKunz K.¹, Świerniak W.², Skarżyński P.H.^{1,2,3}¹ *Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland*² *Institute of Physiology and Pathology of Hearing, World Hearing Center, Kajetany/Warsaw, Poland*³ *Institute of Sensory Organs, Kajetany, Poland*⁴ *Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland*

Objectives: The objective of the study was to compare the parents' opinion on the child's hearing problems with the hearing screening test results.

Materials: The hearing screening program took place in Poland including Malopolskie voivodship in 2015. The study included results of 10364 children (50,5% boys) attending the first class of the primary schools from Malopolskie voivodship, whose parents answer a question about their child's hearing problems.

Methods: Every parent was asked to complete a survey consisting of questions about their child's hearing. One of them was: 'Do you think your child has hearing problems?' with two possible answers 'Yes' or 'No'. Sensory Examination Platform and pure tone audiometry were used for this hearing screening program.

Results: Based on the hearing screening test, 18,1% of children had a positive result of hearing screening and 7,8% were assigned to the 'control' group requiring further observation. Only 6,6% of parents felt that their children had hearing problems, and such an assumption was confirmed in almost 40% of cases. Among parents who did not notice any hearing problems in their children, as many as 25% of children had a positive result of hearing screening or required further observation.

Conclusions: In the light of our findings, the general parents' awareness of their child's problems with hearing seems rather low; however, parents' indicating the possible hearing loss in their child seem to have reasonable suspicions. The results support the legitimacy of conducting hearing screening also in school-aged children, whose parents often do not even suspect the possibility of hearing loss.

P-005

Assessment of the effectiveness of the hearing aids for patients with sudden deafness

Sztabnicka A.¹, Cywka K.B.¹, Skarżyński P.H.^{1,2,3}

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Introduction: Sudden deafness is a hearing impairment which appears suddenly, without apparent cause, in most cases on one side with different levels of hearing loss, including total deafness. The medical definition of sudden deafness is a sensorineural deterioration of hearing by at least 30 dB at least three adjacent frequencies which grow no longer than 3 days. The prognosis as to the return of hearing is very different and depending on coexisting factors. The aim of the thesis is to evaluate the effectiveness of the use of hearing aids in patients with sudden deafness in which using pharmacological and therapeutic procedure has not produced the expected results.

Materials and Methods: The research group consisted of 20 patients after an incident of sudden hearing loss which use hearing aids for air conduction. In order to evaluate the effectiveness of the prostheses, we have performed

speech audiometry tests of and in the free field and conducted questionnaire surveys designed to identify patients' subjective opinions on the use of hearing aids in everyday situations.

Results: The analysis of completed questionnaires and conducted audiometric tests indicate no significant improvement in the quality and comfort of hearing after the application of hearing aids for air conduction.

Conclusions: Patients with sudden hearing loss often do not achieve the anticipated benefits of hearing aids in use. In the case of this group of patients the time in which the diagnosis was made is very important and therapeutic procedures applied. With the extending of the eligibility criteria for implantation of cochlear implants, patients with sudden deafness who do not benefit from hearing aids may be implanted users.

P-006

Assessment of health-related quality of life in cochlear implant users

Obrycka A.¹, Lorens A.¹, Skarżyński P.H.^{1,2,3}, Skarżyński H.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: According to Health Technology Assessment guidelines it is required to include the Health-Related Quality of Life (HRQoL) evaluation in the assessment of health effects. Moreover, a standardized and validated generic (non-disease-specific) instruments are recommended. So far most studies related to HRQoL assessment in the field of cochlear implants (CI) were performed with disease-specific questionnaires. The aim of this research is to assess the HRQoL in adult cochlear implant users with a generic questionnaire.

Materials and Methods: HRQoL was assessed in 124 adult cochlear implant users with AQL-8D questionnaire. Mean age at CI in the group was 54 years. The AQL-8D was distributed to the patients at CI activation and at 9 and 24 months of CI use. The HRQoL was analyzed in eight dimensions (Independent Living, Pain, Senses, Mental Health, Happiness, Coping, Relationships, Self-Worth), in two super dimensions (Physical and Psycho-Social), and as *Health Utility Index*.

Results: The median of the *Health Utility Index* increased significantly from 0.59 to 0.73 after two years of CI use ($p = .0002$). The significant improvement over two years of CI use was observed in five out of eight dimensions: Independent Living ($p = .003$), Senses ($p = 0.00004$), Mental Health ($p = .003$), Relationships ($p = .0002$) and Self-Worth ($p = .002$) as well as in Physical ($p = .0002$) and Psycho-Social ($p = .0004$) super dimensions.

Conclusions: Cochlear implantation improves the quality of life in both physical and psychosocial dimensions.

P-007

Assessment of middle-ear absorbance in PDT patients: a preliminary study

Kochanek K., Jędrzejczak W.W., Śliwa L., Skarżyński H.

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

Objectives: Measurement of middle-ear wideband energy absorbance (EA) is an objective method for assessment of middle-ear conduction properties. The presence of the implanted electrode may influence middle-ear impedance thus affecting energy absorbance. Till present, this problem has not been investigated in implanted partial-deafness (PDT) patients.

Materials and Methods: Energy absorbance (EA) was measured, with other immittance-related characteristics, in the ears of a group of PDT patients qualified for cochlear implantation. The tests were repeated in the postoperative period and the changes in EA characteristics were assessed. Acoustic ear model was used to interpret the results.

Results: The presence of an implant electrode introduces some changes to middle-ear energy absorbance, however, low-frequency and high-frequency EA remains virtually unchanged. We don't observe any meaningful influence on other immittance measures, either. In most cases, immittance characteristics of implanted PDT patients are similar to those of normal-hearing persons.

Conclusions: Preliminary results indicate that implant electrode in the ear implanted with low invasive, window approach method has little influence on transmission properties of the middle ear. This complies well with predictions from the ear model. The problem needs to be investigated in a greater population of PDT patients.

P-008

Assessment of psychomotor development of a child with cochlear implant

Ganc M., Kobosko J., Jędrzejczak W.W., Milner R., Skoczylas A., Ołdak M., Geremek-Samsonowicz A., Skarżyński H.

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

Objectives: The aim of the study was to evaluate the psychomotor profile of a child using a cochlear implant. The usefulness of the Polish test battery for the assessment of psychomotor development (KORP) was also examined.

Materials: This is a case study of a 4-year-old girl with bilateral profound hearing loss (hearing threshold evaluated by ABR test were > 100 dB for 1 kHz and 2–4 kHz). The

genetic basis of hearing loss was detected on the basis of molecular tests. The hearing of girl has been rehabilitated from 6 months of age using hearing aids on both sides. At the age of 2, she received a cochlear implant into the right ear because of too little benefit from hearing aids. Later the girl underwent speech therapy training 3–4 hours a week.

Methods: The psychomotor functioning of a child was evaluated after a 2-year period of cochlear implant use. The study was conducted using KORP, standardized for children from 1 month to 9 years of age. The psychomotor functioning of the child was assessed in the following 7 spheres: motor, fine motor skills and lateralization, visual perception and visual-motor coordination, communication and speech, emotions and social relations, development of behavioral functions and pre-school skills.

Results: Motor development both in the field of large motility, fine motor skills and lateralization of the examined girl was at the level corresponding to the biological age. Skills in the area of visual perception and eye-hand coordination, as well as the level of emotional and social development and behavioral functions, were located at a high level. Exercises that tested competencies in the area of communication and speech, as well as knowledge and learning skills, were the most difficult for the child. In comparison with the normative group, the results obtained by the girl in these spheres were at a low level, at the level of 2–3-year-old children.

Conclusions: The observed profile of psychomotor development of the examined child, showed developmental delays typical for children with deep prelingual deafness. KORP can be used as a tool to diagnose the psychomotor development of children with impaired psychomotor development.

P-009

Atrophy of the long crus of incus of unclear etiology

Skarżyński H.^{1,2}, Plichta Ł.¹, Włodarczyk E.², Skarżyński P.H.^{2,3,4}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

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

³ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Warsaw, Poland

⁴ Institute of Sensory Organs, Kajetany, Poland

Introduction: Study presents the case of a 27-year-old man admitted to our clinic with unilateral stable hearing loss in the right ear which had been present for about 10 years. Patient's medical history did not suggest inflammatory or trauma-related etiology of hearing loss.

Materials and Methods: Pure tone audiometry tests showed conductive hearing loss of 40 dB in the right ear and normal hearing in the left ear. Exploratory tympanotomy revealed atrophy of the distal 2/3 of the long process

of the incus, with a remnant thin strand of connective tissue joining the remnant of the long process of the incus with the stapes head. During reconstruction, the missing part of the incus was rebuilt using glass ionomer cement, with this strand serving as a core of the reconstructed part.

Results: The missing part of the incus was successfully restored preserving the mobility of the ossicular chain. Pure tone audiometry performed at 1 and 12 months after surgery showed improved hearing in operated ear and closure of the air-bone gap.

Conclusions: There are rare cases presenting with ossicular damage without a history of otitis media or head trauma in which etiology is not possible to ascertain. Alloplastic reconstruction of atrophied elements using a glass ionomer cement is an effective treatment method producing lasting hearing improvement.

P-010

Auditory stimulation of voice in the therapy of vocal fold nodules in children

Szkiełkowska A., Miaśkiewicz B.,
Krasnodębska P.

*Institute of Physiology and Pathology of Hearing, Kajetany/
Warsaw, Poland*

Introduction: Vocal fold nodules in pediatric patients are a difficult clinical issue because of numerous etiological factors, differences in children anatomy, characteristics of behavior and emotional attitudes in the developmental age and low efficacy of therapeutic procedures in such cases. The above-mentioned elements lead to recurrent episodes of this condition and have an impact on the effectiveness of treatment especially in school-age children.

Objectives: The aim of the research was to analyze the results of the novel auditory stimulation method applied in the therapy of vocal fold nodules in children.

Materials and Methods: Material includes 198 children in the age 7–12 years old; all children were examined laryngologically and phoniatrically. The following auditory tests were performed: auditory attention test, pitch differentiation test, and volume and sound length differentiation tests.

The therapy aimed to stimulate three crucial spheres, which are important in the pathomechanism of pediatric dysphonia, meaning hearing, voice, and emotions of the child. The biggest advantage of the therapy was the possibility to influence all the spheres in a child at one time, comprehensively. Auditory control in the process of voice production is an important element conditioning effectiveness of the continued rehabilitation of voice. Listening which is connected with the psychological activity of people directly influences human voice. Modifying the listening processes we can influence voice and speech quality. Active listening process is, therefore, a skill which can be trained with specific sound stimuli.

Results: After the therapy in 170 of children (83%) the vocal fold nodules remitted and voice improvement was observed. The result was confirmed by MDVP objective measures.

Conclusions: Obtained results of the applied auditory stimulation of voice indicate that this method is clinically valuable. The elaborated program of auditory stimulation for children with dysphonias and voice nodules, considering abnormalities within the development of auditory and emotional functions is an effective method of therapy of voice in pediatric patients.

P-011

BOR syndrome – a case report

Buksińska M.¹, Dąbrowska-Bień J.¹,
Skarżyński H.^{1,2}, Skarżyński P.H.^{2,3,4}

¹ *Department of Oto-Rhino-Laryngosurgery, Institute
of Physiology and Pathology of Hearing, Kajetany/Warsaw,
Poland*

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

³ *Institute of Sensory Organs, Kajetany, Poland*

⁴ *Heart Failure and Cardiac Rehabilitation Department, Medical
University of Warsaw, Poland*

Branchio-oto-renal syndrome (BOR syndrome) is a rare, autosomal dominant genetic disorder. BOR syndrome is characterized by an association of I and II branchial arch anomalies and renal malformations. Ear malformations can include outer ear, middle ear, and inner ear as well.

Objectives: We report 7.5-year-old girl who presented to the World Hearing Center with bilateral hearing loss. Past medical history included right-sided renal agenesis.

Materials and Methods: Patient had bilateral mixed hearing loss. We present the diagnostic evaluation and treatment of this patient.

Conclusions: I and II branchial arch anomalies present in patients with BOR syndrome require proper diagnosis. Treatment depends on the severity of symptoms and a variety of ear malformations.

P-012

Change of tinnitus perception after cochlear implantation according to Skarzynski Tinnitus Scale (STS) questionnaire

Gocel M.¹, Świerniak W.¹, Dziendziel B.¹, Gos E.¹, Skarżyński P.H.^{1,2,3}, Skarżyński H.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: The aim of the study was to check if there is a change of tinnitus perception after cochlear implantation according to Skarzynski Tinnitus Scale (STS) questionnaire.

Materials and Methods: The object of these study are 105 (55 women and 50 men), patients undergoing their first cochlear implantation (none of the ears were previously operated) from February 2018 to 2019. To assess the change in the occurrence of tinnitus, the STS questionnaire was used. All of the patients were asked to fill in the questionnaire three times: preoperatively, one month after implantation and five months after implantation.

Results: The results are going to be presented during the 32nd Politzer Society Meeting in Warsaw.

Conclusions: According to the literature, the number of patients with tinnitus problem may increase in the future. Tinnitus is the cause of concentration disorders, increased tension and anxiety or depression and as a consequence, they can lead to withdrawal from professional and social life. Thereupon, it seems that the diagnosis and treatment of tinnitus might be a significant challenge for the health care system, especially in countries, where life expectancy increases.

P-013

Changes in bioelectrical brain activity during processing of emotionally neutral and unpleasant sensations – QEEG studies in patients with tinnitus

Milner R.¹, Jędrzejczak W.W.¹, Lewandowska M.², Ganc M.¹, Niedziałek I.³, Skarżyński H.⁴

¹ Department of Experimental Audiology, Word Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Faculty of Humanities, Nicolaus Copernicus University, Toruń, Poland

³ Audiology and Phoniatrics Clinic, Word Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Word Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Objectives: The aim of the study was to identify the brain regions and structures related to the processing of

emotionally neutral and unpleasant sensations in patients with chronic low and high tinnitus distress.

Materials: Eighty-three patients (47 females, 36 males; mean age = 49.9; SD = 12.7) with chronic (<6 months) tinnitus were qualified for the study. Based on the results of the tinnitus handicap inventory two experimental groups were extracted: (1) patients with slight or mild tinnitus (low-tinnitus group, LT) and (2) patients with moderate, severe and catastrophic tinnitus (high-tinnitus group, HT).

Methods: In all patients short EEG recordings (3–4 min.) were made in three different conditions: (1) 'resting state condition' with eye-closed, (2) 'tinnitus condition' when patients had their eyes closed and were asked to pay attention to perceived own tinnitus and (3) 'body concentration condition' with eyes closed in which participants were required to redirect their attention to the sensations from own feet.

The EEG signals were recorded using 19-channels amplifier (Mitsar Co. Ltd.). All of the signals were preprocessed (cleaned from artifacts) and then quantitatively analyzed by means of the Low-Resolution Electromagnetic Tomography (LORETA). Applying LORETA analysis was aimed to localize the brain regions which changed activity in each experimental condition. Only statistically significant results of the paired t-test and the LORETA non-parametric voxel-wise comparisons are presented in this study.

Results: The LORETA analysis showed a significant decrease in Delta (1–4 Hz) and Theta (4–8 Hz) activity in frontal regions when the LT patients focused attention on the sensations from their feet. Decrease Delta activity in sensory-motor cortex in the left brain hemisphere and Theta activity in the left parietal cortex was also observed in this condition. Paying attention to unpleasant tinnitus sensation by patients in LT group resulted in increased activity in Beta range (14–40 Hz) in frontal, central (sensory-motor cortex), temporal and parietal brain regions and limbic structures related to emotions and memory and located only in the right hemisphere. In turn, the pattern of bioelectrical changes observed in the HT group in both (tinnitus and body) conditions were quite similar. When HT patients focused attention on their feet or tinnitus the activity for Delta and Theta significantly decrease around sensory-motor cortex as well as frontal and parietal regions of both hemispheres. The decrease of activity in Delta and Theta range were also identified in different limbic and other structures related to emotions and memory like the insula, anterior cingulate, uncus or para-hippocampal gyrus. In both conditions the decrease of Beta activity in parietal (precuneus, inferior and superior parietal lobule) and increase in limbic (anterior and posterior cingulate) regions were also observed in LT and HT patients.

Conclusions: Structures and regions mainly in the right brain hemisphere (relative to negative emotions) are areas that change bioelectric activity when the patients with low tinnitus distress process own unpleasant auditory sensations. In the patients with high tinnitus distress, the bioelectrical activity in the brain regions and structures related to both cognitive and emotional processes changes

in a similar fashion regardless of whether neutral or unpleasant sensations are analyzed.

P-014

Changes of cochlea glucocorticoid receptor and serum corticosterone in noise-induced hearing loss – an animal model

Kim K.H.¹, Lyu A.-R.², Park K.W.¹, Park Y.-H.¹

¹ Department of Otolaryngology-Head and Neck Surgery, Chungnam National University Hospital, Daejeon, Korea

² Department of Medical Sciences, Chungnam National University, Daejeon, Korea

Introduction and Objectives: Glucocorticoids are hormones secreted from the adrenal cortex in response to stress and are used for the treatment of various inner ear diseases. It is mainly present in rodents as corticosterone and actions by binding to the glucocorticoid receptor (GR). The purpose of this study was to investigate the changes in cochlear GR and serum corticosterone levels following noise exposure. In addition, we aimed to investigate the effect of dexamethasone (DEX) when administered at different time points.

Materials and Methods: 75 CBA/J mice were used for this study. Animals were divided into two groups according to the noise exposure level – transient threshold shift group (TTS), permanent threshold shift group (PTS). Changes in auditory brainstem response (ABR) thresholds were measured, and the changes in gene expression of GRmRNA and inflammatory cytokines were evaluated using real-time polymerase chain reaction (qRT-PCR). Serum corticosterone was evaluated by enzyme-linked immunosorbent assay (ELISA). Changes in the cochlear hair cells were observed using the whole mount. DEX was administered before, after, and before and after the noise exposure.

Results: The expression of the GR gene was significantly decreased after noise exposure, and the serum corticosterone levels and inflammatory cytokines were increased. When DEX was administered, the expression of GR mRNA was further reduced in the TTS group, but not in the PTS group. Serum corticosterone levels and inflammatory cytokines were significantly decreased when DEX was administered in before and after exposure to noise. The hair cells of the TTS group were almost preserved, but the PTS group was mostly destroyed.

Conclusions: Serum corticosterone levels and GR are important to maintain cochlear homeostasis and DEX administration before acoustic trauma is more appropriate to prevent the noise-induced hearing loss.

P-015

Characteristic of hearing loss in children with Pendred syndrome and results of its treatment with cochlear implants – a literature review

Woźniczko K.¹, Rajchel J.J.², Dziendziel B.², Skarżyński P.H.^{2,3,4}

¹ Interdisciplinary Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/ Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: Pendred syndrome is a genetically determined disorder inherited in an autosomal recessive pattern. It is estimated that approximately 10% of inherited hearing loss is caused by this syndrome. It is associated with abnormal pendrin's structure, causing the triad of symptoms; among which main is sensorineural hearing loss. The aim of this literature review is to present the current knowledge on audiological features of hearing loss in children with Pendred syndrome and the efficacy of cochlear implantation in this group of patients.

Materials: 16 articles consistent with the search criteria were found suitable for the review (11 about the audiological characteristic of patients with Pendred syndrome and 5 articles about cochlear implantation).

Methods: To identify suitable literature, a search was performed using the following databases of scientific articles: PubMed, Web of Science and Medline. The combination of the following keywords was used: 'Pendred syndrome', 'children', 'cochlear implantation'. The analyzed articles were in English and Polish.

Results: In children with Pendred syndrome a sensorineural hearing loss with a genetic basis is observed. In most patients the hearing loss is prelingual, but cases with peri- and postlingual hearing loss were also described. In some cases, the hearing loss might be progressive and/or fluctuating nature, triggered by even minor head trauma. The hearing loss is mainly bilateral and symmetrical. An effective method of hearing loss treatment in children reporting a lack of benefits from conventional hearing aids is cochlear implantation. Based on the current literature, it is indicated as an effective method of aural rehabilitation in this group of patients.

Conclusions: Early diagnosis of Pendred syndrome and implementation of its effective treatment give pediatric patients the opportunity of proper development of hearing and speech. Cochlear implantation seems to be the most effective method of rehabilitation in patients without benefits from conventional hearing aids, significantly improving the quality and comfort of patients' life.

P-016

Click auditory brainstem response and frequency following response with the children with the congenital syndrome of Zika virus

Sanfins M.D.^{1,2}, Griz S.M.S.^{1,3}, Skarżyński P.H.^{4,5,6}, Menezes P.L.⁷, Brandão L.¹, Melo A.¹

¹ Instituto de Pesquisa Professor Joaquim Amorim Neto (IPESQ), Campina Grande, Brazil

² Centro de Eletrofisiologia e Neuroaudiologia Avançada (CENA), São Paulo, Brazil

³ Universidade Federal de Pernambuco ' UFPE ' Recife, Brazil

⁴ Institute of Physiology and Pathology of Hearing, Warsaw, Poland

⁵ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁶ Institute of Sensory Organs, Warsaw, Poland

⁷ Universidade Estadual de Ciências da Saúde de Alagoas Macéio, Brazil

Introduction: Zika virus in pregnancy increases the risk of microcephaly in fetuses exposed to the virus. After the epidemic of infection in Brazil in 2015, especially in the Northeast region, several studies were published in this concern. However, few studies are aimed to understand the auditory features which are involved with the children with Congenital Syndrome of Zika Virus. The aim of this study was to analyze the Click Auditory Brainstem Response and Frequency Following Response on those children.

Materials and Methods: Electrophysiological responses was recorded in 24 younger children (22 months to 35 months, $\Sigma = 31.2$ months, $SD = 2.07$) divided in two groups: female group = 14 younger children ($\Sigma = 32$ months, min = 29 months, max = 35 months, $SD = 2.10$) and male group = 10 younger children ($\Sigma = 31.7$ months, min = 22 months, max = 35 months, $SD = 3.72$). The electrophysiological evaluation with click – ABR and Frequency Following Response – FFR) were performed in all younger children.

Results: The results showed 22 normal responses and 2 absence (1 female and 1 male) of response for Click ABR responses and FFR 8 normal responses and 16 abnormal responses (8 female and 8 male).

Conclusions: The analysis of the Click Auditory Brainstem Response and Frequency Following Response younger children diagnosed with Congenital Syndrome of Zika Virus demonstrated that it was observed negative effects on the functioning of the auditory pathways. The verbal sound seems to be more efficient to identify auditory deficit on those children.

P-017

Clinical characteristic of patients with vestibular schwannoma and its relationship to tumor size

Zaborek M.¹, Łyczba J.¹, Rajchel J.J.², Karpiesz L.², Skarżyński P.H.^{2,3,4}

¹ Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: Vestibular schwannoma (VS) is the most common tumor in the area of the cerebellopontine angle. Depending on tumor size and localization, it may manifest itself in a variety of symptoms, the most common being tinnitus, hearing loss, and balance disorders.

Materials: Retrospective case review of adult patients admitted to single tertiary clinical ENT center were carefully studied. The eligibility criteria were age ≥ 50 years, diagnosis of unilateral VS confirmed by a magnetic resonance imaging (MRI) and full medical record of a given patient upon diagnosis, including medical interview and hearing evaluation.

Methods: Patients were divided into 3 groups according to Koos-Pernecky (KP) scale: the first group with tumor size of 0,1–1 cm, second group – 1.1–1.9 cm and third group – 2.0–3.0 cm. Statistical analyses were conducted with IBM SPSS v. 24.

Results: Based on the eligibility criteria, 19 patients were included in the final analysis (52.6% were men). Based on the KP scale, 63.2% of patients were classified to the first group, 31.6% to the second group and 5.3% to the third group. Tinnitus and hearing loss were observed in all patients (100%). Although all of the patients had unilateral VS, bilateral hearing loss was observed in 31,6% of patients and bilateral tinnitus in 15,8% of patients. Balance disorders were reported by 30% of patients and hyperacusis by 22.2%. None of the patients reported the sudden hearing loss or facial nerve palsy. Interestingly, no statistically significant relationship was observed between the tumor size and existence of accompanying symptoms, as well as their severity. Additionally, low specificity of the 3 kHz VS screening method according to Saliba, Martineau, and Chagnon (2009) was observed, which found application only in 58.3% of patients from the first KP group, 0% of patients from the second KP group and in 100% (1 patient) from the third KP group.

Conclusions: Patients with VS can report with a variety of symptoms of different severity, the most common being tinnitus, and hearing loss. The current research failed to show the relationship between the presence and severity of clinical symptoms and the size of the tumor.

P-018

Clinical characteristics and treatment of 27 cases of acquired stenosis of the external auditory meatusZhu Y., Xie Y., Li C., Fu Y., Zhang T.¹ Department of Facial Plastic Reconstructive Surgery, Fudan University, Shanghai, China² ENT Institute, Fudan University, Shanghai, China

Objectives: To analyze the causes of acquired external auditory meatus stenosis or atresia, and to further explore the types and treatment of traumatic external auditory meatus stenosis.

Methods: From January 2013 to March 2018, 27 patients with acquired external auditory canal stenosis or atresia underwent external auditory canaloplasty. The etiology, infection of external auditory canal, the existence of cholesteatoma of external auditory canal and classification of traumatic external auditory meatus stenosis were analyzed.

Results: There were 27 patients with acquired external auditory canal stenosis or atresia, including 1 case of foreign body (battery) in the external auditory canal, 1 case secondary to the operation of cholesteatoma in the external auditory canal, 4 cases secondary to the operation of chronic otitis media, 2 cases secondary to the operation of branchial fistula, 1 case of otitis media, 2 cases of osteoma, 1 case of fibrous dysplasia and 15 cases of trauma. In these 27 patients, there were 12 cases with infection of the external auditory canal and 10 cases with cholesteatoma. Of the 15 cases of the traumatic external auditory canal with stenosis or atresia, 6 cases had stenosis or atresia of the cartilage segment, among them 4 cases had cholesteatoma (4 in 6, 66.67%); 5 cases had stenosis of the bone segment, among them 2 cases had cholesteatoma (2 in 5, 40%); 3 cases had the anterior ear canal wall moved backward after fracture; 1 case, the fracture had involved to the tympanic sinus; 8 cases with the history of ear debridement.

Conclusions: Trauma is the most common cause of acquired external auditory canal stenosis. External auditory canal stenosis is often accompanied by infection or cholesteatoma of the external auditory canal, so it is necessary to perform external auditory canaloplasty as soon as possible. The proportion of external auditory canal stenosis caused by surgery is as high as 58.5%. The major cause of post-traumatic stenosis is the history of debridement and suture of the auricle or auditory canal, which reminds us to pay attention to the method and timing. In order to correct the posterior displacement of the anterior wall of the ear canal, it is necessary to strengthen the follow-up and accurate postoperative packing of the ear canal.

P-019

Clinical experiences of using newly-developed ultra-high resolution computed tomography in the field of otologyYoshioka S.¹, Kato H.¹, Naito K.¹, Toyama H.², Fujii N.², Katada K.²¹ Department of Otolaryngology, Fujita Health University, School of Medicine, Toyoake, Aichi, Japan² Department of Radiology, Fujita Health University School of Medicine, Toyoake, Aichi, Japan

Objectives: Despite apparent usability of computed tomography (CT) in clinical practice, otology, which requires diagnosis and treatment of disease that involves very small areas, sometimes entails a limitation on the performance of CT in depicting lesions located in such areas. Recently, ultra-high-resolution (UHR) CT, which can provide images at dramatically higher spatial resolution than ever before, has been developed. We have been involved in the development of this device and have been using prototypes in clinical settings since 2015, and has become commercially available from Feb 2017. We report our experience of the early stage development of UHRCT in the field of otology.

Patients and Methods: 204 patients with middle ear diseases were examined using a UHRCT (Aquilion precision, Canon medical systems). This scanner with a pixel size (0.25 x 0.25 mm) twice as dense in both vertical and horizontal directions as conventional high-resolution (CHR) CT has the maximum spatial resolution which is 0.15mm or less in the axial direction. The maximum size image is 2048 x 2048 pixels.

Results: We performed UHRCT scan in otology patients and compared the images obtained from UHRCT with those obtained from CHRCT. Spatial resolution in UHRCT images was obviously improved. Tiny structures, such as the *chorda tympani* and ossicles, and small pathological changes caused by the progression of otitis media, etc. were clearly depicted. It was extremely excellent in the visualization of the decapitation of the ossicles and the deformity of the middle ear. Due to an increase in the partial volume effect, improvements such as the performance of UHRCT in depicting soft-tissue lesions or lesions adjacent to the bone, which were considered difficult to depict at CHRCT, were also seen.

Discussion: The tiny structures which had been indistinct before became clearly visible due to UHRCT, indicating the possibility of providing important information into clinical practice. However, because the issues include the necessity of building infrastructure (including display) and a computer system powerful enough to save and handle a huge volume of data, it is necessary to further examine the usage of UHRCT in the future. In addition, it will be necessary to further examine how to help planning treatment plans for the imaging findings newly revealed by this device.

P-020

Cochlear implantation as a treatment for tinnitus in subjects with hearing loss: a preliminary reportWei J.I.-E.¹, Li L.P.-H.^{1,2}¹ Department of Otolaryngology, Cheng Hsin General Hospital, Taipei, Taiwan² School of Medicine, National Yang-Ming University, Taipei, Taiwan

Objectives: Cochlear implants (CIs) have been recognized standard care for the treatment of severe-to-profound sensorineural hearing loss. Previous studies reported CIs benefit recipient's communication and quality of life. In some studies, cochlear implantation also has its role in reducing tinnitus. The aim of this study is to present our experience in tinnitus management with cochlear implantation in patients with both tinnitus and hearing loss.

Materials and Methods: Patients with profound hearing loss and tinnitus were recruited in this study. All the patients underwent implantation of a multichannel CI. The device was activated within 24 hours after implantation. *Visual analog scale* (VAS), *Hospital Anxiety and Depression Scale* (HADS) and the *Tinnitus Questionnaire* (*Tinnitus Handicap Inventory*, THI) were administered before implantation (within 1 day prior to surgery) and 1 day, 1 week, 2 weeks, 1 month, 3 months, 6 months, 12 months, 24 months after the operation. The scores of the questionnaires were analyzed by a paired *T*-test.

Results: The structural interview revealed that all patients (11/11) still wear their CI seven days a week after cochlear implantation. Given the relatively small sample size, quantitative data are presented as median and range (minimum and maximum). In our study, a significant reduction of THI and HADS score was found at 1 year after the implantation. The VAS of tinnitus severity reduces significantly at 2 weeks, 3 months, 6 months, 1 year, and 2 years after the implantation.

Conclusions: Significant reduction in THI and HADS was noted at 1 year after the operation. But the reduction of the VAS achieved a significant level at 2 weeks after the operation and remained stable at 3 months after the operation. Further study with a larger population is needed to validate the long-term scenario of tinnitus reduction, and the effect of daily performance over time as well.

P-021

Cochlear implantation in cases with inner ear malformationsSakuma N.^{1,2,3}, Hatakeyama H.², Yoshida K.², Hachiya J.², Shibata K.², Nakagawa C.³, Oridate N.¹¹ Otorhinolaryngology, Head and Neck Surgery, Yokohama City University School of Medicine, Yokohama, Japan² Otorhinolaryngology, Yokohama City University Medical Center, Yokohama, Japan³ Otorhinolaryngology, Yokohama Sakae Kyosai Hospital, Yokohama Japan

Objectives: Inner malformations constitute about 20% of congenital hearing loss. In Japan, the indication for cochlear implantation is expanded, and the cases with inner malformations who received cochlear implantation are increased. Main factors related to the outcomes of cochlear implantation are the etiology of hearing loss, the age at implantation and the duration of deafness. It was reported that the types of inner malformation also influence the outcome of cochlear implantation. In this report, we evaluated the outcome of cochlear implantation in cases with inner malformations.

Materials and Methods: The retrospective study was conducted on 12 cases with inner malformations. Seven cases were male and 5 cases were female. The age at the time of enrollment ranged from 5 to 15 years (median: 8 years). All cases had bilateral profound hearing loss at the time of enrollment. The age of diagnosis of hearing loss ranged from 0 to 3 years (median: 0 years). The age at implantation varied between 1 and 9 years (median: 4 years). The time postoperatively varied between 8 month and 10 years (median: 4 years). Four cases were diagnosed as developmental disabilities. Two cases used cochlear implants bilaterally. Speech audiometry was performed with CI-2004 (tentative) that is a test battery to evaluate speech recognition in Japanese.

Results: Five and two cases had large vestibular aqueduct and incomplete partition type II, respectively. Four cases had the narrow bony cochlear nerve canal or internal auditory canal with computed tomography and cochlear nerve hypoplasia with Magnetic Resonance Imaging. All 12 cases had thresholds within 45dBHL in implanted ears. The word discrimination scores of 8 cases with large vestibular aqueduct or IP-II was varied from 56 to 100%. The word discrimination scores using CI-2004 of 3 cases with cochlear nerve hypoplasia were 100%, 12%, 33% (closed-set), respectively. The infant-toddler meaningful auditory integration scale (IT-MAIS) of one case with cochlear nerve hypoplasia was 29 of 40 points. The main communication method was speech and oral communication in 10 cases and total communication in 2 cases.

Conclusions: All cases with large vestibular aqueduct or IP-II showed good speech perception ability. Whereas 3 cases with cochlear nerve hypoplasia showed poor speech perception ability. Accurate classification of anatomic malformations is necessary to predict the outcome of cochlear implantation.

P-022

Cochlear implantation in Cogan's syndrome – a literature review**Zygadlo J.¹, Rajchel J.J.², Skarżyński P.H.^{2,3,4}**¹ *Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland*² *Institute of Physiology and Pathology of Hearing, World Hearing Center, Kajetany/Warsaw, Poland*³ *Institute of Sensory Organs, Kajetany, Poland*⁴ *Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland*

Objectives: Cogan's syndrome is a rare disease of the inner ear and the eyeball. In several cases, it may result in deafness, which may be treated with cochlear implantation. The aim of the study is to evaluate the effect of cochlear implantation in patients with Cogan syndrome based on the audiometric findings.

Materials: A literature research was held in English using key phrases: „Cogan's syndrome” or „Cogan syndrome” and „implantation” in scientific databases PubMed and Medline.

Methods: The basic inclusion criterion was the description of hearing- and speech test results in patients with Cogan's syndrome before the implantation and after the implantation. Time criteria weren't used due to the expected small number of the achievable articles.

Results: In all papers, a significant improvement of free-field hearing results were observed in patients after the implantation, no matter of the cochlear implant model. A gradual improvement in hearing abilities was noted along with the time from cochlear implantation. Regarding the speech audiometry, the results varied from 40% to 100% of speech intelligibility, with most of the patients achieving more than 80%.

Conclusions: Cochlear implantation in patients Cogan's syndrome and concomitant deafness of results in significant improvement of hearing abilities. However, the literature is quite small and future studies are needed to conduct reliable metaanalyses and draw firm conclusions.

P-023

Cochlear implantation outcome in straightforward cases: can we do more for adults who cannot understand speech using hearing aids alone?**Luntz M.^{2,3,4}, Khuri M.¹, Khayr K.^{1,3}, Gedaon Khuri W.¹, Khniefes R.^{1,2}, Yehudai N.^{1,2}, Shpak T.^{1,3}**¹ *Ear and Hearing Program, Department of Otolaryngology Head and Neck Surgery, Bnai-Zion MC Medical Center, Haifa, Israel*² *Bruce Rappaport Faculty of Medicine, Technion – Israel, Institute of Technology, Haifa, Israel*³ *Department of Communication Disorders, Haifa University, Haifa, Israel*⁴ *Ear and Hearing Unit, Aram, the Center for Otolaryngology-Head and Neck & Maxillofacial Surgery, Assuta Medical Center, Tel Aviv, Israel*

Introduction: Many adults with moderate-profound hearing loss whose speech recognition has deteriorated and are no longer benefitting from hearing aids (HA) could benefit from cochlear implantation (CI). Of these, only <5% are implanted. In order to inform eligible patients about expected results and ease the route to implantation, better guidelines for candidate selection are needed.

Objectives: To provide reliable guidelines by determining, in a well-characterized group of implantees, the minimal expected post-CI scores for monosyllabic (MS) word recognition.

Patients and Methods: The study includes 20 adults unilateral implantees who prior to implantation were considered straightforward CI candidates (normal inner ear anatomy, users of spoken language, consistent use of HAs, non-fluctuating hearing, and no prolonged auditory deprivation). Prior to implantation (with best fitted HAs), participants had scored between 0 and 20% on MS word test in quiet (presentation level: 65 dB SPL) and 0% in noise with a signal-to-noise ratio (SNR) of +5 dB in the worse hearing ear. In the better hearing ear their scores were between 0 and 70% on MS word test in quiet (16/20 scored 0–30%, and 4/20 scored 40%, 45%, 52%, and 70%), and between 0 and 35% in noise. Implantation was performed in the worse hearing ear. Participants were assessed ≥20 months post-CI. Their post-CI CI-aided thresholds and MS word recognition were compared to their pre-CI scores. In addition, SSQ12 scores were evaluated post-CI.

Results: All participants used their implants consistently. Post-CI, thresholds were 40 dB or better (at 250–4000 Hz) in all participants, and 35 dB or better in 95% of them. 90% scored 60% or better on MS words in quiet. In speech noise, all scored 15–60% and 50% scored 45–60%. Poorer unaided pre-CI thresholds yielded greater patient satisfaction.

Conclusions: Following consultation, a patient whose characteristics are consistent with those of this study's focus population and who complains of difficulty in

understanding speech even when fitted with the best possible hearing aids, should undergo MS word recognition testing. If scores are within the range of the pre-CI scores of the present study participants (MS in quiet, $\leq 20\%$; MS in noise with SNR +5 dB, 0% in the worse hearing ear), the patient should be referred to a CI specialist for formal CI candidacy evaluation. The consulting audiologist or otolaryngologist can confidently assure these patients that after CI their test scores of MS words in quiet in the implanted ear will be at least 40%, and probably (a 90% chance) even 60% or better, and that there is a 50% chance that their test scores of MS words in speech noise (SNR +5 dB) will be at least 45%.

P-024

Cochlear microphonics in hearing preservation cochlear implantees

Walkowiak A.¹, Lorens A.¹, Polak M.², Kowalczyk A.¹, Obrycka A.¹, Furmanek M.¹, Skarzyński H.¹

¹ Institute of Physiology and Pathology of Hearing, Warsaw, Poland

² Med-El, Innsbruck, Austria

Introduction and Objectives: The intracochlear electrocochleography (ECoG) could be recorded directly from the CI electrode in CI recipients with residual hearing. The primary objective of this study is to identify the most sensitive frequency for the recording of cochlear microphonics (CMs) in cochlear implant users with a wide degree of hearing abilities and deep electrode insertion. The secondary objective is to identify the optimum location within the cochlea for the recording of intracochlear potentials.

Methods: CMs were recorded from the cochlear implant electrodes in 8 females and 8 males implanted with cochlear implants Pulsar, Concerto or Sonata, Med-El Corp.

Results: Among the tone pips of various frequencies, 1k or 500 Hz were the most sensitive for cochlear implant users. The most sensitive place in the cochlea to record the CM potentials depended on the tone frequency used. The deeper into the cochlea the mean maximum CM peak-to-peak amplitude was measured, the lower the stimulating tone frequency was.

Conclusions: The identified most optimal recording parameters for intracochlear CM recording can be useful for intraoperative and postoperative monitoring of cochlear health in cochlear implant users with residual hearing.

P-025

Comparison of linear incision and Minimal Invasive Ponto Surgery (MIPS): an observational prospective study

Mochi P., Cuda D.

ENT Department, 'G. da Saliceto' Hospital, Piacenza, Italy

Introduction: Bone conducting hearing systems (BAHS) have existed for more than 40 years, significantly improving the hearing capability of patients with conductive and mixed hearing losses, and single-sided deafness. The percutaneous bone-anchored systems consist of an osseointegrating screw implanted in the skull bone, an abutment breaching the skin barrier, and a hearing aid coupled to the abutment. For many years, tissue reduction (skin thinning) was performed around the abutment to reduce skin mobility. The last decade, the surgical technique has developed. In 2011, the first study utilizing a soft tissue preservation technique was published (here referred to as the 'linear incision with tissue preservation' – technique), resulting in less scarring, better sensibility around the abutment and better cosmetics. In 2015, instrumentation for an even less traumatic surgery was introduced, the Minimal Invasive Ponto Surgery (MIPS) – technique, using only a punch to remove the skin where the implant is placed.

Objectives: The aim of this prospective observational study is to compare the outcome from the linear incision with tissue preservation technique with that of MIPS.

Materials and Methods: Surgical and follow-up data were collected from a total of 48 adult patients; 13 operated with the linear incision soft tissue preservation surgical technique and 35 operated with MIPS. All patients had a surgical FU visit 1–3 weeks post-surgery and a second FU, normally coinciding with sound processor loading, 1–3 months after surgery. Additional visits were included where available. The total follow-up time varied from 3 months to more than 4.5 years. Implant survival, post-operative complications and skin reactions as judged by the Holgers scoring system (grade 0–4), were assessed at all FU visits. For statistics, the Mann-Whitney U was used.

Results: The patient cohort had an age span between 19 and 81 years, the majority 51–75 years old, and a predominance of females (69%). The implants used were Ponto Wide ($n = 38$) and Ponto BHX ($n = 10$) with pre-mounted abutments (all produced by Oticon Medical AB, Askim, Sweden). The skin thickness varied between 3 and 11mm, thus making use of all abutment lengths (6 mm: $n = 6$; 9 mm: $n = 26$; 12 mm: $n = 15$; 14 mm: $n = 1$). The surgery length was substantially less for MIPS (15 ± 6 minutes; range 7'35) compared with the linear incision technique (36 ± 10 minutes; range 27'62), $p < 0.001$. No surgical complications were reported. The surgical wound was healed at the first FU in all patients except for one graded with Holgers = 3, likely due to excessive compression. This patient was operated with the linear incision technique and was successfully treated with oral and topical antibiotics. Otherwise, skin reactions were very rare, with

99% of the visits graded with Holgers = 0. Implant survival was 100%, although two patients with single-sided deafness electively had their abutment removed after 3 months and 2 years respectively. No abutment changes nor revision surgeries have been needed.

Conclusions: Ponto implants were successfully installed both with the MIPS- and the linear incision- surgical technique with an excellent 100% implant survival rate. The MIPS technique significantly reduced the surgery time, but previous experience of more 'open' surgeries is highly recommended. Intra- and post-operative complications, including soft tissue reactions, were similarly rare for both groups.

P-026

Comparison of otoacoustic suppression in children and adults - preliminary results

Włodarczyk K.¹, Rajchel J.J.², Nykiel K.¹, Pilka E.², Skarżyński P.H.^{2,3,4}, Jędrzejczak W.W.²

¹ Interdisciplinary Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: The aim of the current study was to analyze the OAE suppression in nursery children, comparing their results with young adults.

Materials: The OAE evaluation was conducted in a single nursery school in Warsaw, Poland. The evaluated group consisted of a similar number of boys and girls (42.9% vs 57.1%). The child's aged range from 5 to 6 years and was $M = 5.71$, $SD = 0.47$ on average.

Methods: After receiving the informed consent from the child's parents, the audiometric evaluation took place to confirm the normal hearing of the child. The hearing screening was conducted using a well-established screening method called 'Sensory Examination Platform'. After confirming the hearing status of the child, the OAE suppression was measured twice, subsequently, without taking the probe out of the ear. The evaluated parameters included the measurement of response level, signal to noise ratio (SNR) and suppression value. The obtained results were compared with the reference values derived from young normally hearing adults aged up to 25 years.

Results: Children with SOAE had similar OAE suppression as adults, however, their SNR was significantly higher than adults without SOAE in comparison to adults with SOAE. No significant differences were observed in OAE suppression value between children with $SNR > 12$ and $SNR < 12$ as well as children and adults with $SNR > 12$ and $SNR < 12$.

Conclusions: Our preliminary results suggest that a similar OAE suppression can be observed in children and

young adults. To further confirm these findings, we still collect the material to provide statistical analysis on a bigger group of participants.

P-027

Comparison of the postoperative result between laser stapedotomy and non-laser stapedotomy

Bae S.-C., Shin Y.-R., Lee K.S., Chun Y.-M.

Soree Ear Clinic, Seoul, Republic of Korea

Objectives: Stapedotomy fenestration techniques have a risk to damage an inner ear. Recently, laser is adapted to stapedotomy to prevent inner ear damage. Our clinic introduced laser equipment before 3 years. So we can compare postoperative result between laser stapedotomy and non-laser stapedotomy.

Materials and Methods: We reviewed 106 patients of stapedotomy. All surgery performed by one surgeon. We checked pure tone audiogram (0.5, 1K, 2K, 3 kHz) pre-operatively and postoperatively. And we calculated postoperative air-bone gap. We defined the best result as air-bone gap ≤ 10 dB and a good result as air-bone gap ≤ 20 dB.

Results: 10 patients had revision surgery (2 – laser stapedotomy, 8 – non-laser stapedotomy). We excluded the revision case and we evaluated 96 cases of primary surgery. Mean age was 43.2 ± 14.7 at laser group and 44.8 ± 11.1 at the non-laser group. A preoperative air-bone gap of each group was 23.3 ± 7.5 (laser group) and 28.2 ± 8.9 (non-laser group) and showed no significant difference statistically ($P = 0.444$). But, a postoperative air-bone gap of each group was 8.3 ± 6.9 (laser group) and 12.5 ± 9.5 (non-laser group) and showed significant difference statistically ($P = 0.030$). Laser group had better results than non-laser group (best result – 41/56 at laser, 22/40 at non-laser) and showed a significant difference ($p = 0.027$).

Conclusions: Laser stapedotomy group showed lower revision surgery rate, lower postoperative air-bone gap, and better results. So, laser stapedotomy is more safe and effective than non-laser stapedotomy.

P-028

Complications in septoplasty and septoplasty with turbinate surgery based on a large group of 5639 patients

Dąbrowska-Bieñ J., Buksińska M., Łazęcka K., Gwizdańska I., Mickielewicz A., Skarżyński P.H., Skarżyński H.

Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Kajetany/Warsaw, Poland

Objectives: Septoplasty is a common surgical procedure used for correction of the nasal obstruction caused by a deviated septum. It is often accompanied by inferior turbinate reduction, called turbinoplasty. Complications that

may arise from this procedure include excessive bleeding, septal perforation, wound infection, septal abscess, saddle nose deformity, nasal tip asymmetry or depression, sensory changes such as hyposmia, or even ocular or intracranial complications. The aim of the study was to identify complications in septoplasty and analyze incidence depending on the surgical technique, based on material from 2009 till 2017.

Materials and Methods: Material consisted of 5639 medical records from patients aged 16-69, operated in the tertiary referral center. Patients were divided into 2 groups (2784 exclusively with septoplasty and 2855 with combined septoplasty and turbinoplasty). Z-test for the equality of two proportions was made to investigate the assumption that the proportions from two populations are equal, based on two samples, one from each population.

Results: Complications were listed according to international standards. Among the whole study group, different types of complications were noted in 193 patients (3,42%). The most frequent complication was excessive bleeding. Significant differences were observed between the two investigated groups. In patients with combined septoplasty and turbinoplasty septal hematoma, hyposmia, prolonged healing due to infection, adhesions and temporary reduced visual acuity were significantly more often encountered ($p < 0.01$).

Conclusions: Meticulous attention to detail in identifying the appropriate anatomy and maintaining good visualization is the key to a safe and effective septoplasty, enabling for very low complications rate.

P-029

Concurrent superselective intra-arterial chemotherapy and radiotherapy (RADPLAT) for advanced squamous cell carcinoma of the temporal bone

Yoshizaki T., Noda M., Ito M., Sugimoto H.

*Otolaryngology-Head and Neck Surgery, Kanazawa University, Kanazawa, Japan
Pediatric Otolaryngology, Jichi Medical University, Oyama, Japan*

Objectives: Treatment for advanced squamous cell carcinoma (SCC) of the temporal bone has been a matter of issue as its anatomical complexity. However, low frequency of cervical-node metastasis, control of primary disease directly relevant to the prognosis of the patients. This clinical aspect of this disease implicates that it would be a good candidate for applying concurrent superselective-supradose intra-arterial chemotherapy and radiotherapy called RADPLAT. This study was conducted to evaluate the efficacy of RADPLAT for advanced temporal bone SCC.

Methods: Totally, 12 patients with advanced temporal bone SCC were treated with RADPLAT. All patients received irradiation using a conventional once-daily fraction of 2 Gy, with the total dose of 60–70 Gy. Photon beam energy was 6 MV and two laterally angled pairwedged fields

were applied. Intra-arterial cisplatin via transfemoral catheterization and intravenous sodium thiosulfate were administered. Eight patients received a total of 200-600 mg of cisplatin in 2–6 portions. Four patients were treated in 2011 and thereafter received cisplatin at a fixed dose of 150 mg/body, 5 courses. The patients with a salvage lateral temporal bone resection were counted as cases of failed local control. The local control rate, survival rate, and degree and frequency of adverse events were addressed in all the 12 patients.

Results and Conclusions: The mean follow-up period was 35 months (range, 5–86 months). Nine patients are alive without local recurrence (mean survival, 41.4 months), 2 died of local recurrence, 1 died of distant metastasis, and 2 received salvage surgery. One patient developed grade 4 neutropenia, 1 grade 4 leucocytes, and 2 patients facial palsy. Although the sample size is limited, our data suggest that RADLAT is feasible for the treatment of advanced temporal bone SCC.

P-030

Congenital cholesteatoma – still a challenging problem

Dąbrowska-Bień J., Buksińska M., Mrówka M., Skarżyński H., Skarżyński P.H.

Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Kajetany/Warsaw, Poland

Introduction: Congenital cholesteatoma is a difficult diagnostic problem, due to lack of symptoms, uneventful medical history, and often intact tympanic eardrum. If undiagnosed, the disease can progress to irreversibly destroy the conductive hearing mechanism, as well as the surrounding skull base. When diagnosed early, its growth and the above consequences could be prevented.

Materials and Methods: We present a case of 7-years old boy presented to the World Hearing Center due to progressive, unilateral hearing loss. After clinical and audiological examination, high-resolution temporal bone CT the diagnosis of congenital cholesteatoma was made and surgical exploration and hearing reconstruction was performed.

Results: The follow up was uneventful. We achieved a satisfying hearing recovery. After 6 months 'second look' operation was done, and no recurrence of cholesteatoma was observed.

Conclusions: If conductive hearing loss is over 3 months we should keep in mind other pathologies than middle ear effusion. In the case of suspected congenital cholesteatoma surgical treatment should not be postponed, because of potentially irreversible complications.

P-031

Cortical processing related to intensity of a modulated noise stimulus – a functional near infrared (fNIRS) study

Weder S.^{1,2}, Zhou X.², Shoushtarian M.², Innes-Brown H.², Caversaccio M.¹, McKay C.²

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

² Bionics Institute, East Melbourne, Victoria, Australia

Objectives: Sound intensity is a key feature of auditory signals. A profound understanding of cortical processing of this feature is therefore highly desirable. This study investigates whether cortical functional near-infrared spectroscopy (fNIRS) signals reflect sound intensity changes and where on the brain cortex maximal intensity-dependent activations are located. The fNIRS technique is particularly suitable for this kind of hearing study, as it runs silently.

Materials and Methods: 23 normal-hearing subjects were included and actively participated in a counter-balanced block design task. 4 intensity levels of a modulated noise stimulus with the long-term spectrum and modulation characteristics similar to speech were applied, evenly spaced from 15 to 90 dB SPL. Signals from auditory processing cortical fields were derived from a montage of 16 optodes on each side of the head.

Results and Conclusions: fNIRS responses originating from auditory processing areas are highly dependent on sound intensity level: higher stimulation levels led to higher concentration changes. Caudal and rostral channels showed different waveform morphologies, reflecting specific cortical signal processing of the stimulus. Channels overlying the supramarginal and caudal superior temporal gyrus evoked a phasic response, whereas channels over Broca's area showed a broad tonic pattern. This data set can serve as a foundation for future auditory fNIRS research to develop the technique as a hearing assessment tool in the normal hearing and hearing-impaired populations.

P-033

Diagnostic difficulties in non-organic hearing loss in children – a case report

Kapustka D.¹, Domeracka-Kołodziej A.¹, Szkielkowska A.^{1,2}

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

² Fryderyk Chopin University of Music, Warsaw, Poland

Non-organic hearing loss is a rare pathology. Its incidence varies from 0,1 to 6,2%. It refers to the discrepancy between the results of pure tone audiometry and objective auditory testing. According to the Austen and Lynch model, there are three categories of non-organic hearing loss – malingering, factitious disorder and conversion disorder. Third disorder refers to psychological conflict or other stresses that converse into somatic symptoms. The aim of this work

is to present a case of non-organic hearing loss in a child – a disorder that is very difficult to diagnose and often unrecognized. The authors also want to underline that accurate and quick diagnosis is very important for patients. A girl was diagnosed with profound bilateral sensorineural hearing loss at the age of 12. She was treated with hearing aids for a few years. She came to Institute of Physiology and Pathology of Hearing at the age of 21 due to recurring *otitis externa*. The girl was sent for audiological evaluation which revealed discrepancies between pure tone audiometry and acoustic reflex thresholds. The experienced audiologist decided to expand the diagnostic protocol. Normal results were obtained with DPOAE measurements. The auditory brainstem responses (ABR) recorded using tone (1 kHz) and click (2–4 kHz) reached 20 dB. The girl was diagnosed with non-organic hearing loss. Necessary explanations about the obtained audiological data were given. The girl was sent for psychological treatment. After few months spontaneous recovery occurred.

P-034

Difference in serum levels of vitamin D between canalolithiasis and cupulolithiasis of the horizontal semicircular canal in BPPV

Nakada T.¹, Sone M.²

¹ Department of Otorhinolaryngology, National Center for Geriatrics and Gerontology, Obu, Japan,

² Department of Otorhinolaryngology, Nagoya University, Nagoya, Japan

Introduction and Objectives: In the horizontal canal benign paroxysmal positional vertigo (BPPV), *cupulolithiasis* shows apogeotropic direction-changing nystagmus lasting more than 1 minute, while *canalolithiasis* leads to geotropic direction-changing nystagmus lasting less than 1 minute. The difference between *cupulolithiasis* and *canalolithiasis* is widely accepted to be the attachment of the displaced otoconia to the cupula of a semicircular canal. Several studies have shown a relationship between BPPV and vitamin D deficiency, but no studies have compared serum levels of vitamin D between *canalolithiasis* and *cupulolithiasis* patients. The purpose of this study was to clarify the difference in vitamin D serum level between *canalolithiasis* and *cupulolithiasis* of the horizontal canal.

Materials and Methods: This retrospective study included 20 and 15 patients with *canalolithiasis* and *cupulolithiasis* of the horizontal canal, respectively. Serum levels of 25-hydroxyvitamin D (25(OH)D) during the acute phase of BPPV were measured.

Results: The mean 25(OH)D serum level in patients with *canalolithiasis* and *cupulolithiasis* was 13.2 ± 1.4 and 20.4 ± 1.6 ng/mL, respectively, and the difference was statistically significant ($p = 0.0014$), also after adjusting for age and sex ($p = 0.0351$). Eighteen out of 20 (90%) and 5 of 15 (33%) patients were diagnosed with vitamin D deficiency in the *canalolithiasis* and *cupulolithiasis* groups, respectively, and this difference was also statistically significant ($p = 0.0005$).

Conclusions: We found that serum vitamin D level in patients with *canalolithiasis* was significantly lower than that in patients with *cupulolithiasis* of the horizontal canal.

P-035

Different types of hearing aids used in children under two years of age with moderate hearing loss

Cywka K.B.¹, Sztabnicka A.¹, Skarżyński P.H.^{1,2,3}

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Introduction: Proper selection and fitting of hearing aids and early auditory rehabilitation determine the correct auditory development of the child and opportunities for speech development. Currently, many hearing aids are available, conventional hearing aids using air conduction of sound and less common devices for bone conduction. An important element is the ability to evaluate the applied hearing prostheses in order to choose the best solution for the patient. As audiometric tests allow only to assess the level of sound detection, it is necessary to use questionnaires that help to assess the child's auditory development and the benefits from the devices used. The application of questionnaires allows monitoring the progress of the auditory development of children who use hearing aids and to compare their perception with normally hearing children. The work presents audiometric results and assessment of the auditory development based on the LittleEars questionnaire, obtained in children with moderate hearing loss under two years of age after application of hearing aids.

Objectives: The aim of this study was assessing the development of the auditory system in children under two years of age after application of hearing aids and assessing the effectiveness of hearing prosthesis used.

Materials and Methods: The research group consisted of 30 patients from the Institute of Physiology and Pathology of Hearing, children aged 7–23 months on the day of the study. To assess the threshold of hearing in children, auditory brainstem response and behavioral audiometry were performed. 20 children were provided with classical behind-the-ear hearing aids, in 10 children bone conduction hearing aids have been applied. The development of children auditory performance after the application of hearing aids was assessed with the LittleEars questionnaire and a re-examination of the behavioral observation audiometry about 6 months after the hearing aids were applied.

Results: The results of audiometric tests obtained from behavioral observation audiometry (BOA) in a wide range of frequencies showed improvement in hearing in all children. Analysis of the LittleEars questionnaire answers indicates progress in the areas of auditory skills of children who use hearing aids. The delay of auditory development in hearing-impaired children using hearing aids in relation to normally hearing children is on average 4 months.

70% of the research group achieves results within the normal range (the average achieved by children with normal hearing).

Conclusions: The use of hearing aids in children with moderate hearing loss allows for proper development of auditory perception. The use of the questionnaire supports the audiological evaluation and allows monitoring of auditory development. When assessing the child's hearing reactions and development after using different types of hearing aids. There is a significant improvement in the development of listening skills in all devices. In order to reliably evaluate the effects after the use of hearing aids in addition to audiometric tests, standardized questionnaires intended for children of a given age should be conducted.

P-036

Dizziness symptom profile in patients diagnosed with vestibular migraine based on 2018 ICHD-3b criteria

Ho E.C.1, Lee B.W.W.²

¹ ENT Department, Tan Tock Seng Hospital, Singapore

² Lee Kong Chien School of Medicine, Singapore

Introduction: There has been an expanding body of research into a vestibular migraine (VM), now recognized as one of the commonest causes of recurrent dizziness that is underdiagnosed. The International Headache Society (IHS) and Bárány Society issued a Consensus Diagnostic Criteria for VM to improve diagnostic certainty and patient management. However, the types of dizziness that patients with VM experience remain a largely debatable topic. Neuhauser et. al. previously excluded non-vertiginous dizziness from their diagnostic criteria for VM, although non-vertiginous dizziness such as lightheadedness has been reported by other studies to be more common than vertigo among migraineurs. The most recent VM diagnostic criteria included only head-motion induced visual-spatial disorientation with nausea as a qualifying episodic vestibular symptom but not other forms of non-vertiginous dizziness. In a large population-based survey conducted in Germany, the most common vertigo symptoms reported were spontaneous rotatory vertigo (67%) and positional vertigo (24%). The aim of this study is to evaluate and characterize the dizziness symptoms that patients with VM present with to an ENT clinic in a tertiary hospital in Singapore.

Materials and Methods: All 153 subjects identified to have probable or definite VM diagnosed based on ICHD-3b criteria were selected from a larger prospective cross-sectional study conducted on 307 subjects presenting to the ENT clinic in a tertiary hospital in Singapore for consultation for dizziness over a six week period. Patients were administered a questionnaire and descriptions of dizziness symptoms, triggers, and relieving factors and associated accompanying symptoms and diseases as well as family history was evaluated.

Results: Of 153 patients presenting to the ENT clinic with dizziness diagnosed with probable or definite VM, the

commonest dizziness symptom was spontaneous vertigo (92.2%) of which 76.5% experienced external vertigo and 58.2% experienced internal vertigo. Other types of dizziness reported included head position change induced (79.7%), head movement induced (62.7%) and visually provoked dizziness (52.9%). The most common duration of dizziness episodes was between 1 hour to 24 hours (40.5%). Auricular symptoms such as hearing loss, (29.4%) aural fullness (30.7%), and tinnitus (48.4%), as well as headache (68.0%) and nausea or vomiting (71.2%), were prominent during dizziness episodes. 39.2% reported a history of motion sickness. Common triggers were a lack or irregularity of sleep, increased stress in life and worry or anxiety. Common relieving factors were self-medication and resting in a place away from bright lights and sounds. 25.5% had a family history of recurrent dizziness episodes. Majority of subjects reported dizziness getting worse (45.1%). 60.1% of subjects felt that dizziness bothered them more compared to headache.

Conclusions: Spontaneous vertigo is the predominant dizziness symptom presenting in VM patients and is associated with nausea and vomiting as well as concomitant headaches. Patients report a history of motion sickness and family history of recurrent dizziness episodes. Common triggers and relieving factors of dizziness episodes were evaluated. Most subjects reported a worsening course of VM disease progression as well as dizziness symptoms having a greater impact compared to headache symptoms.

P-037

Effect of angiogenesis inhibitor on experimental otitis media with effusion

Jang C.H.¹, Park B.Y.², Kim M.Y.²

¹ Department of Otolaryngology, Chonnam National University, Gwangju, South Korea

² AngioLab, Daejeon, South Korea

Objectives: The purpose of this study was to investigate the effect of a natural angiogenesis inhibitor, in an experimental otitis media model in vivo, and in inflammation-induced human middle ear epithelial cells (HMEECs) in vitro.

Materials and Methods: After skin incision, a small hole was also created by drilling on the bony portion of Eustachian tube (ET) and then dental cement was injected into the small hole using a 1ml disposable syringe. Two days after ET obstruction using dental cement, the bulla was identified again and then rhVEGF (0.5 µg/20 ml, recombinant mouse VEGF, Sigma) was injected into the bulla using 27 gauze connected Hamilton syringe under general anesthesia by isoflurane inhalation. All SD rats were observed using otomicroscope to confirm the presence of OME. After ET obstruction, phosphate buffered saline (control group, $n = 11$), angiogenesis inhibitor ($n = 11$) were taken orally 100 mg/kg/day to rats. The TM change, histopathological findings, mucosal thickness were assessed. TM findings were defined by grade II (full effusion), grade I (partial effusion) and grade 0 (no effusion). For in vitro test, after induction of inflammation in human

middle ear epithelial cells (HMEECs) by VEGF or lipopolysaccharide (LPS), the effect of angiogenesis inhibitor was assessed by the expression of genes encoding the inflammatory cytokine interleukin (IL)-23 and tumor necrosis factor-alpha (TNF-alpha), matrix metalloproteinase (MMP)-2,3,9,13, hypoxia-Inducible Factor (HIF)-1 and VEGF-165 were analyzed using real time-PCR.

Results: OME induction was identified in the control and experimental groups. In the experimental group, the clearing up MEE started to improve from grade 2 to grade 1, and within 7 days, out of eleven, the effusion improved to grade 0 (90.9%). One rat was developed acute otitis media (AOM). In the control group, however, only 2 of the 11 animals showed grade 0 improvement (18.1%), 7 out of 11 rats had no improvement in MEE (63.6%), and 2 of them progressed to AOM (18.1%). Histopathological findings showed that exudates with inflammatory cells were present in the middle ear cavity in the control group, but the effusion was resorbed in the experimental group. The middle ear mucosa was significantly thinner in the experimental group than in the control group ($p < 0.05$). Upregulated IL-23, TNF-alpha, and MMP-3,9,13 genes by VEGF were significantly decreased treated with angiogenesis inhibitor. And upregulated IL-23, TNF-alpha, MMP-3,9,13, HIF-1 and VEGF-165 genes by LPS were significantly decreased treated with angiogenesis inhibitor.

Conclusions: From these results, angiogenesis inhibitor may helpful for the treatment of OME. Further studies are planned to identify the protein level in vitro test.

P-038

Effect of yoga training on the daily functioning of patients with chronic tinnitus

Niedziałek I., Raj-Koziak D., Gos E., Milner R., Wolak T., Ganc M., Wójcik J., Skarżyński P.H., Skarżyński H.

Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

The present study is the first into the efficacy of 12 weeks of yoga training in treating patients with chronic tinnitus. We recruited 25 patients with chronic tinnitus who had no previous experience with yoga. The patients took part in a regular 12-week yoga course, 90-minute classes twice a week. Ten of these patients underwent a magnetic resonance imaging (MRI) examination before and after the training period. The control group comprised of 13 people reporting chronic tinnitus. All participants were assessed with the *Tinnitus Functional Index*, on 8 important domains of negative tinnitus impact before and after the yoga course. After the 12-week yoga training course, the most beneficial areas were: a sense of control of tinnitus, sleep, quality of life and intrusiveness. MRI studies indicated that the connections in the white matter to the motor cortex were strengthened as a result of the training. Yoga training has good potential to improve the daily functioning of patients with chronic tinnitus and could be considered as a promising supporting method for tinnitus treatment.

P-039

Effectiveness of stapes surgery in patients over 60 years old

Gocel M.¹, Kutymba J.¹, Ratajczak A.¹,
Skarżyński P.H.^{1,2,3}, Skarżyński H.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: Otosclerosis is a disease that leads to progressive, unilateral or bilateral hearing loss, firstly conductive, and with time mixed or sensorineural hearing loss (depending on the location of otosclerotic outbreaks and the severity of the disease). Otosclerosis is most common in women aged 15–40. However, as life expectancy increases, there may be a tendency to observe more elderly patients who need stapes surgery. The aim of this study was to analyze the hearing results of stapes surgery in otosclerotic patients older than 60 years.

Materials and Methods: The object of these retrospective study are patients undergoing first stapes surgery (none of the ears were previously operated). In all cases, otosclerosis were diagnosed preoperatively or intraoperatively. Age was an inclusion criterion. All patients at the time of surgery were over 60 years old. The evaluation of the effectiveness of stapes surgery in elderly patients was made on the grounds of pure-tone audiometry (air conduction and bone conduction thresholds). The results were analyzed preoperatively, at 5 years postoperatively, and 10 years postoperatively. The mean preoperative and postoperative air-bone gap (ABG) was calculated as the difference between the air conduction (AC) and bone conduction (BC) thresholds at frequencies 500, 1000, 2000, 4000 Hz. The average hearing gain was calculated as the difference between the preoperative and the postoperative ABG.

Results: In the preoperative period (50 patients, 59 surgeries), the mean AC thresholds at frequencies 500, 1000, 2000 and 4000 Hz were 69,84 dB, mean BC thresholds were 37,63 dB and the mean pre-operative ABG was 32,2 dB. At 1 year postoperatively (49 patients, 58 surgeries) the average AC thresholds at the same frequencies were 45,37 dB, BC thresholds were 34,24 dB and the mean ABG was 11,13 dB. Closure of ABG within 10 dB was achieved in 69 % (40 ears). At 10 years postoperatively (30 patients, 35 surgeries) the average AC thresholds were 50,36 dB and BC thresholds were 41,75 dB. The average hearing gain (preoperative minus postoperative air-bone gap) 1 year postoperatively was 20,21 dB.

Conclusions: According to literature stapes surgery should be offered to the elderly patients (especially when it is possible to recover social hearing) with the same indications as younger patients with otosclerosis even if audiometric results are better in younger groups. Stapedotomy or stapedectomy in the elderly is indicated to avoid hearing aid use or to facilitate hearing aid fitting when the association of otosclerosis and presbycusis makes hearing aid unserviceable.

P-040

Effectiveness of stapes surgery in the elderly – review of literature

Gocel M.¹, Skarżyński P.H.^{1,2,3}, Skarżyński H.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: Otosclerosis is a complex and progressive disease of pathological bone remodeling that affects the otic capsule of the temporal bone, resulting in conductive and with time sensorineural or mixed hearing loss. Otosclerosis is most common in women aged 15–40. However, as life expectancy increases, there may be a tendency to observe more elderly patients. The aim of this literature study is to measure the effectiveness of stapes surgery in the elderly according to various investigators.

Materials and Methods: The review is based on electronic databases, containing scientific articles: PubMed, Web of Science and Google Scholar. The publications have been found by using consecutive keywords: 'otosclerosis in the elderly', 'stapedotomy in the elderly', 'age-related otosclerosis', 'age-related stapedotomy', 'stapes surgery in the elderly'. Eventually, 10 English-language publications, in which at least one of the presented groups of patients were patients over 60 years of age were selected and analyzed.

Results: According to the authors, the decisive factor for successful surgery is the closure of the air-bone gap in 0–10 dB. This result was obtained in over 80% of older patients. Based on a review of the literature, it was observed that in the elderly patients, pre-operative bone conduction thresholds were elevated (> 30 dB HL), which may be dictated not only by otosclerosis but also by presbycusis hearing loss.

Conclusions: Surgical methods of otosclerosis treatment are equally effective in the elderly as in other age groups. However, in three publications, a different position was postulated, paying attention to poorer postoperative results of people over 60 years of age compared to younger patients. At the same time, the value of other aspects demonstrating the benefits of otosclerosis treatment in older people, such as inhibition of the disease process, but also the elderly patients experience greater satisfaction especially in terms of daily activities and interpersonal relations.

P-041**Electrical Complement stimulation (EC) in Partial Deafness Treatment in a child: long-term hearing outcomes**

Skarżyński H.¹, Dziendziel B.², Włodarczyk E.², Lorens A.³, Skarżyński P.H.^{2,4,5}

¹ Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ Implants and Auditory Perception Department, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁵ Institute of Sensory Organs, Kajetany, Poland

Until 2002, there was a group of patients with partial deafness would not have been considered for cochlear implantation due to their functional low-frequency residual hearing. An example of such a group were patients with normal or near-normal hearing in the 125–500 Hz frequency range and severe-to-profound hearing losses for frequencies above 500 Hz. This type of partial deafness has been defined as the Partial Deafness Treatment-Electrical Complement (PDT-EC) according to the Skarzynski's PDT classification. For the first time, the PDT-EC cochlear implantation was performed by H. Skarżyński in 2002 in an adult patient, and in 2004 in a child. In this chapter, we report the results of cochlear implantation in an adolescent with a hearing loss diagnosed as partial deafness: his good hearing in low frequencies (below 500 Hz) was complemented with electric stimulation in the frequency range above 500 Hz. We present the auditory benefits in a 10-years-long observation period.

P-042**Electrical Complement stimulation (EC) in Partial Deafness Treatment in an adult cochlear implant user: long-term hearing outcomes**

Skarżyński H.¹, Dziendziel B.², Włodarczyk E.², Lorens A.³, Skarżyński P.H.^{2,4,5}

¹ Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ Implants and Auditory Perception Department, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁵ Institute of Sensory Organs, Kajetany, Poland

The first surgery in the world of cochlear implantation (CI) in an adult with partial deafness was performed by H.

Skarżyński in 2002. The patient had a fully efficient hearing in the frequency range of 125–500 Hz and deafness at other frequencies. Treatment of this type of hearing loss has been called Partial Deafness Treatment-Electrical Complement stimulation (PDT-EC). In this chapter, we present long-term hearing results in the first adult CI patient with PDT-EC. She had first CI in the left ear in 2002 and the second in the right ear in 2010. Both implantations were done according to the Skarzynski's 6-steps surgical procedure. Pure-tone audiometry tests were performed pre- and postoperatively and hearing preservation score (HP) calculated using the Hearing Preservation Calculator developed by H. Skarżyński. The auditory benefit was assessed using the Pruszewicz monosyllabic word test in a free sound field. The results (in the left ear after 17 years and in the right ear after 9 years) show complete-to-partial HP in both ears. In the whole follow-up period, the HP exceeded 60%. The monosyllabic word tests conducted before and after surgery showed steady improvement of speech understanding in quiet and in noise. The greatest auditory benefits were seen in bilateral electrical stimulation. Long-term results show good preservation of the preoperative hearing thresholds and significant auditory benefits from CI. If a patient with partial deafness has no benefits from hearing aids, electric complementation of existing hearing with a CI is an effective method of compensation.

P-043**Electro-Natural Stimulation (ENS) in Partial Deafness Treatment – a longitudinal case study**

Skarżyński H.^{1,2}, Włodarczyk E.², Dziendziel B.², Lorens A.², Skarżyński P.H.^{1,2,3,4}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

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

³ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁴ Institute of Sensory Organs, Kajetany, Poland

Introduction: There is a significant group of elderly patients whose hearing impairment is characterized by normal or slightly elevated thresholds in the low and medium frequency bands (below 1500 Hz) with nearly total deafness in the high-frequency range, who often remain beyond the scope of effective treatment by hearing aids. The application of a cochlear implant to restore the high-frequency hearing while preserving low and mid-frequency acoustic hearing in the implanted ear (electro-natural stimulation PDT-ENS) is a new, but effective and proven treatment approach. However, in order to popularize this method of treatment in cases of partial deafness with such preoperative hearing profile, the long term follow-up of hearing preservation is crucial.

Case report: This study presents the case of a 75-year-old patient with a good hearing in the range 125–1500 Hz and deafness at other frequencies. He underwent cochlear implantation in PDT-ENS. At present, the post-implantation follow-up, in this case, is nearly 9 years.

Conclusions: The results demonstrate that low and mid-frequency hearing (up to 1500 Hz) can be preserved using the round window surgical technique. A substantial improvement in speech discrimination was also observed when electrical stimulation on one side was combined with acoustic stimulation on both sides. There is scope to extend qualifying criteria for cochlear implantation to include elderly patients suitable for ENS. The long term follow-up results confirm the validity of the surgical intervention in such cases of partial deafness.

P-044

Eustachian tube mucosal melanoma diagnosed by pathological findings of middle ear effusion

Kanazawa H.¹, Yoshida N.²

¹ Saitama Citizens Medical Center, Saitama, Japan

² Jichi Medical University Saitama Medical Center, Saitama, Japan

Objectives: To present a case of primary Eustachian tube mucosal melanoma by a pathological diagnosis of the mucus middle ear effusion.

Materials: Pathology of the mucus middle ear effusion.

Methods: Patient is a 44-year-old female presented with glue ear for 2 months. Tympanostomy and tube insertion was performed, but the dark effusion didn't improve as in cholesterol granuloma. We also found a dark small mass of Eustachian tube (ET) pharyngeal orifice. Brown lesion was not seen in the middle ear. A temporal bone computed tomography (CT) scan and MRI demonstrated a limited mass of ET and middle ear effusion which extend to the mastoid. There existed melanophages in the dark middle ear effusion which was positively stained with DOPA reaction and Fontana-Masson stain. An immunohistochemical study showed positive reactivity of atypical cells with S-100 protein and HMB-45 antibodies. After diagnosis could be treated with carbon ion radiotherapy and chemotherapy without distant metastatic.

Results: Middle ear and Eustachian tube mucosal melanoma have difficulty in treatment according to its anatomical localization. Biopsy of the mucosa is generally recommended to diagnose melanoma but carries a high risk of metastatic change. There was no cytological diagnosis of middle ear effusion in mucosal melanoma of temporal bone in previous literature. The examination of cerebrospinal fluid is already used when meningitis malignant melanoma is suspected.

Conclusions: Cytological examination of middle ear effusion might be very useful for safe and early diagnosis without risk of metastasis.

P-045

Evaluation of change in brain metabolism in tinnitus with use of hydrogen magnetic resonance spectroscopy

Wójcik J.¹, Cieśla K.¹, Wolak T.¹, Skarżyński P.H.^{2,3}

¹ Bioimaging Research Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Introduction: Tinnitus is the subjective perception of auditory sensations in the absence of an external sound source. The mechanism of tinnitus generation has not been clearly elucidated but it is known that it is accompanied by structural and functional changes in the central nervous system. Human and animal studies indicate that metabolites, including gamma-aminobutyric acid, glutamate, and glutamine, might be directly involved in tinnitus. The method of hydrogen magnetic resonance spectroscopy (1HMRS) is used for non-invasive assessment of metabolites in the human body. The study aimed to evaluate relative levels of brain metabolites, as well as psychological functioning in patients with tinnitus, with the use of 1HMRS.

Materials and Methods: Participants of the study included patients with unilateral or bilateral tinnitus and healthy subjects. All subjects participated in a 1HMRS in technique Single Voxel Spectroscopy (SVS) for 4 brain locations: right frontal area, left frontal area, right temporal area, left temporal area. The relative concentration of glutamine and glutamic acid (Glx) to creatine and GABA to creatine have been calculated using the LCModel software. All participants completed psychological questionnaires: State-Trait Anxiety Inventory and *Polish Depression Assessment Questionnaire*. Patients with tinnitus, in addition, filled in 3 questionnaires about tinnitus: *Tinnitus Handicap Inventory* (THI), *Tinnitus Functional Index* (TFI) and *Kwestionariusz charakterystyki szumów usznych* [Polish Tinnitus Characteristics Inventory] – an in-house instrument developed by specialists of the Institute of Physiology and Pathology of Hearing. All test results were deemed statistically significant at $p < 0.05$. Statistical analyses were done in IBM SPSS Statistics 20.

Results: Healthy subjects presented with higher levels of GABA, as compared to patients with unilateral and bilateral tinnitus and normal hearing, in all examined brain sites. This indicates decreased inhibition in temporal and frontal lobes in tinnitus.

Conclusions: Based on literature review it can be said that the presented study applying the 1HMRS method to evaluate levels of Gamma-aminobutyric acid, Glutamate and Glutamine (Glx) in the brain is the first one in the world involving such a sizable population of patients with tinnitus.

P-046

Evaluation of self-perceived disability due to headache symptoms in patients presenting to ENT clinic diagnosed with migraine and vestibular migraine

Ho E.C.¹, Lee B.W.W.²

¹ ENT Department, Tan Tock Seng Hospital, Singapore

² Lee Kong Chien School of Medicine, Singapore

Introduction: Migraine and dizziness are common complaints amongst the general population, and it has been established that the association between these common symptoms are more than a chance occurrence. Vestibular migraine (VM), which is the constellation of episodic vertigo linked to migraine symptoms, has been incorporated into the International Classification of Headache Disorders (ICHD) – 3rd edition (beta version) of headache classification. There has not been a study on the impact of headache symptoms on patients presenting with dizziness, although studies have shown migraine to result in severe disability and a substantial burden to patients, disrupting social and leisure activities as well as physical and emotional functioning and health-related quality of life. It can result in a loss of productivity while at work as well as absence from work, both of which may result in substantial economic burden. The aim of our study is to evaluate the impact of headache symptoms on the lives of patients with VM.

Materials and Methods: Patients presenting to the ENT clinic with dizziness symptoms were administered a questionnaire asking about their headache and dizziness symptoms. They were diagnosed with probable and definite VM and migraine through the diagnostic criteria in the ICHD – 3rd edition (beta version). Impact on daily life was conducted through the *Migraine Disability Assessment Test* (MIDAS), *Dizziness Handicap Inventory* (DHI) and *Depression, Anxiety and Stress Scale* (DASS-21). Statistical analysis was performed using Stata (version 13.1, College Station, TX: StataCorp LP). Kruskal-Wallis equality-of-populations rank test and *Chi-squared* or Fischer's exact test was used for categorical data.

Results: Of 117 subjects with probable and definite VM and migraine selected for this study, 59.8% of patients experienced mild to severe disability, with 23 (19.7%) mild, 13 (11.1%) moderate and 34 (29.1%) severe disability due to headache symptoms. The most prevalent aspect of daily life that headache symptoms affected was productivity in household work, of which a mean of 7.7 days (± 18.1) in the last 3 months was reduced by half or more. Comparing the correlation between MIDAS and the DHI as well as DASS-21 used to measure the amount of disability and negative emotions caused by dizziness symptoms, there was a significant correlation between DHI severity and MIDAS ($p < 0.001$), as well as between Anxiety Domain of DASS-21 and MIDAS ($p = 0.002$).

Conclusions: Headache can have a significant impact on the daily lives of patients with dizziness, and it is important for clinicians to be able to recognize and diagnose

migraine and VM based on the ICHD-3b criteria. MIDAS can be used as an assessment tool in patients with headaches to identify patients with significant disability from headache symptoms, and can also give an indication on the severity of dizziness as well as negative emotional states that these patients might have.

P-047

Evaluation of the effectiveness of maneuvering in benign paroxysmal positional vertigo

Janicki K.¹, Szuber D.¹, Bartnicki B.¹, Skarżyński P.H.^{2,3,4}

¹ Subcarpathian Center of Hearing and Speech Medincus, Rzeszów, Poland

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

³ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁴ Institute of Sensory Organs, Kajetany, Poland

Introduction: Benign paroxysmal positional vertigo (BPPV) is one of the most common causes of vertigo. It is caused by the displacement of otoliths into the semicircular canals of the labyrinth. In order to determine the localization of otoliths, the Dix–Hallpike and Roll test are usually applied.

Objectives: The aim of the study is to present the results of diagnostic tests and assess the effectiveness of maneuvering in the treatment of benign paroxysmal positional vertigo.

Materials and Methods: The research group consisted of 25 patients with benign paroxysmal positional vertigo from the Subcarpathian Center of Hearing and Speech. The patients underwent the VNG examination and in the next stage, adjustment maneuvers were performed.

Results: In cases of 12 patients a positive Dix–Hallpike test was obtained on the left side and in 12 on the right side (one patient was diagnosed twice). A positive Roll test result was obtained in two subjects. In all patients, the discomfort was relieved after the maneuvers, but five patients reported a recurrence of the discomfort that resolved after the next treatment maneuvers. Of the 25 patients with BPPV, 7 people had an additional single-sided decrease of excitability of the labyrinth.

Conclusions: In the own material of the clinic, as in the medical literature, the effectiveness of the adjustment maneuvers was confirmed.

P-048

Evaluation of relationship between psychoacoustic matches of tinnitus loudness and tinnitus intensity measured with Visual Analogue Scale

Raj-Koziak D.¹, Gos E.¹, Świerniak W.¹, Karpiesz L.¹, Niedziałek I.¹, Włodarczyk E.¹, Skarżyński H.¹, Skarżyński P.H.^{1,2,3}

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: The aim of the study was assessing the relationship between psychoacoustic matches of tinnitus loudness and tinnitus intensity measured with Visual Analogue Scale (VAS) in normal hearing and hearing loss tinnitus patients.

Materials: A clinical group of 140 adult patients (46,4% women and 53,6% men) in age from 19 to 81 years old, with chronic tinnitus sensation lasting more than 6 months.

Methods: All participants completed a VAS scale measuring tinnitus intensity before any audiometric and psychoacoustic testing. Psychoacoustic loudness of tinnitus was evaluated for each patient. Hearing threshold levels were determined for each patient at the frequencies from 0.125 to 8 kHz. The relationship between tinnitus loudness and tinnitus intensity was calculated using Pearson's *r* correlation coefficient. Linear regression analysis was conducted to investigate whether perceived tinnitus intensity measured with VAS could be predicted by psychoacoustically measured tinnitus loudness.

Results: Tinnitus loudness measured with dB SL was significantly lower in patients with bilateral hearing loss than both in patients with unilateral hearing loss and also patients with normal hearing. Tinnitus intensity measured with VAS was significantly higher in patients with bilateral hearing loss than in patients with normal hearing. There is a relationship between psychoacoustic matches of tinnitus loudness and tinnitus intensity measured with VAS, but this relationship is present only in patients with normal hearing.

Conclusions: VAS scale describing tinnitus loudness as a scale corresponding to a psychoacoustic measurement of tinnitus is useful only in the group of normal hearing tinnitus patients.

P-049

Extension of the criteria for Partial Deafness Treatment

Lorens A.¹, Skarżyński H.², Włodarczyk E.³, Skarżyński P.H.^{3,4}

¹ Implants and Auditory Perception Department, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Warsaw/ Kajetany, Poland

³ Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

We present a series of cases with partial deafness (PD) whose hearing impairment is characterized by normal or slightly elevated thresholds in the very narrow low-frequency range (typically up to 250 Hz), and with nearly total deafness at higher frequencies. These cases are outside the classification criteria for partial deafness cochlear implantation. However, their preoperative results suggest that these patients with preserved hearing after implantation can benefit from the combination of acoustic and electric hearing. Therefore, extending the indications for partial deafness treatment (PDT) is still possible.

P-050

First application of the Vibrant Soundbridge implant with an LP-coupler in the posttraumatic hearing loss

Skarżyński H.¹, Porowski M.¹, Barylyak R.¹, Włodarczyk E.², Skarżyński P.H.^{2,3}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

First clinical application of the new LP-coupler, shown at the international conference and a series of demonstration surgeries on 31st March 2017, was the first demonstration of the new possibilities of the safe and efficient application of the Vibrant Soundbridge implant. We describe here a case of a 45-year-old patient with bilateral mixed hearing loss caused by head trauma. A tympanoplasty procedure performed earlier has been successful in sealing the defect of the tympanic membrane in the right ear, removing the adhesions and mobilizing the conductive apparatus of the middle ear damaged due to the trauma. The improvement of hearing after the surgery was short-lived (about 1 month); the middle ear conditions observed intraoperatively during the tympanoplasty suggested the luxation of the first ossicle, the weak joint between the malleus and the incus and adhesion between the head of the malleus and the superior wall of the tympanic cavity. The lack of

the durable auditory effect was the reason of the qualification of the patient for the revision surgery with the first application of the new LP-coupler for fixing of the FMT transducer of the VSB implant to the long process of the incus. The hearing effect observed directly after the removal of the packing and connecting the sound processor was very good. In the 2-year long follow-up period, the audiological results did not deteriorate, which may be considered a significant clinical achievement.

P-051

Gait strategies associated with unilateral vestibular loss

Lee H.H.

Department of Otolaryngology-Head and Neck Surgery, Kosin University College of Medicine, Busan, Korea

Objectives: Despite patients with dizziness were reported of revealing gait problems, there is still a lack of objective quantitative measurement of gait patterns of peripheral vestibular disorders. Based on a shoe-type wearable device, this paper develops gait analyzing algorithms to obtain quantitative measurements and explores the essential indicators from the measurements for peripheral vestibular disorder diagnosis.

Materials and Methods: Between April 2017 and January 2019, 62 patients diagnosed with unilateral vestibulopathy (vestibular neuritis ($N = 57$), sudden sensory neural hearing loss with vertigo ($N = 5$)) were enrolled in this study. The DynaStabMotionCore Analysis (shoe-type inertial measurement units (IMU)* was used to analysis subjects. We assessed normalized stride length, cadence, time of toe off, directional stride regularity (SR), gait variability (GV), *Phase Coordination Index* (PCI) and gait asymmetry (GA) of data from shoe-type IMU sensors during leveled treadmill walking. We tested 1,217 healthy volunteers and classified them as different groups.

Results: We identified the time of toe off rate among the parameters of the human walking pattern. The time of toe off rate of patients with unilateral vestibulopathy was increased to 60.93 ± 2.04 compared to 60.38 ± 1.88 in a healthy volunteer. In addition, there were differences in PCI, GA, and related gait parameters, when comparing peripheral vestibular disorders groups and healthy volunteers.

Conclusions: Gait analysis by the use of shoe-type IMU could provide important information regarding vestibular pathophysiology in patients with unilateral vestibulopathy. Gait performance tests can examine gait variability quantitatively. It will be taken into consideration as a vestibular function test for patients with vertigo.

P-052

Gender differences in dynamics of speech skills acquisition in deaf children using cochlear implants – a longitudinal study

Ganc M.¹, Kochański B.², Jędrzejczak W.W.¹, Kobosko J.¹, Paluch P.², Milner R.¹, Lewandowska M.⁴, Skarżyński H.⁵

¹ Experimental Audiology Department, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

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

³ Rehabilitation Clinic, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Faculty of Humanities, Nicolaus Copernicus University, Toruń, Poland

⁵ Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Objectives: The study was aimed to assess the development of speech skills in infants who are cochlear implant users.

Materials: The study involved 44 children (21 boys, 23 girls) cochlear implant users (average age at CI activation: 13,1 months, std: 3,1 months). All participating children were bilaterally congenitally deaf. The children were divided additionally into two groups according to their gender. The average age in each group was $13,9 \pm 3,1$ and $12,7 \pm 3,1$ months for girls and boys respectively. The groups were not statistically significantly different by age. All children were born on time. No neurological disorders were diagnosed beside to sensorineural hearing loss.

Methods: Speech skills were assessed using the *Children Development Scale* (CDS) by Matczak et al. (2007). The CDS is a Polish age-specific behavioral test for children from 2 months to 3 years of age. CDS allows for broad psychomotor assessment of children in ten sub-tests describing skills and behavior: Manipulation, Motor Skills, Perception, Scribbling and Drawing, Toy blocks, Comparisons, Memory, Speech, Vocabulary, and Social Behaviors. In the present study only results in Speech were analyzed. The children were assessed longitudinally on four intervals regarding CI activation: in a moment of activation and 5, 9 and 14 months after activation.

Results: The CDS results were analyzed in each interval separately. The raw scores in Speech sub-test were compared between gender groups using *t*-test statistic at each interval. At the activation and 5 months after activation there were no significant differences between the groups, however, in the next two intervals, the differences were significant with large effect size (and higher effect size for the latter of them).

Conclusions: Development of speech after cochlear implantation is similar between genders at the beginning but after 9 months gender differences start to occur. Slightly worse performance of boys is in agreement with the results

from the normal population. Further research may bring more information needed for developing targeted therapy for children with cochlear implants.

Acknowledgment: The research is funded by the National Science Centre (2013/08/W/HS6/00333).

P-053

Genetic association study in Polish otosclerosis patients – analysis of RELN and TGFB1 variants

Oziębło D.^{1,2}, Domagała S.¹, Leja M.^{1,2}, Skarżyński H.³, Ołdak M.¹

¹ Department of Genetics, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Postgraduate School of Molecular Medicine, Medical University of Warsaw, Poland

³ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Otosclerosis (OTSC) is one of the most common causes of adult-onset hearing loss in the Caucasian population. Development of OTSC is associated with the abnormal bone remodeling in the region of the otic capsule and stapes footplate. Etiology of OTSC is complex and there are a number of genetic variants reported to be associated with OTSC susceptibility. However, their frequencies have not been analyzed in the Polish population. The purpose of our study was to investigate the genetic variants most strongly associated with OTSC in Polish patients.

Materials and Methods: Genomic DNA was isolated from blood samples or buccal swabs and four genetic variants in TGFB1 (rs1800472) and RELN (rs39335, rs39350, rs39374) genes were genotyped in clinically diagnosed OTSC patients ($n = 94$) and control group ($n = 198$) using Custom TaqMan SNP Genotyping Assays and a real-time PCR system. Allele and genotype frequencies were compared between the groups by *Chi*-square test and odds ratio (OR) with 95% confidence intervals (95% CI) were calculated to estimate risk.

Results: For all of tested genetic variants the distributions of alleles and genotypes were not statistically significantly different between the group of OTSC patients and the control group. There were also no statistically significant differences in relation to the gender of the tested subjects.

Conclusions: Despite multiple pieces of evidence on the contribution of TGFB1 and RELN variants to the development of OTSC in other populations, there is a lack of statistically significant association between the studied variants and the development of OTSC in Polish patients. Our results indicate the presence of inter-population differences and confirm the genetic heterogeneity of this disease.

P-054

Genetic basis of autosomal dominant hearing loss in pediatric patients

Oziębło D.^{1,2}, Leja M.^{1,2}, Sarosiak A.^{1,2}, Skarżyński H.³, Ołdak M.¹

¹ Department of Genetics, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Postgraduate School of Molecular Medicine, Medical University of Warsaw, Warsaw, Poland

³ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Autosomal Dominant Hearing Loss (ADHL) is the second most common form of inherited hearing loss with an onset after the second decade of life. Current knowledge on the genetic aspects of ADHL in Polish patients is limited, which significantly affects the diagnosis, genetic counseling and prevents prediction of disease progression.

Materials and Methods: Thirteen families with ADHL diagnosed before 18 years of age were enrolled in the study. DNA was isolated from peripheral blood or oral cavity swab samples from probands and family members. High-throughput genetic analysis using the TruSight One panel (Illumina Inc.) and the MiSeq sequencer was carried out for the probands. To confirm the presence of identified genetic variants and their segregation with ADHL in individual families Sanger's sequencing was performed.

Results: Genetic cause of ADHL was identified in approximately 60% (8/13) of the families. The identified variants were located in ACTG1, COCH, DIAPH1, EYA4, KCNQ4, PTPRQ, TBC1D24 and TMC1. Among the identified variants approximately 60% (6/8) were novel. In the remaining families the selected variants did not segregate with ADHL.

Conclusions: Our results show high genetic heterogeneity of ADHL in Polish pediatric patients. Considering frequent identification of new genetic variants, it is necessary to perform thorough clinical examination and segregation analysis of the selected variants with ADHL in the largest possible number of family members. In patients with no genetic cause identified, the study area should be extended and include all protein-coding regions or the whole genome.

Supported by: NCN Sonata BIS6 grant no. 2016/22/E/NZ5/00470.

P-055

Group psychological intervention in the rehabilitation of tinnitusSarnicka I.¹, Fludra M.², Karendys-Łuszcz K.¹¹ *Tinnitus Clinic, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland*² *Rehabilitation Clinic, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland*

Introduction: The aim of the psychological hospitalization in the Institute of Physiology and Pathology of Hearing is to facilitate patients' adaptation to tinnitus. It is based on cognitive behavioral therapy. The proposed form of psychological intervention is a unique project consisting of three thematic blocks: (1) psychological intervention based on group work, (2) relaxation techniques using music therapy and bodywork, and (3) activities to improve concentration. The therapy is designed to change patient's reactions to tinnitus in different fields such as perception, attention, emotions, and behavior. As an effect, the therapy is to make tinnitus less troublesome and improve patient's functioning in everyday life.

Aim: The aim of this study was to show the result of both subjective assessment of psychological rehabilitation made by its attendants and the influence of the rehabilitation on cognitive functioning of patients and their behavioral reactions connected with their perception of tinnitus.

Materials and Methods: The research group consisted of 152 audiotically diagnosed patients (average age of 55.9 years). They were informed about the rules of Tinnitus Retraining Therapy (TRT). They all attended one-week psychological hospitalization conducted at the Institute. At the end of their stay patients filled out an evaluation questionnaire developed for this study.

Results and Conclusions: The results of the assessment show that patients perceive psychological hospitalization as a crucial part of tinnitus therapy.

P-056

Headache Symptom Profile of patients with vestibular migraine and migraine based on ICHD-3b criteria

Ho E.C., Lee B.W.W.

¹ *ENT Department, Tan Tock Seng Hospital, Singapore*² *Lee Kong Chien School of Medicine, Singapore*

Introduction: The clinical association between migraine and vertigo is increasingly recognized in recent decades, with studies finding a greater prevalence of migraine amongst patients with dizziness and vice versa. Various terms have been used for this group of patients such as migraine-associated dizziness, migraine-related vestibulopathy, and currently termed vestibular migraine. The International Classification of Headache Disorders (ICHD) – 3rd edition (beta version) contains the diagnostic criteria

for both migraine as well as vestibular migraine (VM), which was only recently incorporated. While there have been several studies on the prevalence and epidemiology of VM in population studies, there has not been an analysis of the headache symptom profile of this group of patients. The aim of this study is to analyze the headache symptoms that patients diagnosed with migraine or VM present with, its associated symptoms as well as triggers and relieving factors.

Materials and Methods: 117 subjects diagnosed to have probable or definite VM and probable or definite migraine based on the ICHD-3 criteria were selected from a larger prospective cross-sectional study conducted on 307 subjects presenting to the ENT clinic for dizziness in Singapore. Patients were administered a questionnaire and descriptions of headache symptoms, triggers and relieving factors and associated symptoms and presence and duration of auras were evaluated.

Results: Of the 117 patients presenting to the ENT clinic with dizziness diagnosed with probable or definite VM and probable or definite migraine, the mean number of years patients have been having headaches is 22.5 years (± 16.6), and mean number of days of headache within the last month was 6.9 days (± 8.8), of which 4.8 days (± 7.7) were severe. The mean duration of each headache episode was 10.4 hours (± 10.5). 90 (76.9%) of these patients had a unilateral headache, 93 (79.5%) was described to be pulsating in nature, 78 (66.7%) was worsened by or resulted in avoidance of physical activity, 72 (61.5%) had nausea and vomiting and 67 (57.2%) had both photophobia and phonophobia. 99.1% of patients rated the severity of headaches to be moderate to severe, and 100 (85.5%) had headaches during dizziness episodes. Other associated symptoms include drowsiness (19.7%), clumsiness (17.1%) and tinnitus (15.4%). 22.2% of subjects experienced auras such as seeing bright spots or flashes (7.7%), weakness (7.7%) and numbness (6.0%) and mean duration that auras last was 13.9 minutes (± 13.0). Common triggers of headache include lack of sleep or poor sleep (53.8%), increased stress (46.2%) and worry or anxiety (42.7%). Relieving factors for headaches include taking a nap (44.4%), avoiding bright lights or loud sounds (40.2%) and self-medication (42.7%). Notably, 67.5% of patients have never been to see a doctor for their headaches.

Conclusions: Despite the agenda of patients presenting to the ENT Clinic being to treat their dizziness symptoms, a significant proportion of them experience significant headache symptoms as well, with a majority rating headaches as moderate to severe in intensity. Furthermore, a large proportion of these patients have never seen a doctor for their headache symptoms. Awareness of the association between dizziness and headache as well as commonly associated symptoms will help identify these patients and implement relevant treatment as well as lifestyle modifications such as avoiding common triggers to improve the quality of life for such patients.

P-057

Hearing aids satisfaction and benefits and their relationship with psychological resources

Rajchel J.J.¹, Krejtz I.², Cywka K.¹, Sztabnicka A.¹, Skarżyński P.H.^{1,3,4}

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

² University of Social Sciences and Humanities, Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: The objective of the study was to evaluate self-reported hearing aids satisfaction and benefits and their relationship to psychological factors considered as important psychological resources: generalized self-efficacy and positive orientation.

Materials: The research group consisted of people admitted to a routine control visit in the Hearing Aids Department single ENT center. The patients were considered as potentially eligible for the study if they were Polish-speaking adults, had postlingual hearing loss, had mild to severe hearing loss depth according to the World Health Organization hearing impairment classification, aged 25–75 years and used on a regular basis at least one hearing aid since a minimum of one month. The exclusion criteria were an earlier diagnosis of concomitant neurological or psychological disorders based on the medical interview or any other condition preventing participation in a questionnaire study.

Methods: Self-efficacy was measured using the *Generalized Self-Efficacy Scale* (GSES) by Schwarzer and Jerusalem (1995) in the Polish adaptation of Juczyński (2000), which is made up of 10 items referring to the person's beliefs about his or her efficacy in dealing with difficult situations and life obstacles. The positive orientation was measured with the *Positivity Scale* (P scale) by Caprara et al. (2009; 2012), in the Polish adaptation of Łaguna, Oleś and Filipiuk (2011), which is built of eight items covering self-esteem, optimism, and life satisfaction. Additionally, data on participants' gender, age, education, marital status, duration of hearing loss, duration of being a hearing aid user (from the moment of hearing aid first fitting until the participation in the study) and number of hours of hearing aid usage per day were collected using a survey designed by the study author. This survey was also composed of two questions referring to the self-report overall satisfaction and benefits of hearing aid use. The answers were placed on a five-point Likert scale from 1 (No benefits/Definitely dissatisfied) to 5 (Large benefits/Definitely satisfied), with the higher score meaning higher satisfaction or higher benefits with hearing aids. To assess the relationship between the evaluated constructs, Pearson and Spearman correlations were used. Significant predictors of hearing aid satisfaction were evaluated using multiple linear regression analysis. Two regression models consisted of the strongest significant audiological variables of hearing aids satisfaction and of positive orientation (model 1) and generalized self-efficacy (model 2). Statistical significance was established at $p < 0.05$.

Results: Two proposed multiple linear regression models were well suited to the data and revealed that both psychological resources: positive orientation ($\beta = 0.31$; $p = 0.002$) and generalized self-efficacy ($\beta = 0.29$; $p = 0.004$) are significant and positively related to hearing aids satisfaction. Interestingly, the psychological variables were not related to hearing aids benefits ($p > 0.05$).

Conclusions: Psychological resources are important predictors of hearing aids satisfaction, which should be taken into consideration in the psychological counseling for adult hearing aids users. In the future, it is worth evaluating cause and effect relationships between these psychological variables and hearing aids satisfaction.

P-058

Hearing outcome according to the intratympanic dexamethasone injection method in combined treatment for sudden sensorineural hearing loss

Park D.H., Choi S.W., Oh S.J., Lee H.M.

Department of Otorhinolaryngology-Head and Neck Surgery, Pusan National University College of Medicine, Pusan National University Yangsan Hospital, Yangsan, Republic of Korea

Objectives: Combined intratympanic and oral steroid treatment has been accepted as an effective treatment strategy for sudden sensorineural hearing loss (SSNHL). However, the treatment protocol of combined treatment for SSNHL has not been established. In this study, we investigated whether hearing outcome differed according to the method of intratympanic dexamethasone injection (ITD) in combined treatment for SSNHL.

Materials and Methods: Tertiary academic referral center-based retrospective medical record and audiological data of 144 SSNHL patients who received combined treatment from January 2015 to April 2018 were reviewed. All patients underwent a 2-week oral systemic steroid treatment and multiple ITD according to hearing improvement. The hearing results of 3 months after treatment were compared according to the timing and number of ITD.

Results: The mean pure tone audiogram gain was 24.3 ± 23.6 dB. When Shigel's criteria were used, the overall rate of hearing improvement was 63.9% (92/144). The rate of hearing improvement was statistically significantly higher in women ($p = 0.043$), and there was a statistically significant lower rate of recovery in the presence of hearing loss ($p < 0.01$) or otitis media ($p < 0.01$). There was no significant difference between the number of ITD and the rate of recovery. However, the delay between the onset of the hearing loss and the first ITD were smaller, the recovery rate increased statistically significantly ($p < 0.01$).

Conclusions: Combined intratympanic and oral steroid treatment is an effective method for SSNHL. The result of this study suggests that early ITD after hearing loss during combined treatment increase the chance of hearing recovery.

P-059

IgG4 expression in patients with eosinophilic otitis media**Masahiro T., Okano M., Iwasaki S., Noguchi Y., Furutate S., Maekawa K.***Department of Otorhinolaryngology, International University Health and Welfare, Mita Hospital, Tokyo, Japan*

Objectives: Eosinophilic otitis media is an inflammatory disease characterized by induction and prolongation of Type 2 inflammatory reactions such as eosinophil activation and mucin production or IgE production. Eosinophilic otitis media has progressive severe hearing loss and may undergo cochlear implantation in some cases, but its pathology has not been elucidated. Focusing on IgG4, which is becoming apparent in the involvement of chronic inflammation, especially Type 2 inflammatory response. Sinusitis may be seen in patients with IgG4 related diseases. The purpose of this study is to investigate IgG4 expression in patients with eosinophilic otitis media.

Materials: The presence or absence of expression of IgG4 was examined in the middle ear mucosa with eosinophilic otitis media cases and cochlear implantation cases without otitis media. This study was approved by the Internal Review Board of International University Health and Welfare, Mita Hospital (5-18-10).

Methods: IgG4 positive cells in the middle ear mucosa of patients with eosinophilic otitis media and control patients who received cochlear implant were identified by immunostaining.

Results: A large number of IgG4 positive cells were expressed in the middle ear mucosa of patients with eosinophilic otitis media. Meanwhile, IgG4 expression was not observed in patients without eosinophilic otitis media.

Conclusions: A large number of IgG4 positive cells were collected in eosinophilic otitis media with cochlear implants. It was suggested that IgG4 or IgG4 positive cells show some relation in the pathophysiology of eosinophilic otitis media.

P-060

Immediate enhancement of speech in noise understanding through audio-tactile stimulation**Cieřła K.^{1,2}, Wolak T.¹, Lorens A.¹, Heimler B.², Skarżyński H.¹, Amedi A.²**¹ *World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland*² *Amir Amedi's Lab for Multisensory Processing, Jerusalem, Israel*

Understanding speech in noise is a significant challenge for the hearing impaired, including users of hearing aids and cochlear implants. This is because of the limited availability of the temporal fine structure (FS) information, both

due to the hearing deficit and limitations of both assistive systems. Interestingly, it has been shown that auditory speech understanding can improve when accompanied by low-frequency tactile stimulation, providing some FS. Here we present a proof-of-concept study of the latter effect in normal hearing subjects, using an in-house Sensory Substitution Device (SSD).

12 non-native individuals listened to English sentences presented against speech-like noise, with (Auditory, A) or without (Audio-Tactile, AT) simultaneous tactile vibration which was the sentences' fundamental frequency (f0). An SSD was used to deliver the latter on two fingertips. For both conditions, 20 sentences were presented via headphones and the participant had to repeat them. A staircase procedure was applied to estimate SNR for 50% understanding (Speech Reception Threshold, SRT), starting at SNR = 0 (65 dB).

8 of the participants took part in a preliminary fMRI study. The study conditions were the same as in the behavioral test. New series of sentences were presented at individually established SRTs. The participants repeated the sentences to a microphone. The main sparse paradigm parameters were set to TR = 7.5 s, TA = 1.5 s, 72 slices, voxel size 2x2x2. The data were analyzed with SPM12, using standard pre-processing steps and the 2nd level analysis.

In the behavioral study, the SRT for the A condition was 18.6 dB (SD = 7.9 dB), and for the AT condition, it significantly improved to 12.6 dB (SD = 8.5 dB; Wilcoxon Signed-Ranks test, $z = -3.06$; $p < 0.005$). The mean group benefit of adding vibration was 6 dB (SD = 4 dB).

The main brain regions revealed when processing audio-tactile speech stimulation included a) bilateral auditory cortex and sensorimotor areas, b) frontal and temporal language regions, c) the cerebellum, d) numerous basal ganglia. These results confirm that the SSD can be used in the MR scanner for a multisensory task.

The study shows that understanding degraded speech can significantly improve by adding complementary information via touch, with no prior training. This provides support of the inverse effectiveness law which says that multisensory enhancement is most significant when SNR between two sensory modalities is low. The immediate integration of audition and touch is probably due to a number of similarities between these senses, such as both transmitting vibrations. The developed SSD has applications for restoration of speech understanding in patients with hearing loss, including those equipped with cochlear implants. Further research is needed to elucidate the underlying neuronal correlates.

P-061

Indications for ventilating tubes insertion in pediatric cochlear implant candidates - conclusions from a very long-term prospective study

Yehudai N.^{1,2}, Duek M.¹, Barzilai R.¹, Brodsky A.^{1,2}, Shihada R.^{1,2}, Chniefes R.^{1,2}, Peleg C.¹, Shpak T.^{1,3}, Luntz M.^{2,3,4}

¹ Ear and Hearing Program, Department of Otolaryngology Head and Neck Surgery, Bnai-Zion MC, Haifa, Israel

² Bruce Rappaport Faculty of Medicine, Technion – Israel Institute of Technology, Haifa, Israel

³ Department of Communication Disorders, Haifa University, Haifa, Israel

⁴ Ear and Hearing Unit, Aram, Center for Otolaryngology - Head and Neck & Maxillofacial Surgery, Assuta Medical Center, Tel Aviv, Israel

Introduction: In pediatric cochlear implant (CI) users special concerns are raised regarding the potential risks of spread of middle ear infection along with the electrode array into the cochlea and central nervous system as well as regarding late sequela of otitis media (OM): eardrum perforation, atelectasis, and cholesteatoma. The age for implantation in children overlaps the peak age incidence of acute OM (AOM) and secretory OM (SOM) and delay of implantation reduces the potential benefit from the intervention. Therefore, control of OM by inserting ventilating tubes (VT) is widely performed in pediatric CI candidates who also suffer from otitis media.

Objectives: To refine indications for VT insertion in candidates for cochlear implantation who also suffer from otitis media.

Materials and Methods: Of 200 children referred for CI and implanted one after another (during a period of 15 years) 126 classified as OM-prone. 98 of them suffered from AOM and 28 from SOM. Rate of development of late sequela of middle ear disease (eardrum perforation, atelectasis, and cholesteatoma) was compared between the two subgroups of OM-proneness.

Results: 15 children (7.5%) developed late sequela of middle ear disease: 3.5% developed eardrum perforation, 3.5% atelectasis and 0.5% cholesteatoma. Late sequela of middle ear disease developed only in the SOM subgroup, and not in the AOM subgroup.

Conclusions: Pre-CI VT insertion in children with SOM who underwent CI did not prevent the development of late sequela of middle ear disease. VT insertion with the object of preventing late sequela of middle ear disease in CI candidates who suffer from SOM only is not required. In otitis-prone children, and especially in implanted otitis-prone children, a long term oto-microscopic follow-up is needed in order to identify late sequela of middle ear disease.

P-062

Is hyperbaric oxygen therapy effective as an additional therapy of profound sudden sensorineural hearing loss?

Lee J.B., Choi J.J., Kim M.H., Ahn H.G., Chung M.-H.

Department of Otorhinolaryngology-Head and Neck Surgery, Konyang University Hospital, Konyang University College of Medicine, Daejeon, Republic of Korea

This study aimed to evaluate the efficacy of hyperbaric oxygen (HBO) therapy used as an addition to the first-line combination steroid treatment of sudden sensorineural hearing loss (SSNHL). 60 profound SSNHL patients were enrolled in our study. Among them, 40 patients received the combination steroid therapy (control group) and 20 individuals were treated with a supplemental application of HBO2 therapy (HBO group). Hearing outcome was determined by pure tone average and speech discrimination score measured by audiometry. There was no significant difference in the improvement between control and HBO group ($p = 0.263$). Our study did not show a statistically significant hearing improvement in all frequency between control and HBO group ($p = 0.368$). Nevertheless, combination steroid therapy showed significant improvements in hearing gain at 500 Hz and 1 kHz compared to that of the pre-treatment audiogram. Additional HBO therapy did not have better improvement than only combination steroid therapy in patients with profound SSNHL.

P-063

Microscopic versus endoscopic ear surgery for isolated ossicular abnormalities

Song K.H., Lee G.H., Kang J.Y., Choi J.W.

Department of Otorhinolaryngology, Head & Neck Surgery, Chungnam National University, College of Medicine, Daejeon, South Korea

Objectives: To compare surgical outcomes of transcanal endoscopic ear surgery (TEES) for isolated ossicular anomalies with those of conventional microscopic surgery.

Materials and Methods: Study design: retrospective case review. Setting: tertiary referral academic center. Patients: fifty-nine ears in 56 patients with isolated ossicular abnormalities. Interventions: ossiculoplasty or stapes surgery using either ear endoscopes or an operating microscope. Main outcome measures: postoperative audiometric results, operation time, the requirement of additional skin incisions, and complications.

Results: Thirty-nine ears (66.1%) were in the microscopic group and 20 ears (33.9%) were in the TEES group. The mean preoperative air-bone gap was 30.5 dB ($SD = 10.2$) in the microscopic group and 31.7 dB ($SD = 12.8$) in the TEES group. The mean postoperative air-bone gap was 7.1 dB ($SD = 6.0$) in the microscopic group and 6.8 dB ($SD = 4.6$) in the TEES group. The differences in the preoperative and

postoperative air-bone gaps between the two groups were not statistically significant ($p = 0.697$ and $p = 0.844$, respectively). Operation time in the TEES group was significantly shorter than that in the microscopic group ($p = 0.001$). TEES patients did not require additional skin incisions, two patients in the microscopic group did. The difference was statistically significant ($p = 0.045$). Postoperative sensorineural hearing loss occurred in one patient in the microscopic group.

Conclusions: TEES for isolated ossicular abnormalities has comparable audiometric results and complication rates to conventional microscopic surgery. TEES appears to have the advantages of shorter operation times and less need for additional skin incisions.

P-064

Music in rehabilitation and development of pediatric patients after cochlear implantation – active and passive music therapy

Skarżyński H., Kaczyńska B., Warsicka M., Sepioło A.

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

Objectives: Main aim of the cochlear implantation in congenital or acquired total and partial deafness is the provision of systematic development of hearing, speech and communication skills. Excellent results of rehabilitation in a large group of patients implanted at different ages made the development of artistic skills of patients a measure of progress in therapy. Results of active and passive music therapy indicate that children who were rehabilitated with music have accelerated auditory development and have as well developed their cognition. The best results were obtained in patients rehabilitated with active music therapy, meaning systematic training with music (playing instruments and singing). The aim of this paper is to present a study of implanted patients whose hearing development was supported by active and passive music therapy.

Materials and Methods: Material includes a group of patients after cochlear implantation, presenting musical skills. All patients were operated according to the 6 steps Skarżynski's procedure. Patients using active and passive music therapy had accelerated the process of hearing rehabilitation. In addition, they have developed other skills, including linguistic, communication, cognitive and general development skills.

Results and Conclusions: In all operated patients, the standard-shaped, and personalized post-operative rehabilitation program was enriched with musical activities. In the opinion of the patients themselves and their families and friends, the inclusion of musical activities contributed to the intensification of the rehabilitation program and quick acquisition of auditory, linguistic and additionally musical skills. At the same time, in the group of teenage and adult patients, the positive influence of music contributed to the reduction or elimination of tinnitus. Supplementing the

traditional post-operative rehabilitation program after cochlear implantation in various types of deafness and profound sensorineural hearing loss with properly selected musical elements has a significant impact on the acquisition of auditory, linguistic, musical and general development skills. It also reduces tinnitus.

P-065

Neurophysiological examinations in otolaryngology: using blink reflex and facial nerve myography in the diagnosis of anarthria

Krasnodębska P., Czarkwiani L., Jarzyńska-Bučko A., Szkiełkowska A.

Audiology and Phoniatrics Clinic, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Neurophysiological examinations give a thorough analysis of nerve, pathway and muscle activities. According to the European Laryngological Society algorithms neurophysiologic examinations are recommended as complementary tests, especially when standard procedures do not bring a solution examinations of the head and neck area most frequently used are electromyography and electroneurography. Blink reflex is rarely used but gives extremely valuable information concerning the condition of the reflex arc leading from the optic nerve (branch of N.V) through the brain stem to the motor fibers of N.VII. The aim of the study was to present diagnostic difficulties in a patient with anarthria lasting for a year, in which neurophysiological examinations allowed to find the causes of ailments and establish a therapeutic plan.

Materials and Methods: A 72-year-old woman with anarthria has been referred to the Department of Audiology and Phoniatrics. Dysarthria lasted for more than two years. The patient was speechless from a year. Additionally reported symptoms were a few second apnea, problems with the loose mobility of the jaw, difficulty swallowing saliva and food. The patient did not report other chronic diseases. Medical history revealed two episodes of gamma rays illuminations due to drug-resistant neuralgia of the right trigeminal nerve. The irradiation concerned the pre-terminal part of the nerve V (7 years ago) and the lower part of the nerve trunk (5 years ago). During the hospitalization in our department, the patient was subjected to the otolaryngological-phoniatric and neurological consultation, speech therapy, neuropsychological and radiological diagnostic procedures.

Results: The physical examination showed a reduction in the efficiency of the peripheral speech apparatus, in particular of the tongue and mouth. The function of the throat and laryngeal muscles were preserved. In addition, impaired respiratory-phonation coordination was observed asymmetrical paresis in the area of the lower branch of the facial nerve was visible (more pronounced on the right side). External consultation of the leading neurosurgeon (with the last MR control test from 10 months ago) regarding the dependence of the symptoms reported by the

patient on the previous gamma irradiation was negative. Nevertheless, we suspected that the failure of the articulation muscles could be caused by distant complications after irradiation associated with the remodeling of the nerve tissue. We performed neurophysiological tests – blink reflex and electroneurography of the facial nerves. The blink reflex showed a disturbed response on the right and left sides. During the right side stimulation, the ipsilateral response was normal, whereas in the contralateral response only 2 out of 8 responses were recorded (all with increased amplitude and prolonged latency). During the stimulation of the left side, R2 responses were not recorded each time, and the recorded responses were characterized by a reduced amplitude. The result of the study indicated that the obstacle in the conductivity is located in pons proximity. Nerve VII neurography showed asymmetry of the responses (to the detriment of the right side). On the right side, extended latencies of the responses from all three branches were recorded. The record of 1st and above all 3rd branch was characterized by a low amplitude. On the left side, the features of nerve irritation were visible. The record of 1st and 2nd branches was characterized by an increased amplitude and the prolonged response of the 3rd branch. The abnormal result of the above tests prompted us to repeat the imaging examination in order to trace the brainstem in detail. Magnetic resonance imaging showed the destruction of the right trigeminal nerve trunk with scarring of the surrounding area. During the hospitalization, the patient participated in individual speech therapy, physiotherapy, and biofeedback therapy.

P-066

Ossiculoplasty for the treatment of hearing loss in patients with osteogenesis imperfecta

Kordowska K.¹, Skarżyński H.¹, Skarżyński P.H.^{1,2,3}

¹ Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: Osteogenesis imperfecta is a connective tissue disorder affecting structures and organs with high collagen content, including the ear. Typically, the examination of the middle ear reveals stapes immobilization through thickening and fixation of the plate, sometimes pathologies of malleus or incus, e.g. epitympanic fixation. In this poster, we present the characteristics and auditory outcomes of a patient after ossiculoplasty for the treatment of hearing loss due to osteogenesis imperfecta.

Materials and Methods: The following case report describes a patient with type III OI, with hearing loss diagnosed since the age of 22 and massive abnormalities of the middle ear. The treatment involved 5 subsequent surgeries to correct a hearing loss in the right ear.

Results: Comparison of the preoperative hearing measurements and the results after the last surgery shows the reduction of the air-bone gap and improvement of hearing

thresholds. The patient rejected the proposition of the implantable hearing devices, therefore it has been decided to continue using the classic hearing aids.

Conclusions: Conductive or mixed hearing loss in osteogenesis imperfecta is an indication for the reconstructive surgery – stapedotomy and ossiculoplasty. Involvement of the 1st and 2nd ossicle and diffuse foci of deossification and bone remodeling within the middle ear, especially in patients with the most advanced forms of osteogenesis imperfecta, is associated with a much lower chance of obtaining a durable, satisfactory auditory effect over the years.

P-067

Otological problems in Churg-Strauss syndrome

Skarżyński H.¹, Zagóra K.¹, Cywka K.¹, Dziendziel B.², Skarżyński P.H.^{1,2,3}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: Churg-Strauss syndrome, also known as eosinophilic granulomatosis with polyangiitis, is an inflammatory disease affecting various tissues and organs. Otolaryngological complications are common and often occur early during the prodromal phase, which points to the key role of otorhinolaryngologists in early diagnosis and for achieving permanent disease remission. The aim of this paper is to present otological problems associated with Churg-Strauss syndrome, their clinical course and therapeutic options supported by a clinical case.

Materials and Methods: A female patient presenting with bilateral, exudative and later obliterative otitis media with extremely thick exudate and transient improvement in response to corticosteroids and surgical treatment including repeated tympanotomies and ventilation tubes. Due to progressing hearing loss caused by obliteration in the early stages of the disease, a conventional hearing aid was used. After the development of the sensory component of the hearing loss, we decided to implant the Bonebridge system in one ear.

Conclusions: Our case shows that for small lesions on otoscopy, recurrent and persistent exudate and mild conductive or mixed hearing loss, the procedure of choice is anterior tympanotomy with long-term ventilation tubes. In the case of progressive hearing loss resulting from very advanced obliteration with mixed hearing loss, better results can be achieved when using bone conduction implants.

P-068

Outcomes of the cochlear implant treatment of a 51-year-old patient with prelingual deafness

Rostkowska J.^{1,3}, Wojewódzka B.^{1,3},
Geremek-Samsonowicz A.^{1,3}, Skarżyński H.^{2,3}

¹ Rehabilitation Clinic, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

The poster presents a case study of a 51-years old man with prelingual hearing loss using a cochlear implant system. Phases of the therapeutic process and the patient's hearing achievements are summarized. The original language material used for auditory training is presented.

P-069

Overestimation of VOR gain in the video head impulse test results in the patients with endolymphatic hydrops

Inagaki T., Otsuka K., Itani S., Ogawa Y.,
Tsukahara K.

Department of Otorhinolaryngology Head and Neck Surgery,
Tokyo Medical University, Tokyo, Japan

Introduction: The vestibulo-ocular reflex (VOR) functions to stabilize images on the retinas during head movement by producing eye movements in the direction opposite to head movement, which helps us preserve the image on the center of the visual field. In the video head impulse test (vHIT), the VOR gain is calculated by measuring eye velocity during head rotations, and which is the ratio of the eye movement to the head movement. Theoretically, the VOR gain should never exceed 1, but sometimes we see the VOR gain more than 1 in the patients with vestibular dysfunction.

Objectives: To investigate the patients with the VOR gain more than 1 in vHIT.

Materials: Twenty-seven patients with vestibular dysfunction which showed the horizontal nystagmus in positional test and the VOR gain more than 1 in vHIT.

Methods: We investigated the following 3 items in these patients: (1) the VOR gain in affected side and the opposite side, (2) the association of the peak velocity of head movement and the VOR gain, (3) the catch-up saccade (CUS).

Results: 1. There were 12 Meniere disease (MD), 5 peripheral vestibular disorder (PVD), 4 benign paroxysmal positional vertigo (BPPV), 3 delayed endolymphatic hydrops (DEH) and 3 acoustic neurinomas (AT). MD and DEH were associated with the endolymphatic hydrops,

and they were 56% of these patients. The VOR gain more than 1 on both sides were frequently seen in the patients with MD. 2. There was no relationship between the peak velocity of head movement and the VOR gain. 3. The CUS can be seen in patients with lower VOR gain. On the other hand, we can see the small wave like CUS in patients with normal VOR gain.

Conclusions: In the patients with vestibular dysfunction associated with endolymphatic hydrops, the VOR gain can be over-estimated in vHIT.

P-070

Paediatric squamosal chronic otitis media: seven years' experience on trends, early outcomes from a tertiary hospital in a developing country

John M.¹, Boaz R.¹, Kalai S.², Kamran S.¹,
Picardo N.¹, Varghese A.M.¹

¹ Department of ENT, Christian Medical College, Vellore, India

² Department of ENT, Jawaharlal Institute of Postgraduate Medical Education & Research, Puducherry, India

Objectives: The squamosal type of chronic otitis media is more aggressive in children. Surgery, which is the mainstay of the management, offers various canal wall up (CWU) and canal wall down (CWD) procedures. The outcomes of treatment depend on the extent of the disease, associated co-morbidities, age of the child, follow up opportunities and facilities available. This article reviews the clinical profile, trends and early outcomes following surgical management of all the pediatric squamous disease over seven years, in a tertiary care center.

Materials and Methods: Data was collected for all the children who underwent surgery for paediatric squamous disease from January 2012 to December 2018 at Christian Medical College, Vellore, South India, by reviewing the chart stored online. All children less than 16 years of age who underwent surgery for the first time for pediatric squamous disease were included in the study. The clinical profile, surgical details, trends in management and early outcomes were analysed. Early outcomes included hearing levels and status of the operated ear, three months after surgery.

Results: Two hundred and eighty-three (283) patients underwent surgery for pediatric squamous disease during this period. Among the surgeries, 58% of children underwent CWU procedures. Over the study period, there was an increasing trend of CWU procedures versus CWD procedures with nearly 30% of the patients having intact canal wall procedures in the first few years of study as compared to 90% in the last year of study. The assistance of otoendoscope in clearing the disease from the hidden areas during the later study period could be the reason for this change. Majority of the children (75%) had disease starting in the mesotympanum, posterosuperior retraction pocket being the most common cause. However, in CWD procedures, 33% started as attic disease as compared to 19% in CWU procedures. Nearly half (51%) of the patients had the disease confined to the mesotympanum and epitympanum

at the time of surgery. In accordance with the literature, Incus was most commonly affected ossicle with 72% of the children having incus erosion. The most commonly performed ossiculoplasty was type 3. At the end of three months, the clinically healthy ear was observed in 74% and 71% of the CWU and CWD procedures respectively. Strict criteria that excluded minimal granulation or mild retractions of the operated ear from considering it as the healthy ear is thought to be the reason the above-mentioned results. The children who came back with a perforation at three months did not show any specific age association. Hearing improvement at three months with a minimum of five decibel gain was seen in 84% of CWU procedures and 75% of CWD procedures. Patients with minimal hearing loss preoperatively did not show any improvement audiotically thus decreasing the hearing improvement percentage, although they were symptom-free.

Conclusions: CWU procedures showed an increasing trend as compared to CWD procedures in children who underwent surgery over seven years period; the introduction of endoscopic-assisted surgery in disease clearance is thought to be one of the reason. At the end of three months, a clinically healthy ear was observed in nearly three-fourths of the children. CWU procedures showed better hearing outcomes as compared to CWD procedures.

P-071

Partial Deafness Treatment Electro-Natural Stimulation (ENS) in a child – long-term hearing outcomes

Skarżyński H.¹, Lorens A.², Dziendziel B.³, Skarżyński P.H.^{3,4,5}

¹ Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Implants and Auditory Perception Department, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁵ Institute of Sensory Organs, Kajetany, Poland

The cochlear implantation qualification criteria are expanding in line with the steady progress of implant technology and medicine. A new group of patients eligible for cochlear implantation comprises patients with partial deafness. This type of hearing impairment is characterized by normal or slightly elevated thresholds in the low and mid-frequency bands (below 1500 Hz) and nearly total deafness in the high-frequency range. Often, these patients find that hearing aids cannot efficiently ameliorate their hearing. Although the partial deafness is most often observed in adults and in the elderly, this type of hearing loss may also occur in children and adolescents. In this chapter, we present the case of a 16-year-old adolescent with a good hearing in the range 125–1500 Hz and deafness at other frequencies. Cochlear implantation has restored

hearing at high frequencies, and low and mid frequency natural hearing in the implanted ear has been preserved. This situation is described as electro-natural stimulation (ENS) of the inner ear. We present the auditory results in a 10-year observation period.

P-072

Partial or total replacement prosthesis after modified radical mastoidectomy

Plichta Ł.¹, Miązek-Zapala N.¹, Suska-Więch A.¹, Górski S.¹, Porowski M.¹, Skarżyński P.H.^{1,2}, Skarżyński H.^{1,2}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

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

Objectives: to analyze predictive factors and outcome of ossiculoplasty after modified radical mastoidectomy using Kurz Titanium prosthesis.

Materials: Retrospective review of 156 ossiculoplasties using partial ossicle replacement prosthesis (PORP) and total replacement prosthesis (TORP) performed in a tertiary referral center in 2016. 45 PORP and 111 TORP cases were evaluated.

Methods: Mean preoperative and postoperative air-bone gaps and the changes in the mean hearing loss were analyzed using a four frequency (500, 1000, 2000 and 4000 Hz) pure tone average. The success rate was defined as a postoperative air-bone gap within 20 dB. Hearing results, complication rates and clinical parameters including age, sex, past history, preoperative diagnosis, and surgery findings were compared among different groups.

Results: Success rate was obtained in 56% in TORP and 62% in PORPS cases. Extrusion rate was 4%. The analysis indicated the presence or absence of malleus handle as a prognostic factor.

Conclusions: Anatomical and technical factors diversely affect the functional outcome of tympano-ossiculoplasties. A better knowledge of their predictive value will enable accurate, preoperative, individual assessment when counseling patients with regard to the success of any proposed intervention.

P-073

Peptide vaccine GV1001 rescues acute hearing loss induced by kanamycin and furosemide

Kim S.H., Rhee J.H., Jung G.O., Koo J.W.

Department of Otorhinolaryngology, Seoul National University Bundang Hospital, Seongnam, Korea

Introduction: Cell-penetrating peptide GV1001 has been under investigating as an anticancer agent. It derived from

the active site of the human telomerase reverse transcriptase. Recently, it has also demonstrated antioxidant and anti-inflammatory effects during a clinical trial. In this study, GV1001 was given at different time point after inducing hair cell damage and checked if GV1001 rescues from hair cell damage and restores hearing.

Methods: A deaf mouse model was created by intraperitoneal injection of kanamycin (Km) and furosemide. First, to test the early temporal change of hearing and extent of hair cell damage after Km and furosemide injection, hearing and outer hair cells (OHCs) morphology were evaluated on day 1, day 2 and day 3 after injection. In the second experiment, following Km and furosemide injection, GV1001, dexamethasone, or saline were given for three consecutive days at different time points: D0 group (days 0, 1, and 2), D1 group (days 1, 2, and 3), D3 group (days 3, 4, and 5) and D7 group (days 7, 8, and 9). The hearing thresholds were measured at 8, 16, and 32 kHz before ototoxic insult, and 7 days and 14 days after Km and furosemide injection. After 14 days, each turn of the cochlea was imaged to evaluate OHCs damage.

Results: In the first experiment, the hearing was markedly deteriorated even from the next day (Day-1 group) of Km and furosemide injection. However, OHCs morphology of apical, middle and basal turns was intact in two out of three mice of the Day-1 group. In the second experiment, GV1001 group and dexamethasone group showed less hearing loss than the saline control group at all tested frequencies (8, 16, 32 kHz) at day 7 and 14 ($*p < 0.017$). In GV1001 group, delayed administration of GV1001 up to 3 days did not show fewer rescue effect as compared with the dexamethasone group. However, we could not find statistical significance between different treating time points of GV1001 administration (D0 / D1 / D3 / D7). GV1001 treated mice showed higher hair cell survival than those of dexamethasone or saline groups with statistical significance especially at D0 group ($*p < 0.017$), and this protective effect of GV1001 than those of saline group showed especially on the middle and basal turn of the cochlea. The BUN values of all GV1001 /dexamethasone/saline treated mice ranged from 12 to 33 (19.02 ± 5.01) mg/dl, and these values belonged in the normal range of BUN.

Conclusions: We demonstrated that cell penetrating peptide GV1001 treated mice showed lesser hearing loss and hair cell damage than those of dexamethasone and saline groups in kanamycin-furosemide induced deaf mouse model. There was no statistically significant difference of hearing loss and OHC damage between D0 / D1 / D3 / D7 experiments with the superior tendency of preventing hair cell damage and hearing rescue even in delayed administration of GV1001 up to 3 days. From this, GV1001 may have a potential clinical role to restore hearing from acute sensorineural hearing loss.

This study was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF-2017R1D1A1B03033013).

P-074

Perceived stress level and stress coping strategies among adult hearing aid users with regard to gender

Rajchel J.J.¹, Kobosko J.¹, Skarżyński P.H.^{1,2,3}

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

² Institute of Sensory Organs, Kajetany, Poland

³ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: The importance of psychological variables in hearing aids rehabilitation process is gaining increasing recognition in the audiological literature. Being a hearing impaired person and hearing aid user can be a demanding experience for an individual, demanding re-shaping self-image and often overcoming obstacles connected with stigmatization in private and professional life. The objective of the study was to evaluate perceived stress level and stress coping strategies among adults with hearing aids with particular regard to potential gender differences.

Materials: The research group consisted of 51 people (52.9% men) aged $M = 60.65$; $SD = 12.34$ admitted to a routine control visit in the Hearing Aids Department single ENT center. The patients were considered as potentially eligible for the study if they were Polish-speaking adults, had postlingual hearing loss, had mild to severe hearing loss depth according to the World Health Organization hearing impairment classification, aged 25–75 years and used on a regular basis at least one hearing aid since a minimum of one month. The exclusion criteria were an earlier diagnosis of concomitant neurological, or psychological disorders based on the medical interview, or any other condition preventing participation in a questionnaire study.

Methods: Perceived stress level was measured using the *Perceived Stress Scale* in the Polish adaptation of Juczyński and Ogińska-Bulik. In this scale, a respondent is asked to assess the degree to which different situations that happen to him or her over the last month are perceived as being stressful. Stress coping strategies were evaluated with the Brief COPE inventory in the Polish adaptation of Juczyński and Ogińska-Bulik, which assess the frequency of using 14 stress coping strategies: active coping, planning, positive reframing, acceptance, humor, religion, use of emotional support, use of instrumental support, self-distraction, denial, venting, substance use, behavioral disengagement and self-blame. Additionally, a self-constructed survey was used to collect data on participants' gender, age, duration of hearing loss, duration of being a hearing aid user (from the moment of hearing aid first fitting until the participation in the study), degree of hearing loss and number of hours of hearing aid usage per day. Descriptive statistics were used to characterize the study population Pearson and Spearman correlations and *t*-tests were used to assess the relationship between the perceived stress level, coping strategies and sociodemographic factors. Statistical significance was established at $p < 0.05$.

Results: People with hearing aids reported average perceived stress level with no statistically significant differences between men and women. There was no statistically significant relationship between age, degree of hearing loss, duration of hearing loss, duration of hearing aids use and a number of hours of hearing aid usage per day and perceived stress level. Significant differences were found between men and women regarding the frequency of coping with stress with acceptance and denial, showing that women significantly more use acceptance coping, and men denial coping. Additionally, age was related to the more frequent use of humor in men and behavioral disengagement in women. More frequent behavioral disengagement coping in women was also related to longer duration of hearing aids use. Regarding the relationship between perceived stress level and coping strategies, men with higher perceived stress level less frequently seek emotional support. Additionally, both men and women with higher perceived stress level used acceptance coping strategy less often.

Conclusions: Although hearing impaired men and women with hearing aids do not differ in perceived stress level, there are significant differences between both genders in terms of patterns of stress coping strategies. Knowledge about the differences between both genders in coping with stress can be potentially useful in the psychological support of people with hearing aids experiencing stress.

P-075

Positive orientation and observed tinnitus annoyance

Fludra M., Kobosko J., Gos E., Karendys-Łuszcz K., Geremek-Samsonowicz A., Skarżyński H.

Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Occurrence of tinnitus in an individual may cause a disorder of the existing balance of the body. One of the resources to deal with this imbalance is positive orientation. Positive orientation is a personal tendency to react to life, future and oneself in a positive way.

Objectives: The aim of the study was to assess whether the positive orientation influences the observed tinnitus annoyance.

Materials and Methods: 176 patients suffering from tinnitus took part in the research. The group included 123 women and 53 men. The patients filled in the following questionnaires: the *p Scale* to assess their positive orientation, *Tinnitus Handicap Inventory* (THI) and *Tinnitus Functional Index* (TFI) questionnaires to assess the impact of tinnitus on their everyday life and the sociodemographic questionnaire.

Results: Positive orientation remained in significant and negative relation to the tinnitus annoyance, measured with questionnaires. Analysis of the value of regression

coefficients presented that the positive orientation has a significant impact on the perceived tinnitus discomfort. Among the additional variables, an important predictor of tinnitus annoyance was age, presence of additional diseases and duration of tinnitus.

Conclusions: Positive orientation is an important immune resource that affects the perceived tinnitus annoyance. Based on the high level of this variable we are able to anticipate a reduced tinnitus discomfort.

P-076

Postoperative tympanic morphology of *pars flaccida* cholesteatomas observed for more than 20 years

Kazuo M.¹, Koichi K.², Naoko T.¹, Kotaro I.¹, Yasuhiro H.¹, Mika N.³

¹ Department of Oto-Rhino-Laryngology, Seirei Yokohama Hospital, Yokohama, Japan

² Department of Oto-Rhino-Laryngology Musashikosugi Kure Doctor's Office, Japan

³ Department of Oto-Rhino-Laryngology Kawakita General Hospital, Tokyo, Japan

Pars flaccida cholesteatoma is the most common of the acquired cholesteatomas. Residual cholesteatomas and recurrences often appear in *pars flaccida* cholesteatoma, and many surgical procedures have been reported. We perform a canal wall down tympanoplasty with canal reconstruction using cymbal cartilage, also called the 'open-then-closed method', for *pars flaccida* cholesteatoma. In this technique, reconstruction is performed with the cymbal cartilage of the auricular cartilage. An original modification is used that reduces the number of postoperative recurrences. Staged surgery is adopted for residual recurrences, checking for residual cholesteatoma in the second stage. We have performed tympanoplasty for the reconstruction of the external auditory canal and epitympanum with auricular cartilage since 1992, and staged surgery was used in some patients who underwent this procedure over a 7-year period until 1998. We thus performed tympanoplasty a total of 128 times, in 100 patients. Of these, eight patients were followed-up for more than 20 years for various reasons. They included patients in whom part of the tympanic membrane was recessed or a tube was inserted, but no recurrences were seen in these eight patients, and the postoperative morphology of the tympanic membrane and external auditory canal was good. Here we report mainly the findings for pre- and postoperative tympanic membranes in those cases. Cases in which tympanic membrane findings have been recorded over a long period of more than 20 years are probably quite rare. We report modifications in a surgical technique for which no true recurrences were encountered, even after 20 years.

P-077

Preliminary results of hearing screening in nursery school children aged 5–6 years

Nykiel K.¹, Włodarczyk K.¹, Rajchel J.J.², Skarżyński P.H.^{2,3,4}

¹ Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: The aim of the current study was to evaluate the hearing of nursery school children using a self-constructed survey and a well-established screening tool: Sensory Examination Platform (SEP).

Materials: Nursery children attending a single kindergarten in Warsaw, Poland, were included in the analysis. The eligibility criteria were child's age ≥ 4 years old, the child being mature enough to undergo pure-tone audiometry using SEP and being healthy on the examination day.

Methods: The audiometric measurement were conducted in a separate room in the quiet part of the kindergarten. The self-constructed survey consisted of questions regarding the existence of hearing problems in a child, the occurrence of child's asking for repetitions of questions or information, the existence of tinnitus, the existence of hearing loud music by a child, previous history of otological treatment and complaining of the child to excessive noise at nursery school. Every question had two possible answers: 'yes' or 'no'. The survey was filled in by parents before completing the audiometric measurement. The positive hearing screening result was established when a hearing threshold of at least 25 dB HL was observed for at least one frequency in at least one ear. All statistical analyses were conducted using IBM SPSS v. 24.

Results: Into the preliminary study we included 18 randomly selected children aged 5 to 6 years. There were 40% of girls and 60% of boys. Normal hearing was observed in 88.9% of children. Based on the self-report survey, none of the parents noticed a hearing problem in the child. However, quite a big number of parents (33.3%) reported that the child frequently asks for repetition of questions and had otological treatment in the past. Interestingly, none of the parents reported that the child complains about tinnitus or listens to the loud music, although almost 30% indicated that a child complains about excessive noise in the nursery school. Among two children with the positive result of hearing screening, only one parent noticed that the child frequently asks for repetition of questions. The other parent did not indicate any difficulties.

Conclusions: The current results should be analyzed with a special caution due to its preliminary character. Based

on our preliminary findings, hearing screening in nursery schools could enable even earlier diagnosis of hearing impairments in children. It is especially important considering observed lack of awareness about the hearing loss existence in nursery children among parents.

P-078

Prevalence and severity of tinnitus in Polish otosclerosis patients qualified for stapes surgery

Dziendziel B.¹, Skarżyński H.¹, Gos E.¹, Rajchel J.J.¹, Skarżyński P.H.^{1,2,3}

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: To assess the prevalence and severity of tinnitus among a group of Polish patients with otosclerosis who qualified for stapes surgery. A secondary objective was to gauge the relationship between tinnitus severity and hearing thresholds.

Materials: Based on the eligibility criteria, 460 adults with otosclerosis (236 women, 134 men) were included in the study. The age of the patients at the time of surgery ranged from 18 to 82 years ($M = 48.0$, $SD = 11.5$).

Methods: The *Tinnitus Functional Index* (TFI) was used to assess tinnitus severity. Hearing thresholds for air- and bone-conduction were established using clinical pure-tone audiometry in a soundproof cabin.

Results: Based on the medical interview, tinnitus was the first symptom of otosclerosis in 35% of the participants and 65% of all patients with otosclerosis experienced clinically significant, chronic tinnitus before stapes surgery. For 59% of patients, tinnitus was a significant or severe problem. The degree of hearing loss seemed to be marginally related to the severity of tinnitus reported by the patient. In the group of patients with slight hearing loss, up to 45% of them had significant or severe problems with tinnitus, whereas in the group of patients with moderate to profound hearing loss 57–64% of patients reported significant or severe problems with tinnitus.

Conclusions: Tinnitus is a common complaint among patients with otosclerosis, being a significant or severe problem for more than half of them. For this reason, it is worth considering in the future the implementation of standardized questionnaires for the assessment of tinnitus severity as a routine procedure in the diagnostic process of patients with otosclerosis, as it can be an important factor influencing the perception of stapes surgery outcomes by patients.

P-079

Prevalence of tinnitus in children from selected Asian and African countries – the preliminary results

Woźniczko K.¹, Rajchel J.J.¹, Świerniak W.¹, Pierzyńska I.², Karmaliev B.², Beysheeva Ch.², Abdrahmanov I.³, Skarżyński P.H.^{4,5,6}

¹ Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

² Centre of Hearing and Speech Medincus, Bishkek, Kyrgystan

³ Centre of Hearing and Speech Medincus, Shymkent, Kazakhstan

⁴ Institute of Physiology and Pathology of Hearing, World Hearing Center, Kajetany/Warsaw, Poland

⁵ Institute of Sensory Organs, Kajetany, Poland

⁶ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: Tinnitus is defined as a phantom perception of sound, which can resemble buzzing, ringing or other noises. This symptom occurs not only in adults but can be also found in the paediatric population. It may affect normally hearing children and these with otological disorders such as hearing loss. Although tinnitus can be a demanding experience for a child, the literature on its prevalence, frequency, impact, and treatment is scanty. The aim of the present study is to present preliminary data on the prevalence of tinnitus in children from selected Asian and African countries and establish its relationship with hearing status and to further explore this topic in this population.

Materials: The preliminary study included children aged from 5 to 12 year's old coming from three countries; two Asian – Kazakhstan and Tajikistan (40.9% of participants) and one African – Nigeria (59.1%).

Methods: The study was carried out with the use of the Sensory Examination Platform, which is a well-established tool used worldwide for hearing screening purposes. Pure tone audiometry was performed and hearing threshold values for air conduction were determined in the frequency range of 0.5–8 kHz. The abnormal test result was stated the threshold value for air conduction was of 25 dB HL or more for at least one frequency in at least one ear. Tinnitus existence was assessed using a self-constructed survey, which was filled in by children's parents. Only pupils whose parents responded to the survey were included in the final analysis.

Results: The study participants consisted of 230 children, 51.9% of whom were boys. Based on the screening pure-tone audiometry, the normal hearing was observed in 77.6% of children from Nigeria, 76.3% from Tajikistan and 66.2% from Kazakhstan. Tinnitus was the most prevalent symptom in Nigeria (66.2% of parents indicated its occurrence in their child), being less prevalent in Kazakhstan (23.1%) and Tajikistan (13.4%). Additionally, in every country tinnitus was significantly more prevalent in children with hearing loss than in children without hearing loss.

Conclusions: Based on the current findings, tinnitus is a common symptom among children from selected Asian and African countries, being significantly more prevalent in children with hearing loss than in children with hearing impairment. The results indicate an urgent need to conduct hearing screening programs in these regions of the world. Considering the preliminary nature of the study, more studies are needed to further explore this important topic.

P-080

Previous ear infections based on parents report and the result of hearing screening program in Podlaskie voivodship

Nykiel K.¹, Świerniak W.², Skarżyński P.H.^{1,2,3,4}

¹ Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: The aim was to research on the frequency of the positive results of hearing screening program and the relationship between previous ear infections and present hearing defects in a child.

Materials: This study refers to the results of the hearing screening program in Podlaskie in 2015 in the first-grade pupils from primary schools in Podlaskie Voivodship, where 2912 children were subjected to the hearing screening. Among 2912 children, there were 1408 girls and 1504 boys.

Methods: Procedure involved pure tone screening audiometry and a short questionnaire dedicated to parents with a substantial question: 'Has your child been treated due to ear infections?' The results of hearing screening were considered to be positive when pure tone audiometry was 25 dB HL or higher for at least one frequency in one ear.

Results: On the basis of the audiogram, the hearing problem was identified in 300 (10.3%) children from 2912 pupils who took part in this test. Based on parents report, 862 were treated against ear infections and 2050 were not. No conspicuous difference between boys and girls ear infections history was reported – 440 boys out of 1504, which is 29.3%, and 422 girls out of 1408, which is 30%. 19.2% of children who did not have ear infections were reported to have hearing dysfunction and 14.1% of children who did not suffer from this disease.

Conclusions: The results of this study indicate that the hearing problem is a frequent problem among school-age children, which concerns both boys and girls. The data also suggests that one reason of this defect could possibly be a previous ear infection, therefore, quick diagnosis and effective treatment is as important as parents' awareness of the consequences of past ear infections on the hearing development of the child.

P-081

Protective effects of curcumin in cisplatin induced ototoxicity in ratsArslan A.¹, Arslan S.¹, Vuralkan E.², Ayar A.³¹ Department of Otorhinolaryngology Head and Neck Surgery, Karadeniz Technical University, School of Medicine, Trabzon, Turkey² Department of Otorhinolaryngology Head and Neck Surgery, Medical Park Yıldızlı Hastanesi, Trabzon, Turkey³ Department of Physiology, Karadeniz Technical University, School of Medicine, Trabzon, Turkey

Objectives: Cisplatin is an antineoplastic agent with potent alkylating effect and is used in the treatment of various solid tumors including head and neck carcinomas. Cisplatin ototoxicity is characterized by bilateral irreversible progressive high-frequency hearing loss and tinnitus. Cisplatin ototoxicity is attributed to the overproduction of reactive oxygen radicals in the cochlea. Curcumin is known with its antioxidant, anti-inflammatory, immunomodulatory and antitumoral effects but otoprotective effects have not been searched so far. Vitamin E is a potential otoprotective agent and a free radical scavenger that is used to prevent cisplatin ototoxicity. In this study, the efficiency of curcumin and Vit. E in the prevention of cisplatin ototoxicity was studied comparatively.

Materials and Methods: five groups of 8 rats were enrolled in the study as follows: 1st group received 1.5 ml of saline intraperitoneally (IP); 2nd group received cisplatin 15 mg/kg IP; 3rd group received 50 mg/kg Vitamin E followed by 15 mg/kg of cisplatin IP after 30 minutes; 4th group received 200 mg/kg curcumin IP followed by cisplatin 15 mg/kg IP after 30 minutes; 5th group received 1.5 ml of 0.5% carboxymethylcellulose solution IP followed by 15mg/kg of cisplatin IP after 30 minutes. The basal hearing level was evaluated by TEOAE and DPOAE tests 72 hours after intraperitoneal injections.

Results: In cisplatin and carboxymethylcellulose groups the significant decrease in signal to noise ratio (SNR) particularly in 4, 6 and 8 kHz frequencies confirmed cisplatin-induced hearing loss. Statistically significantly higher DPOAE and TEOAE SNR values were found in curcumin and Vit. E groups when compared to cisplatin group.

Conclusions: This is the first study to search the protective effects of curcumin against cisplatin ototoxicity. Further studies evaluating inner ear histopathology and higher frequency hearing thresholds are needed to confirm the current findings of this study.

P-082

Rehabilitation effectiveness in patients with peripheral vestibular dysfunctionGawrońska A.¹, Pajor A.¹, Rosiak O.¹, Szczepanik M.², Walak J.², Woszczak M.², Lucas-Grzelczyk W.¹, Józefowicz-Korczyńska M.¹¹ Balance Disorders Unit, Department of Otolaryngology Department, Medical University of Łódź, Poland² Rehabilitation Unit, The Norbert Barlicki Memorial Teaching Hospital, Łódź, Poland

Objectives: In vertigo and balance disequilibrium caused by labyrinth dysfunction rehabilitation interventions are based on exercises which stimulate compensation and habituation processes on different central nervous system levels. The aim of the study was to compare in patients with peripheral vestibular dysfunction the effectiveness of two types of management – individually designed vestibular rehabilitation and pharmacological treatment supported by physiotherapeutic exercises at home.

Materials and Methods: The study included 70 patients (46 women, 24 men; $x = 44.5$ years old) with peripheral vestibular system dysfunction, complained from vertigo and balance disequilibrium. All patients had peripheral vestibular system dysfunction confirmed by videonystagmographic (VNG) examination and lack of spontaneous compensation within one month from impairment; also no previous disorders of the motor system and co-existing neurologic disturbances. The first group (group I), which comprised 44 patients performed rehabilitation individually created programme, supervised by a physiotherapist. Patients had two, five-days exercises sessions and the next two weeks they performed exercises at home in the same way. The second - comparative group (group II) comprised 26 patients and was treated pharmacologically (Betahistine twice a day) and performed exercises at home. Patients from both groups were evaluated three times, on the baseline, after one month and three months of the therapy. Each patient was interviewed for history related to dysfunction of the labyrinth and coexisting diseases according to the questionnaire. Patients filled the self-assessment survey about the intensity of dizziness under the *Visual Analog Scale* (VAS) and the *Vertigo Syndrome Scale* (VSS). In the clinical study, the patients were evaluated with Sharpened Romberg Try, the Amended Motor Club Assessment (AMCA), and the Eurofit Test which is the European Test of Physical Efficiency. Measurements of postural stability (Euroclinic platform SSS ED 8000) were based on six posturographic tests: with eyes opened or closed in two and one, left or right leg standing. The following parameters were used for analyzing and evaluating study findings: the total length of stabilogram which is length marked by projection of patient's center of pressure excursion [mm]; stabilogram expanded area [mm²] and the length of center of pressure deviation versus the area marked by the center of pressure projection on the supporting plane ratio.

Results: The *Visual Analog Scale* (VAS) showed that patients, who performed exercises supervised by a physiotherapist,

evaluated their dizziness intensity as less annoying than pharmacologically treated group. Results of the *Vertigo Symptom Scale* (VSS) survey confirmed the improvement of patient's self-assessment in part about physical as well as emotional feedback. Clinical research results (from the sensitized Romberg Try, AMCA Test, and the Eurofit Test) pointed out the improvement of the postural stability. Patients who were practicing supervised by physiotherapist demonstrated better postural dynamics across the particular tests: AMCA (4.18 s vs 1.47 s; $p < 0.00$) Eurofit – eyes opened (9.66 s vs 1.81 s; $p < 0.00$), eyes closed (4.89 s vs 1.46 s; $p < 0.02$). Researches done at posturographic platform showed objective improvement of balance control pertained to decreasing the length of the center of pressure deviations projected on the supporting plane, as well as the decreasing area marked by the projection of the center of pressure. Patients who were exercising under supervision by physiotherapist showed greater dynamics of balance control improvement.

Conclusions: 1. Individually designed vestibular rehabilitation dedicated to patients' deficit is an effective treatment for patients with peripheral vestibular dysfunction. The analysis based on subjective self-assessment and objective measurements confirmed a decrease in symptoms and improvement in postural stability. 2. In patients with peripheral vestibular dysfunction, individually designed vestibular rehabilitation is more effective than pharmacotherapy.

The study was supported by STRATEGMED2/266299/19/NCBR/2016.

P-083

Repeatability of otoacoustic emissions' suppression in young adults – preliminary results

Pyrzyk K.¹, Rajchel J.J.², Piłka E.², Skarżyński P.H.^{2,3,4}, Jędrzejczak W.W.²

¹ Interdisciplinary Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: The aim of the current study was to evaluate the repeatability of otoacoustic emissions' suppression in adults with normal hearing.

Materials: In the study, we included young adults who voluntarily agreed to participate. The main eligibility criteria were: normal hearing in both ears (based on the interview and screening pure-tone audiometry) and participant's age is 18 to 30 years old. There was a similar number of male and female participants in the study population. The mean age of the participants was $M = 20.9$, $SD = 2.22$.

Methods: After signing informed consent, participants underwent pure-tone screening audiometry to confirm their hearing status. Next, the repeatability of OAE's suppression

was conducted according to the protocol consisting of two subsequent measurements of otoacoustic emission suppression with a probe in the ear. Additionally, to OAE suppression, the presence of spontaneous OAE was measured. All measurements were conducted in a quiet study room.

Results: No differences were observed between two measurements in terms of signal to noise ratio and suppression, even when controlling for the SOAE occurrence. Interestingly, significant differences regarding the signal to noise ratio were observed between subjects with SOAE and without SOAE. Participants with SOAE had about two times bigger signal to noise ratio than participants without SOAE. However, no such differences were observed regarding the OAE suppression value.

Conclusions: Based on the current findings we conclude that OAE suppression is repetitive, which proves in favor of further consideration of the use of this method in clinical practice.

P-084

Results of pilot hearing screening in schoolchildren from selected Asian countries

Cyran O.¹, Rajchel J.J.¹, Świerniak W.¹, Skarżyński P.H.^{3,4,5}, Pierzyńska I.², Karmaliev B.², Beysheeva Ch.²

¹ Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

² The Centre of Hearing and Speech Medicine, Bishkek, Kyrgyzstan

³ Institute of Physiology and Pathology of Hearing, World Hearing Center, Kajetany/Warsaw, Poland

⁴ Institute of Sensory Organs, Kajetany, Poland

⁵ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: As a result of the European Scientific Consensus agreement, a number of pilot hearing screening programs were started by the Institute of Physiology and Pathology of Hearing in various countries, promoting hearing-loss detection and treatment of communication disorders in young school-age children. The aim of the study was to evaluate the hearing status of schoolchildren from selected Asian countries and to further raise awareness among parents, schools, and governments on the need for conducting hearing screening programs.

Materials and Methods: Hearing screening was performed in a group of 1027 children aged from 6 to 12 years, in four Asian countries: Armenia, Russia, Kyrgyzstan, and Azerbaijan. The study was carried out with the use of the Sensory Examination Platform. The threshold values for air conduction were determined in the frequency range of 0.5–8 kHz. The eligibility criteria were: good cooperation with the child, low noise level during the examination and the ability to measure hearing thresholds for all evaluated frequencies. The positive hearing screening result was established when a hearing threshold of at least

25 dB HL (hearing loss) was observed for at least one frequency in at least one ear. All statistical analyses were conducted using IBM SPSS v. 24.

Results: Based on the eligibility criteria, the results of 876 children were found suitable for statistical analyses. Among them, 35% were from Kyrgyzstan, 31.6% from Armenia, 22.6% from Azerbaijan and 10.7% from Russia. In 74.3% of children normal hearing was observed. Unilateral hearing loss was observed 14.4% of children and bilateral in 11.3%. Hearing loss was the most prevalent in Azerbaijan – 47% of children had positive hearing screening results. The lowest occurrence of hearing loss was observed in Russia – 14.9%. The frequency of hearing loss in the evaluated study group turned out to be higher than that observed so far in the countries of Europe, the United States or Canada.

Conclusions: The high incidence of hearing the loss in children from selected Asian countries indicates the need of conducting hearing screening programs in this part of the world, which would allow for earlier diagnosis of hearing problems a child and enhance the possibility of introducing a proper diagnostic and therapeutic approach leading to the best results.

P-085

Revised grading system for *Tinnitus Handicap Inventory* based on a large clinical sample of tinnitus patients

Skarżyński P.H.^{1,2,3}, Rajchel J.J.¹, Gos E.¹, Dziendziel B.¹, Kutyla J.¹, Bieńkowska K.¹, Świerniak W.¹, Gocel M.¹, Raj-Koziak D.¹, Włodarczyk E.¹, Skarżyński H.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: According to the authors' knowledge, no studies have been published so far on the normative values of *Tinnitus Handicap Inventory* (THI) results in a large, representative sample of people suffering from tinnitus, with clearly defined study's eligibility criteria. As the creation of such normative values is useful in clinical and research practice for different populations, the purpose of the current study was to establish the revised grading system for THI based on a large clinical group of tinnitus sufferers.

Materials: The research group consisted of adult patients referring to the tertiary referral ENT center due to problems with tinnitus (as a primary complaint or secondary to hearing loss), who filled in the THI upon their diagnostic evaluation, were retrospectively screened to check the compliance with the studies eligibility criteria: tinnitus duration of a minimum of 6 months and complete documentation including basic data of participants (age, gender, tinnitus duration), complete THI results and pure-tone audiometry.

Methods: Data on participants' age, gender, tinnitus duration and tinnitus laterality of evaluated patients was gathered based on the routine medical records. Polish version of THI (2017), which was originally developed by Newman, Jacobson, and Spitzer (1996) was used in the current study. Every patient underwent a routine pure-tone audiometry assessment in a soundproof cabin using calibrated headphones. World Health Organization classification (1980) was used to divide patients into two groups: patients with normal hearing – with the pure tone average (PTA) from frequencies 500, 1000, 2000 and 4000 Hz being < 26 dB HL, and hearing impairment – with PTA ≥ 26 dB HL. Inspection of the THI scores was performed and descriptive statistics were calculated. Two kinds of norms were proposed: Z-scores and percentiles.

Results: Among 1042 participants, 518 (49.7%) were female and 524 male (50.3%). The mean age of the participants was $M = 51.81$; $SD = 13.25$ (range 19–84). The mean tinnitus duration was $M = 6.86$; $SD = 7.74$ years (range 0.5–50 years). Bilateral tinnitus was reported by 57.2% of patients and unilateral in 42.8% (left in 25.9% and right in 16.9%). The mean PTA for the right ear was $M = 34.01$; $SD = 27.85$ and for the left ear $M = 33.8$; $SD = 27.16$. According to the World Health Organization hearing impairment classification, 38.6% (402) of participants had normal hearing and 61.4% (640) had a hearing impairment. Multivariate analysis of variance was used to analyze the effect of gender and hearing loss on the THI scores, showing a significant effect of gender and hearing status on THI results. Therefore, separate grading systems for women and men as well as subjects with normal hearing and hearing loss were proposed.

Conclusions: The revised THI grading system can be used as a benchmark for clinicians and researchers showing how the results of a given person fall on the background of a tinnitus help-seekers population. The division of standard scores by gender and hearing status allows for individual consideration of each patient's case, which is useful particularly in the decision making process upon selection of the most appropriate intervention and the evaluation of its outcomes.

P-086

Self-esteem in the deaf who have become cochlear implant users as adults

Kobosko J.¹, Jędrzejczak W.W.², Gos E.³, Geremek-Samsonowicz A.¹, Skarżyński H.³

¹ Rehabilitation Clinic, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Experimental Audiology Department, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Objectives: Self-esteem is a predictor of mental health and is crucial for psychological functioning. It is especially important in situations generating the risk of mental problems, such as deafness or partial deafness. The purpose of the study was to answer the question about the level of

global self-esteem in adults with hearing problems of different onset (pre-/post-lingual) and amount of hearing loss (deafness/partial deafness) who received the cochlear implant (CI) after 18 years of age compared to the general population. Of interest was also the association of self-esteem with variables related to deafness and CI (e.g. CI satisfaction or type of hearing amplification) and sociodemographic variables. There seem to be no results of global self-esteem for this population.

Materials and Methods: The data were obtained by mailing the questionnaires to the patients that obtained CI after 18 years of age. The subjects were divided into four subgroups: subjects with pre-lingual deafness, postlingual deafness, pre-lingual partial deafness, and postlingual partial deafness. In order to evaluate their self-esteem, the SES questionnaire by M. Rosenberg was used. To collect information on sociodemographic data and information related to deafness and CI, we used our own Information Inquiry. For statistical analysis of the results, we used the following comparison tests: mean (t-test, ANOVA), correlation and linear regression.

Results: The self-esteem of deaf and partially deaf CI users, is significantly lower than in the general population, especially for postlingual subjects. The only variable factor that explains self-esteem is the satisfaction with CI – higher satisfaction with CI is associated with higher self-esteem. The most important sociodemographic variables that explain self-esteem were the marital/partnership status (in relation), education (higher) and gender (men). Also, active people (or studying) have higher self-esteem. SES was found to have a one-factorial structure for the population studied.

Conclusions: Deafness and partial deafness may be a risk factor for lower self-esteem. It should be made aware of rehabilitation, medical, educational or employment communities. It is especially relevant for women, single people and those with lower education. Medical intervention in the form of CI as such gives the opportunity to hear (improvement), but work on self-esteem is still in the hands of various forms of psychological, psycho-educational, and psychotherapeutic interventions.

P-087

Sense Examination Capsule – an innovative self-service health control system

Skarżyński H.¹, Skarżyński P.H.^{1,2,3}, Kutyla J.¹, Doliński P.¹, Będziński W.¹, Wojciechowski M.¹, Soćko S.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Screening programs are an important element of public health. Early detection of disorders and treatment significantly reduces the cost of health care. The increasingly aging society forces the creation and development of new

methods and devices to carry out screening tests. These tools must allow effective access to the patient. Currently, there is no such system of devices in the world, thanks to which it is possible to perform a study of the most important sensory and speech organs in one place and a short time. To diagnose subsequent organs, patients must visit several centers - this means many visits and often long months of expectations for consultations. For many, diagnostics are so burdensome that they give up research and treatment. In response to the demand, an innovative diagnostic and rehabilitation capsule has been created that can be installed in various field centers. The Sense Examination Capsule is the world's first integrated device for the study of the human senses. It contains infrastructure and equipment and standardized tests for conducting screening and diagnostic tests. The capsule allows you to test hearing, sight, smell, taste, balance, speech and processing functions. Her main tasks are early detection of sensory disorder, early capture of prognostic factors predicting the development of neurodegenerative diseases, early implementation of mental and movement training, dissemination and improvement of access to preventive examinations of people with multiple sense organs disorders, as well as their rehabilitation. During the conference, the possibilities of using the Sense Examination Capsule will be presented. The solutions and diagnostic tests used as well as the individual and social benefits of investing in such devices will be discussed in detail.

P-088

Short-term audiological assessment of the effectiveness of Bonebridge implantation in children with conductive and mixed hearing loss

Dziewirz Z., Ratuszniak A., Gos E., Skarżyński P.H., Skarżyński H.

Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

In some cases of children with conductive or mixed hearing loss, the application of conventional hearing aids may be impossible or limited. In these cases, the most often recommended solution is to use of bone conduction devices. The aim of this study was a short-term analysis of the audiological effectiveness of the application of this device in the population of Polish children. The study material comprises a group of 17 children between 5 and 17 years old with uni- or bilateral, conductive or mixed hearing loss, implanted in one ear with the Bonebridge system in the Institute of Physiology and Pathology of Hearing in Kajetany near Warsaw in the years 2014–2018. The results of free field tests show a statistically significant improvement in hearing sensitivity and speech discrimination rate. The analysis of the results of free field tests shows statistically significant improvement of hearing sensitivity and speech discrimination rate. In a short-term follow-up period, the Bonebridge system has been demonstrated to be an effective tool for compensating for the conductive or mixed hearing losses in children. If the anatomical conditions are adequate, the Bonebridge can be a good alternative for other popular systems based on the bone conduction of sounds.

P-089

Simultaneous use of radical mastoid surgery along with postauricular island flap in patients with external auditory meatus and conchal bowl carcinoma

Durko M.¹, Iljin A.², Antoszewski B.²,
Zieliński T.², Pietruszewska W.¹

¹ Department of Otolaryngology and Laryngological Oncology,
Medical University of Łódź, Poland

² Department of Plastic, Reconstructive and Aesthetic Surgery,
Medical University of Łódź, Poland

Objectives: Presenting our clinical experience with radical method together with postauricular island flap (PIF) and estimation of the results following partial external auditory canal (EAC) and conchal bowl reconstructions with the PIF in patients after cancer resections.

Methods: We have analyzed postoperative results of 15 patients with a malignant tumor of the auricular conchal bowl and EAC after cancer resection and reconstruction with the use of the radical method and PIF, between 2000–2016. The patients were followed-up in respect of postoperative results.

Results: The cancers were completely excised in all patients. We did not confirm any recurrences within at least 2 years after surgery. We noted venous congestion in 9 cases (60 %), pinning of the operated ear in seven patients (46.6 %), prominent earlobe in five (33%), and EAC constriction in six cases (40 %). The functional postoperative result was very good in all cases.

Conclusions: 1. Simultaneous operations comprising radical method with postauricular island flap reconstructions after partial (external auditory meatus and auricular conchal bowl) resections allowed for complete removal of cancers together with the preservation of ear function and aesthetic ear shape. 2. The radical method with the retro-auricular approach in cancer involvement of the external auditory meatus ensured accurate evaluation of tumors extent and facilitated surgical access.

P-090

Skarzynski's Scale for the assessment of the results of the surgical treatment of microtia

Skarżyński H.¹, Mickielewicz A.¹, Łazęcka K.¹,
Skarżyński P.H.^{1,2,3}

¹ Department of Oto-Rhino-Laryngosurgery, Institute
of Physiology and Pathology of Hearing, Kajetany/Warsaw,
Poland

² Heart Failure and Cardiac Rehabilitation Department, Medical
University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

The methods of reconstruction of the auricle, in case of its congenital deformity, underdevelopment or absence, have its own long history. Ultimately the most popular

combination of Brent technique and Nagata's technique that in the course of time was modified by world most renowned otosurgeons. In the case of microtia, it was always crucial to assess the postoperative effects. It usually involved the subjective perception of the surgeon and a patient. Thus the attempt to objectify surgical results should be considered an important issue, and in consequence, it should lead to the foundation of realistic basis serving to compare different techniques and introduce further modifications. The presented Skarzynski's Scale responds to these expectations and is the first attempt to objectify the results of surgical treatment and compare different techniques.

P-091

Stapedotomy in a patient with a small air-bone gap

Dziendziel B.¹, Skarżyński H.², Włodarczyk E.¹,
Skarżyński P.H.^{1,3,4}

¹ Department of Teleaudiology and Screening, World Hearing
Center, Institute of Physiology and Pathology of Hearing,
Kajetany/Warsaw, Poland

² Department of Oto-Rhino-Laryngosurgery, World Hearing
Center, Institute of Physiology and Pathology of Hearing,
Kajetany/Warsaw, Poland

³ Heart Failure and Cardiac Rehabilitation Department, Medical
University of Warsaw, Poland

⁴ Institute of Sensory Organs, Kajetany, Poland

Otosclerosis is one of the most common causes of acquired hearing impairment in adults. The most common and effective method of treating otosclerosis is stapes surgery, which in most cases provides satisfactory results in terms of hearing the improvement. Different authors present different opinions as to the degree of hearing loss that is required as an indication for surgery varies among authors. Stapes surgery in the case of a patient with a small air-bone gap (ABG) is considered controversial in many centers. The decision to perform stapes surgery in a patient with small ABG must always consider the risk-to-benefit ratio. While surgical aspects and hearing outcomes in cases of otosclerosis have been extensively described in previous publications, studies on the prevalence and severity of associated symptoms – particularly tinnitus – are sparse. Tinnitus, alongside progressive hearing loss, is one of the basic symptoms of otosclerosis development. Tinnitus, which are annoying for the patient and can significantly reduce the quality of life. In the diagnosis process towards the qualification of the patient for the surgery of stapes, it is worth taking into account not only the size of the ABG but also tinnitus severity perceived by the patient. This report presents the audiometric and self-report results of an adult patient with small preoperative ABG who underwent stapedotomy.

P-092

Stapedotomy to treat mixed hearing loss in osteogenesis imperfecta

Skarżyński H.¹, Kordowska K.¹, Dziendziel B.¹,
Skarżyński P.H.^{1,2,3,4}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

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

³ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁴ Institute of Sensory Organs, Kajetany, Poland

Objectives: In osteogenesis imperfecta, hearing loss is a common comorbidity of anomalies in the osteoarticular system. A thickened and fixated stapes footplate can contribute to a conductive component of hearing loss. Exploratory tympanotomy with stapedotomy is the method of choice in such cases.

Materials and Methods: We report the case of a 60-year-old osteogenesis imperfecta patient with bilateral progressive hearing loss, who underwent surgical treatment: explorative tympanotomy with bilateral stapedotomy in stages.

Results and Conclusions: Surgical intervention resulted in closure or reduction of the air-bone gap on both sides and subjective improvement of hearing, demonstrating the effectiveness of the treatment.

P-093

Stapes surgery for otosclerosis: audiometric and self-reported hearing outcomes

Skarżyński H.¹, Skarżyński P.H.^{1,2,3},
Dziendziel B.¹, Gos E.¹, Bienkowska K.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: The objective of our study was to measure audiometric and self-assessed hearing changes in otosclerosis patients after stapes surgery. A secondary objective was to gauge the relationship between self-reported hearing and audiometric hearing thresholds.

Materials and Methods: This prospective study included 236 patients (174 women and 62 men) with otosclerosis who underwent primary stapedotomy. Their ages ranged from 21 to 75 years ($M = 47.8$, $SD = 10.9$ years). Pure-tone audiometry and the *Abbreviated Profile of Hearing Aid Benefit* questionnaire (APHAB) were used to measure subjective hearing before surgery and 6 months postoperatively. Pure-tone audiometry was also conducted at the same observation periods.

Results: The air- and bone-conduction thresholds, as well as the air-bone gap, confirmed that there was a significant improvement in hearing. The difference between the pre- and postoperative APHAB Total score was 26.7 points and was statistically significant ($t = 20.29$; $p < 0.001$). A weak correlation was found between the pre- and postoperative change of APHAB total score and air conduction thresholds ($\rho = 0.23$; $p < 0.01$) as well as between the change in the APHAB Total score and the size of the air-bone gap ($\rho = 0.19$; $p < 0.05$).

Conclusions: Both audiometric and self-reported hearing outcomes confirmed the high rate of success for stapedotomy. However, audiometric results give limited information about the status of the patient's hearing. The patient's subjective perspective, alongside audiometric data, provides valuable information that can be helpful in clinical decision-making and counseling.

P-094

Study on 82 probable benign paroxysmal positional vertigo patients

Otsuka K., Inagaki T., Itani S., Sakurai E.,
Ogawa Y., Noriko N., Tsukahara K.

Department of Otolaryngology Head and Neck Surgery, Tokyo Medical University, Tokyo, Japan

Introduction: A problem occasionally encountered in clinical practice is the presence of a positive history of benign paroxysmal positional vertigo (BPPV) with a negative diagnostic maneuver for positional nystagmus. This type of vertigo might be classified as probable BPPV. The first aim of the present study was to assess how many patients with probable BPPV convert into definite BPPV. The second aim was to study the patients not converted into definite BPPV.

Methods: During 3 years, all consecutive patients with probable BPPV diagnosed at our department were studied. Criteria of diagnosis were: (1) history of repeated brief episodes of vertigo with change in head position; (2) absence of detectable nystagmus during and after the Dix-Hallpike or spine Roll test. All patients underwent otolaryngologic, audiological, and neurologic evaluation. Patients with only one visiting and any clinical, laboratory, or imaging findings suggesting pathology of the central nervous system were excluded. Eighty-two patients with probable BPPV were studied (mean age 64 years), 31 men and 51 women.

Results: Twenty-eight patients (34%; Group A) with probable BPPV converted into definite BPPV during follow-up within 3 months. Fifty-four patients (66%; Group B) with probable BPPV did not convert into definite BPPV. Group A: mean age 65 years, 11 men and 15 women. Schellong test was abnormal in 3 (38%) patients out of 8 patients. cVEMP was abnormal in 6 (33%) out of 18. oVEMP was abnormal in 5 (28%) out of 18. Group B: mean age 63 years, 20 men and 34 women. Schellong test was abnormal in 3 (20%) patients out of 15 patients. cVEMP were abnormal in 6 (21%) out of 28. oVEMP were abnormal in 4 (13%) out of 30.

Discussion: BPPV *canalolithiasis* is known as the otoconia detached from the utricle moving along the canal wall by changing head position. In Group A, we suspected the otoconia temporary stagnated to somewhere in the canal. The otoconia tended to stagnate in the ampulla in our animal model experiment. In Group B, we first suspected the otoconia dispersed and absorbed into endolymph by daily life, secondary suspected another disease. The candidates of another disease were eorthostatic dysregulation, cervical vertigo, and saccule dysfunction.

Conclusions: Probable BPPV converted into definite BPPV in one in three patients within three months. The patients of probable BPPV must be checked nystagmus during and after the Dix–Hallpike or spine roll test in every visit and be tested by Schellong and etc.

P-095

Surgical ligation of large mastoid emissary vein complaining about pulsatile tinnitus: a case report

Lee E.J., Kim S.K.

Department of Otorhinolaryngology-Head and Neck Surgery, College of Medicine, Chonbuk National University, Jeonju, Korea

Pulsatile tinnitus is an uncommon symptom characterized by a perceived pulsatile sound synchronous with the heartbeat. We report a rare case of a patient with unilateral pulsatile tinnitus induced by large, prominent mastoid emissary vein. A 45-year-old woman visited our hospital with pulsatile tinnitus. She had persistent tinnitus for 20 years and her symptoms worsened from two years ago. It was said that there was a sound in accordance with the heartbeat sound. She has had some hearing impairments in both ears for a long time due to long-term otitis media. The temporal bone CT result was a large right jugular bulb. And a mastoid emissary vein canal draining into the right sigmoid sinus was large. Therefore, we decided to perform a large mastoid emissary vein ligation with the planned right tympanoplasty. On follow-up, the patient's tinnitus was near completely improved. According to reviews, surgical ligation of large mastoid emissary vein as a treatment for pulsatile tinnitus was the first case. So we report this case with a review of the literature.

P-096

Surgical results of transcanal endoscopic type 3–4 tympanoplasty in chronic otitis media: comparative study with a postauricular microscopic approach

Ohki M., Tanaka S., Kikuchi S.

Department of Otolaryngology, Saitama Medical Center, Saitama Medical University, Kawagoe, Saitama, Japan

Objectives: Previous comparative studies of tympanoplasty between endoscopic ear surgery and microscopic ear surgery have reported hearing results. Majority of them are with respect to short-term surgical results of

tympanoplasty without ossiculoplasty. Recently, Ohki et al. reported that long-term surgical results (one year following ear surgery) of tympanoplasty without ossiculoplasty that, under favorable conditions of the middle ear, TEES and PAMES resulted in similar hearing improvement by tympanoplasty without ossiculoplasty under favorable conditions of the middle ear, but under adverse conditions of the middle ear, TEES was a more beneficial approach for hearing improvement than PAMES (in press). However, there are few papers focusing on endoscopic tympanoplasty with ossiculoplasty. In addition, there are no papers showing long-term surgical results to our knowledge. To reveal long-term surgical outcomes by tympanoplasty with ossiculoplasty in chronic otitis media between transcanal endoscopic ear surgery (TEES) and postauricular microscopic ear surgery (PAMES).

Materials: Patients with chronic otitis media who had undergone tympanoplasty with ossiculoplasty were enrolled in the retrospective study. Cholesteatoma, narrow external ear canal, or active suppurative infections were excluded in this study.

Methods: Pure tone audiometry was assessed before and one year after ear surgery. Hearing improvement was assessed by the guidelines of AAO-HNS. A successful hearing result was defined as a postoperative AB gap of 20 dB or less one year after the surgery. A successful repair of tympanic membrane perforation was defined as a dry tympanic membrane without perforation one after surgery. The hearing outcome, repair of tympanic membrane perforation, and surgical time were assessed. Middle ear condition was graded using the middle ear risk index by Kartush.

Results: The surgical success rates for the hearing were equivalent between both TEES and PAMES groups. Air conductive threshold significantly decreased after surgery in both groups. The post-operative hearing resulted in similar improvement of air conductive thresholds, and closure of air-bone gaps between TEES and PAMES groups. The repair of tympanic membrane perforation and surgical time were equivalent between both TEES and PAMES group.

Conclusions: TEES and PAMES resulted in similar hearing improvement and repair of perforation.

P-097

Surgical treatment of *pars flaccida* cholesteatoma with habitual sniffing

Mizuta K.¹, Endo S.², Nakanishi H.², Takizawa Y.², Arai M.¹, Shimodaira Y.¹, Yamatodani T.², Hosokawa S.², Mineta H.²

¹ Ear Surgery Center, Hamamatsu Medical Center, Hamamatsu, Japan

² Department of Otorhinolaryngology-Head and Neck Surgery, Hamamatsu University School of Medicine, Hamamatsu, Japan

Objectives: To clarify the different pathogenesis of cholesteatoma: sniff induced type and non-sniff type.

Introduction: Based on the efficacy in preventing recurrence of cholesteatoma by making ventilation route between epitympanum and supratubal recess, pathogenesis of cholesteatoma has been proposed. The authors of the report posited that the real pathogenesis of cholesteatoma is not tubal dysfunction, but the osseous tympanic diaphragm between epitympanum and the supratubal recess. However, these authors did not clarify which cases require this ventilation route. Is it necessary to make ventilation route for all cholesteatoma? There are, however, several reports that the cessation of sniffing prevented the recurrence of cholesteatoma in patients with habitual sniffing. In the present study, we examine whether or not the ventilation route surgery is required for habitual sniffers.

Materials and Methods: Adult acquired cholesteatomas with habitual sniffing (53 ears) were surgically treated by closed tympanomastoidectomy. Superior scutum and posterosuperior canal wall were removed then reconstructed with rigid materials (cortical bone plate). We did not remove the anterior attic bony plate between epitympanum and supratubal recess.

Results: In the ceased-sniffing group who had a type A tympanogram, almost cases showed no retraction of the tympanic membrane, whereas, in the continued-sniffing group who had a type C tympanogram, retraction pocket was seen in all cases. Regarding the postoperative re-pneumatization, many cases progressed the aeration to antrum in the ceased-sniffing group, however, the aeration stayed at mesotympanum in the continued-sniffing group.

Discussion: Close insufficiency of the Eustachian tube is a kind of tubal dysfunction. Patients, who have close insufficiency of Eustachian tube, sniff to alleviate uncomfortable aural symptoms such as aural fullness and autophonia. Magnuson suggested that sniffing was a reactive mechanism to the failure of Eustachian tube closure, and this mechanism was associated with middle ear diseases including cholesteatoma. Intratympanic negative middle ear pressure can be induced by sniffing. As our results show, the cessation of sniffing releases intratympanic negative pressure. Thus, the cessation of sniffing is effective in preventing recurrence of cholesteatoma. The efficacy of making ventilation route from epitympanum to supratubal recess alone does not lead to a conclusion that 'the real pathogenesis of cholesteatoma is not tubal dysfunction but the osseous tympanic diaphragm'. Instead, we can conclude that 'the real pathogenesis of cholesteatoma is not the osseous tympanic diaphragm, but tubal dysfunction'. After all, it would be reasonable that the pathogenesis of cholesteatoma is different in habitual sniffers and in non-habitual sniffers.

Conclusions: Cessation of habitual sniffing eliminates the need for a ventilation route from the attic through the supratubal recess in the surgical treatment of cholesteatoma by closed tympanomastoidectomy.

P-098

The accuracy of parental suspicion of hearing loss in their children

Skarżyński P.H.^{1,2,3}, Kochanek K.⁴, Gos E.¹, Świerniak W.¹, Jędrzejczak W.W.⁴, Skarżyński H.⁵

¹ Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Department of Experimental Audiology, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁵ Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Objectives: Parental suspicion of hearing impairment in their children is generally inaccurate. Parents tend to underestimate hearing problems in their children. The objective was to assess the accuracy of parental suspicion of hearing the loss in their children.

Materials: This was a population-based, epidemiological study conducted in elementary schools in villages and small towns (below 5000 inhabitants) in all voivodships in Poland. The study sample was 64,750 children (31,387 girls and 33,363 boys) aged 6–13 years old ($M = 8.67$; $SD = 2.55$).

Methods: The children underwent hearing screening with pure-tone audiometry. The parents answered a question about hearing problems in their children. The outcome parameters were sensitivity, specificity, and predictive value of parental perception of hearing problems in their children. Parental suspicion of hearing problems was assessed by a questionnaire. Pure-tone air-conduction hearing thresholds were obtained at 0.5–8 kHz. Hearing loss (HL) was defined as a pure-tone average higher than 20 dB in one or both ears in at least one of the three following pure-tone averages: four-frequency pure-tone average (FFPTA), high-frequency pure-tone average (HFPTA), and low-frequency pure-tone average (LFPTA).

Results: Positive results of hearing screening were obtained in 16.3% of children. Hearing loss was detected in 6025 children, of whom 1074 (17.8%) were correctly perceived by parents as having hearing problems. Sensitivity was the highest in the case of four-frequency hearing loss, when it was 21.6%. The sensitivity of detecting hearing loss by parents reached above 30% for moderate or worse hearing loss and above 25% for bilateral hearing loss.

Conclusions: Parents underestimate hearing problems in their children, but they are more able to accurately detect hearing loss if it involves speech-related frequencies and is at least a moderate hearing loss or bilateral loss.

P-099

The innovative assessment scale for music perception in cochlear implant (CI) and effectivity of music therapy for pediatric CI users. Analysis of the results of authorial study run within ‘Music in Human Auditory Development’ program

Kaczyńska B., Porębska A., Warsicka M., Grudzień D., Skarżyński H.

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

Introduction: ‘Music in Human Auditory Development’ is the proprietary program of music therapy for patients with hearing implants and after different hearing disorders. The program is directed at providing care for adults and children with hearing impairments beginning as early as the first months of life, thus improving the chances of the effective rehabilitation of hearing and speech. A primary idea of the program is to aid the patients who have received a hearing implant, as well as patients with hearing disorders, in achieving the fastest and most effective rehabilitation and consequently, a stable and natural functioning in social, cultural and professional life. Excellent effects of rehabilitation in a very large group of implanted patients at different ages allow an assumption that a measure of progress in therapy may also be the development of patients’ artistic skills. It unequivocally shows that music can provide extraordinary support for the development of auditory and artistic competencies, as well as in tinnitus therapy.

Materials and Methods: In the study, we have used a proprietary measure of assessment of the quality of music perception through an implant and the quality of the process of music therapy in persons with the hearing implant, developed by the team of the World Hearing Center. The analysis involved a study of a group of patients age range 2–12, first before being included in the group of music therapy under the program ‘Music in Human Auditory development’. The same group of patients underwent then the same assessment after 3 months of participating in music therapy following this program.

Results: The process of development of hearing, speech and language competencies was much faster. Patients after 3 months have achieved much better scores in replying and understanding the tasks included in the quality measure. They have also performed much better in the difficult elements of the measure, such as differentiating musical phrases in terms of pitch, number of sounds and differentiating within the interval sequence.

Conclusions: Treatment of different types of deafness or profound sensorineural hearing loss with the application of a cochlear implant means not only creation of an opportunity to develop hearing, speech, and language, and reduce tinnitus, but it means also the widening of the possibilities of auditory development and quality of music perception of implanted patients.

P-100

The bilateral cochlear implant in a child with the incomplete partition type III cochlear malformation

Porowski M.^{1,2}, Skarżyński H.^{1,2}, Mrówka M.^{1,2}, Skarżyński P.H.^{2,3,4}

¹ *Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland*

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

³ *Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland*

⁴ *Institute of Sensory Organs, Kajetany, Poland*

Incomplete partition type III (IP-III) is a rare congenital inner ear malformation causing significant hearing loss and congenital deafness. A constant fluid leak during cochlear implantation is a characteristic feature of this disorder. The goal of this work was to assess the utility of bilateral cochlear implantation in a child with this disorder and profound bilateral sensorineural hearing loss. The copious bilateral fluid leak was observed during surgery but it subsided after securing and sealing of the electrode. No further complications associated with the anomaly or gusher were observed. In our conclusions, we emphasize the safety of the procedure and benefits for patient’s hearing.

P-101

The Bonebridge implant in children: subjective assessment with APHAB questionnaire

Miśko E., Ratuszniak A., Skarżyński P.H., Skarżyński H., Dziewirz Z.

Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

The study materials comprise a group of 19 children with uni- or bilateral, conductive or mixed hearing loss or single-sided deafness, implanted in one ear with the Bonebridge system in the Institute of Physiology and Pathology of Hearing in Kajetany near Warsaw in the years 2014–2018. Assessment of the effectiveness of this treatment was conducted using APHAB questionnaire applied before and after implantation – minimum one month after a stable fitting. The results of the questionnaire assessment confirm the benefits observed in the auditory functioning of children in different acoustic conditions after Bonebridge implantation. The highest reduction of problems in hearing (global score) is observed for patients with mixed hearing loss (the mean value is 54 percentage points). The Bonebridge system has been assessed to be an effective tool for compensating for the conductive or mixed hearing impairment and single-sided deafness in children.

P-102

The difference between a standard fitting procedure and fitting application in experienced patients

Przytuła-Kandzia K., Markowski J., Klimczak-Gołąb L.

Department of Laryngology, Silesian Medical University, Katowice, Poland

Introduction: The development of new technologies allows patients with CI to adjust hearing profile in their sound processors by themselves. This solution is dedicated to aware patients who are CI recipients for a long time. It is very comfortable for the patient because he/she doesn't have to visit the clinic every time when he/she wants to correct a sound processor's settings. The aim of this study was to figure out what is the difference between a standard fitting procedure and 'fitting procedure with patients adjustments' in experienced patients.

Materials and Methods: We invited 5 adult patients with CI to our clinic to perform a standard fitting procedure. All patients were users of Nucleus 7 (Cochlear) processors and each of them was a user of CI longer than 5 years. During the standard fitting procedure, we measured parameters as follow: time of the procedure, level of patients satisfaction after the procedure, and hearing quality. The level of patients satisfaction was measured using a simple scale with 4 rates from 'very satisfied' to 'dissatisfied'. Hearing quality was measured using speech, spatial and qualities of hearing scale (SSQ). During the fitting visit, the Nucleus Smart App was installed on patients' phones and all of them were trained on how to use it. Patients settings were extended to advanced option giving them a real influence on settings control. Patients were asked to use Nucleus 7 Smart App during the next few months - always when they want to correct processor settings, but at least one time. Then, after 3 months, they were asked to assess the same parameters as above (average time of the procedure, level of satisfaction after the procedure, and hearing quality), but in relation to the possibility of the independent fitting.

Results: The results show that time of the standard fitting procedure (performed by a doctor) is about 15 minutes longer than the independent fitting procedure (performed by the patient using application). The level of patient satisfaction is similar in both cases. Results of SSQ show that hearing quality is similar in both procedures. Additionally, patients emphasized, that independent fitting procedure is more comfortable and they feel more relaxed than if they have to spend long hours visiting the hospital and waiting for the consultation.

Conclusions: The independent fitting procedure may be a good solution for experienced patients who want to avoid long travel to the clinic every time when the correction of processor settings is needed.

P-103

The effect of antidepressant in the treatment of tinnitus

Jeong H.J.

Department of Psychiatry, Pusan National University School of Medicine, Pusan National University Hospital, Busan, Korea

Introduction: Tinnitus is one of the common symptoms that designates significant comorbidity with anxiety and depression. Among antidepressants, a selective serotonin reuptake inhibitor (SSRI) is frequently used in pharmacological protocols for the management of tinnitus.

Objectives: This study aims to verify the effect of the SSRI on patients with tinnitus.

Materials and Methods: Thirty-eight patients with chronic tinnitus, who visited in Pusan National University Hospital from Jan 2015 to December 2016 were investigated prospectively. Pretreatment and posttreatment by taking SSRI *Visual Analogue Scale* (VAS) measurements of tinnitus loudness (intensity), duration, annoyance, the impact of life, and *Tinnitus Handicap Inventory* (THI) and its subcategory (functional, emotional, catastrophic) were evaluated and compared.

Results: Four subjects were dropped out due to intolerance. VAS measurements such as annoyance, the impact of life were improved significantly after treatment. In the THI score, not only total score but also subcategory scores were got better, which had statistical significance.

Conclusions: Our results show that SSRI could positively effect on chronic tinnitus patients with considerable tolerability. But it might be necessary for the evidence-based approach such as double-blind randomized controlled trial to clarify the effect of SSRI on tinnitus.

P-104

The frequency of co-occurring symptoms and comorbidities in adult patients with sudden sensorineural hearing loss and hearing recovery

Marciniak J.¹, Krawczyńska A.¹, Niedzialek I.², Skarżyński P.H.^{2,3,4}

¹ *Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland*

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

³ *Institute of Sensory Organs, Kajetany, Poland*

⁴ *Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland*

Objectives: The purpose of the study was to evaluate the frequency of co-occurring symptoms and comorbidities in

patients with sudden sensorineural hearing loss (SSNHL) and their relationship with hearing recovery.

Materials: Records of 67 patients admitted to the Department of Audiology and Phoniatrics of the Institute of Physiology and Pathology of Hearing, due to SSNHL were retrospectively reviewed.

Methods: The inclusion criteria were: age over 18 years, unilateral hearing loss, complete pre- and posttreatment audiometric results' records, and treatment consisting of intravenous corticosteroids and hyperbaric oxygen therapy (HBOT). Participants were evaluated regarding the presence of tinnitus, dizziness and ear fullness sensation. Additionally, they were classified into two groups, one of them with comorbid diseases (hypertension, thyroid disorders, systemic autoimmune diseases, hypercholesterolemia, stress), and another one, without co-occurrence of such diseases. Pure tone thresholds were estimated at 250, 500, 1000, 2000 and 4000 Hz. The correlation between the time of treatment and the results were calculated using Mann-Whitney U test with the statistical significance established at $p < 0.05$.

Results: In the evaluation of the patients, 89,6% had tinnitus, 35,8% had dizziness and 34,3% of the patients in our sample had ear fullness. The study reveals that participants who experienced fullness in the ear had statistically significant hearing improvement of $M = 19,4$ ($SD = 18,76$) based on the mean difference ($U = 353$, $p = 0.043$). Presence of tinnitus and dizziness did not influence on hearing recovery significantly. Among the examined group, there were 17 patients without any comorbidities, and 50 had at least 1 associate disease. In both groups, the outcomes were statistically insignificant regarding hearing improvement.

Conclusions: The most common co-occurring symptom with SSNHL is tinnitus. Although the majority of patients reported at least one comorbidity (74,6%), no statistical difference was noted in comparison to a group without comorbidities.

P-105

The impact of implanting the middle ear implant on the sensation of tinnitus

Kutyba J.¹, Skarżyński P.H.^{1,2,3}, Świerniak W.¹, Bieńkowska K.¹, Gocel M.¹, Dziendziel B.¹

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: Tinnitus is becoming a global problem affecting people of all ages. Between 15 and 20% of the population experience them. Tinnitus often occurs with hearing loss of varying degrees. This problem also applies to people who are qualified to implant the implant into the middle ear. Patients hope that after implantation, not only hearing will improve, but also tinnitus annoyance will

decrease. The aim of the study is to assess the occurrence and changes occurring in the sensation of tinnitus after implantation of the VSB implant.

Materials and Methods: 18 people (6 M / 12 F) operated on at the Institute of Physiology and Pathology of Hearing in Poland were recruited for the study. The average age of people participating in the study is 61.2 years. All people had tinnitus in the operated ear, and 14 people were also hearing in the other ear. To assess tinnitus a set of standardized questionnaires was used: *Tinnitus Handicap Inventory*, *Tinnitus Functional Index* and *Tinnitus Hearing and Survey*. All participants completed the same set of tools before surgery and 3 and 6 months after implant placement.

Results: The performed analyzes showed that implantation into the middle ear of the Vibrant Soundbridge type affects the perception of tinnitus. The results of the questionnaires showed statistically significant differences indicating a reduction in the nuisance of tinnitus after surgery. Detailed analyses and results will be presented during the conference.

Conclusions: The results of the conducted studies clearly indicate the positive effect of implanting the VSB implant on tinnitus. After surgery, patients can enjoy not only improved hearing but also an easier life with tinnitus. This fact can help to make decisions for prospective patients regarding the implantation of this type of device.

P-106

The occurrence of gusher during cochlear implantation in adults – a literature review

Rychlica S.¹, Rajchel J.J.², Skarżyński P.H.^{2,3,4}

¹ Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: The objective of this literature review is to investigate the group of adult patients who underwent cochlear implantations with cerebrospinal fluid gusher being the point of main interest. Incidence rate, surgical techniques, other complications, comorbidities are areas of additional inquiries.

Materials: Two scientific databases – Web of Science and PubMed – were chosen for the purpose of this review. Both provide a variety of articles and citations in English, with a simple search system.

Methods: Databases were searched using the keywords 'cochlear implantation' and 'gusher'. After applying the language filter and removal of duplicates, full-text articles were assessed for eligibility. This review was performed following PRISMA 2009 guidelines as a basis.

Results: A total of 96 full-text articles were assessed for eligibility. Those included: case reports of rare syndromes associated with malformation of the inner ear; analysis of radiological findings which might indicate CSF gusher occurrence; single clinic studies assessing the incidence of certain complications; suggestions concerning surgical approach in cochlear implantation and stapedotomies. The appearance of gusher during cochlear implantation remains a complex issue with a variety of approaches possible. Although some cases of gusher can be explained by surgical interventions or patients' health condition, there are still cases of a gusher of unknown origin. The patients with rare diseases and malformations of the inner ear seem to be particularly exposed to this phenomenon during cochlear surgery.

Conclusions: The literature on gusher in adult cochlear implantation surgery is rather small and derived from the variety of methodological approaches. More clinical, prospective studies are needed on a larger population of patients to provide reliable evidence on gusher existence prediction and the most efficient management. Upon retrospective evaluation of experiences with cochlear implantation within a single clinic, it might be reasonable to distinguish adult and underage patients in order to analyze those groups separately.

P-107

The outcomes of cochlear implantation in children with Dandy-Walker syndrome – a literature review

Bieńkowska K.W.¹, Rajchel J.J.², Skarżyński P.H.^{2,3,4}

¹ Local Students' Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: The aim of the study is the evaluation of the cochlear implantation results of children with Dandy-Walker syndrome and concomitant deafness, considering surgical procedures, post-surgery auditory rehabilitation process, diagnostics process and subjective advantages of device implantation assessment.

Materials: Scientific articles on Dandy-Walker syndrome, deafness and cochlear implantation in children.

Methods: A literature search was conducted using PubMed, Cochrane, and Web of Science databases. Searches were made using the keywords: 'Dandy-Walker malformation', 'Dandy-Walker syndrome' resulting in 2886 articles. Based on the eligibility criteria, 4 articles were included in the final analysis.

Results: In selected manuscripts, in all evaluated cases, the standard technique of cochlear implantation was used.

Only in one case, surgical method was modified because of anatomical variants, unrelated to Dandy-Walker malformation. In all papers, after cochlear implantation, the hearing improvement was observed. Three of four children developed speech correctly. One child did not develop speech correctly as it didn't undergo regular auditory rehabilitation.

Conclusions: More research is needed on cochlear implantation in children with Dandy-Walker syndrome as currently there are few papers. Cochlear implantation is a chance to improve speech ability and quality of life in this group of patients. Regular auditory rehabilitation is an important part of the treatment, which leads to optimal results of cochlear implantation.

P-108

The Polish version of the Nasal Obstruction Symptom Evaluation Scale (NOSE). Cross-cultural adaptation in a clinical population

Dąbrowska-Bień J., Buksińska M., Łazęcka K., Gwizdalska I., Mickielewicz A., Skarżyński P.H., Skarżyński H.

Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Kajetany/Warsaw, Poland

Objectives: The Nasal Obstruction Symptom Evaluation Scale (NOSE) is a brief, self-administered questionnaire widely used for assessing the quality of life related to nasal obstruction and is utilized in outcome studies. This study aimed to establish psychometric properties of the Polish version of this tool and test it among patients with nasal obstruction.

Methods: The controlled validation study was conducted in a tertiary referral center. The Polish version of the NOSE Scale was developed according to the guidelines for cross-cultural adaptation. Psychometric properties (internal consistency, reproducibility, validity, responsiveness, and interpretability) were assessed in 51 consecutive patients and 51 controls matched according to gender and age.

Results: Internal consistency and reproducibility of the Polish version of the NOSE Scale were good. Construct validity was confirmed by inter-item and item-total correlations. The tool demonstrated adequate criterion validity (assessed by correlation with Visual Analogue Scale) and excellent discriminant validity (between patients and controls), as well as high responsiveness and adequate interpretability.

Conclusions: The Polish version of the NOSE Scale is a brief and robust tool very useful in clinical practice. We recommend its use in Polish-speaking patients with nasal obstruction.

P-109

The quality of life of the postlingually deaf adults who use cochlear implants

Rostkowska J., Wojewódzka B.,
Geremek-Samsonowicz A.

Rehabilitation Clinic, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

Introduction: Current trends in patients' management beside medical aims include improvement of wellbeing that enables patients to function efficiently (physically, socially and psychically) in everyday life. This dimension has been called the quality of life and it is the measure of the success of treatment.

Objectives: Main aim of the study was to observe and assess changes occurring in the quality of life of the postlingually deaf adults who received cochlear implant systems.

Materials and Methods: The research group included 104 adults postlingually deafened and implanted with a cochlear implant system persons. To assess the quality of life AQoL - 8 D questionnaire, available in Polish language, was applied. The research was performed twice before the cochlear implantation and after implantation of the device.

Results: After application of the cochlear implants in patients a statistically significant difference was noted in the quality of life, in relation to the results of the quality of life score obtained before the implantation.

Conclusions: Application of the CI improves the quality of life in the researched areas of life: such as independence, senses, sanity, wellbeing, dealing with reality, social relations and general quality of life.

P-110

The results of corticosteroids and hyperbaric oxygen therapy treatment for sudden sensorineural hearing loss in adult patients

Krawczyńska A.¹, Marciniak J.¹, Niedzialek I.²,
Skarżyńska M.B.³

¹ Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

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

³ Center of Hearing and Speech Medincus, Kajetany, Poland

Objectives: The aim of the study was the evaluation of audiometric results before and after the full course of treatment with corticosteroids administered intravenously and simultaneous hyperbaric oxygen therapy (HBOT) in patients hospitalized due to sudden sensorineural hearing loss (SSNHL).

Materials: Records of 67 patients hospitalized in the Department of Audiology and Phoniatrics of the Institute of

Physiology and Pathology of Hearing due to SSNHL were retrospectively screened to provide compliance with eligibility criteria.

Methods: The inclusion criteria were: age over 18 years, unilateral hearing loss, complete pre- and posttreatment audiometric results - documentation, and treatment consisting of intravenous corticosteroids and HBOT. The examined patients were divided into 2 groups based on the time of starting the intervention. The first one ($n = 53$), started treatment within 14 days from symptoms' occurrence, the second one ($n = 13$), over 14 days. The pre- and postoperative audiometric results were established as a pure tone average from frequencies: 250, 500, 1000, 2000 and 4000 Hz. The statistical analyses were conducted using the Mann Whitney U test with the statistical significance established at $p < 0.05$.

Results: Examined group consisted of 35 men and 32 women, but there were no statistically significant differences in hearing improvement ($p > 0.05$) depending on gender. In the first group (treatment onset within 14 days), the average increase in hearing threshold was $M = 15.4$ ($SD = 16.87$) and in the second group $M = 5.5$ ($SD = 11.49$) on average. This difference was statistically significant ($U = 229.5$; $p = 0.029$). In addition, 55 % of patients who were subjected to treatment within 14 days from symptoms presentation, gained the improvement ≥ 10 dB, whereas, the other group revealed it happened in only 28.6% of cases.

Conclusions: Starting the treatment as far as possible has a significant impact on the hearing recovery in patients treated with corticosteroids and HBOT, showing that earlier treatment onset results in better hearing recovery.

P-111

The results of the Bonebridge implantation after multiple reconstructive surgeries due to otosclerosis

Skarżyński H.¹, Dziendziel B.², Świerniak W.²,
Ratuszniak A.³, Włodarczyk E.²,
Skarżyński P.H.^{2,4,5}

¹ Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ Audiology Research and Hearing Prosthetics Department, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁵ Institute of Sensory Organs, Kajetany, Poland

Otosclerosis is one of the most complex causes of progressive hearing impairment developing primarily in the middle age. Stapes surgery has established its position as the primary treatment of conductive or mixed hearing loss in otosclerosis. High efficiency of stapes surgery is often reported in the literature. However, it sometimes happens

that in some patients the improvement of hearing is short-lived. If a patient's auditory benefits after revision surgery are limited, it is necessary to apply additional sound enhancement that can be achieved by the application of a bone-conduction implant (BCI). An example of such a technological solution – active bone conduction devices – is the Bonebridge system (Med-El). In this report, we present the treatment of a patient with otosclerosis, who underwent numerous reconstructive surgeries in another center. Considering the patient's medical history, further revision surgeries were abandoned. Satisfactory improvement of the hearing was achieved by the application of the Bonebridge system.

P-112

The results of traumatic pneumolabyrinth by air location

Baek M.J., Bang E.K.

*Department of Otolaryngology, Haeundae Paik Hospital, Busan, Korea
Department of Otolaryngology, Busan Veterans Hospital, Busan, Korea*

Objectives: 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, and head trauma. The cases of traumatic pneumolabyrinth are 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 239 cases of head trauma Patients who underwent temporal bone CT between Jan 1st, 2012 to Dec 1st, 2018. Review of records was done according to the factors: temporal bone fracture, otic capsule involvement, location of the air bubble, symptom improvement.

Results: Nine patients showed pneumolabyrinth with symptoms of dizziness and hearing loss. Dizziness which is related to the air bubble in the vestibule showed symptom improvement in all cases. While hearing loss followed by an air bubble in the cochlea (7 cases) did not show symptom improvement. No correlation was found between Symptom improvement and otic capsule involvement.

Conclusions: 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 in predicting the prognosis of traumatic pneumolabyrinth.

P-113

The role of subtotal petrosectomy in cochlear implant surgery

Ito M.^{1,2}, Kase K.^{1,3}, Dias M.¹, Nakamura K.¹, Sugimoto H.³

¹ *Department of Otolaryngology, Jichi Medical University, Tochigi, Japan*

² *Department of Pediatric Otolaryngology, Jichi Medical University, Tochigi Pediatric Medical Center, Tochigi, Japan*

³ *Department of Otolaryngology-Head and Neck Surgery, Kanazawa University, Kanazawa, Japan*

Objectives: Cochleovestibular malformations and facial nerve anomaly must be careful in patients with cochlear implantation (CI). We have been using the Subtotal petrosectomy (SP) and blind sac closure technique for the cochlear implantation of difficult cases. SP gives excellent visibility and access during surgery in difficult temporal bone anatomy.

Methods: We present a case of CI surgery in the presence of intra-temporal bone facial nerve bifurcation. We performed CI surgery with subtotal petrosectomy and blind sac closure of the external ear canal. Also, retrospective analysis of our cases of CI was carried out.

Results: Case; During the first surgery, the facial nerve bifurcation obscured the promontrium and round window. It was hard to perform cochleostomy because of lack of landmarks of basal turn of the cochlea and quite the first surgery. We performed CT scan again after the first surgery and reconstructed 3D images of the temporal bone and the cochlea, then successfully opened the cochlea at revision surgery. After insertion of CI, the external auditory canal was closed as a blind sac.

Indications for performing SP + CI surgery are followings; chronic otitis media with persistent otorrhea, presence of a radical cavity/canal wall down open mastoid technique, cochlear ossification/obliteration, inner ear malformations and/or facial nerve anomaly, fracture of temporal bone with inner ear involvement, unfavorable anatomic conditions for posterior tympanotomy. Contraindications are following: Only one absolute contraindication is the case using electroacoustic stimulation with EAS-CI system. Relative contraindication is the case with active infection of middle ear or cavity. The procedure can be staged. At first stage, SP with total eradication of the infection has to be performed. SP with blind sac closure of the external ear canal combined with CI is a good procedure required in specific situations as mentioned as above.

Conclusions: Reconstructed 3D CT image was very useful to identify the site of cochleostomy in cases of such difficult temporal bone anatomy. Subtotal petrosectomy and blind sac closure combined with CI is a procedure required in specific situations and it gives excellent visibility and access in difficult anatomy.

P-114

Theory-of-mind development in prelingually deafened children (of hearing parents) with cochlear implants: a preliminary investigation

Pluta A.^{1,2}, Zgoda M.¹, Wysocka J.², Golec K.², Krysztofiak M.², Wójcik J.¹, Skarżyński H.¹

¹ Institute of Physiology and Pathology of Hearing, Warsaw, Poland

² Faculty of Psychology, Warsaw University, Warsaw, Poland

Introduction: Theory of mind (ToM) is a mental capacity, that allows representing internal, unobservable mental states (beliefs, desires, emotions) of other people, to infer them from situational cues, and to base on them the predictions of other's behaviour. Such abilities are crucial for effective social interaction and communication. This ability emerges around the age of four years in typically developing children (TD). Unlike typical development, certain groups may be substantially and selectively delayed in ToM development. Accounting for the fact that language is argued to have a causal role in the development of the theory of mind, children with delayed language development may be at risk of delayed or impaired ToM advancement. One of the population which may be of interest in this respect are deaf children of hearing parents (deaf of hearing parents, DoH). In recent years, deaf children of hearing parents (deaf of hearing parents, DoH) are increasingly likely to receive CI at younger ages. Thus, this unique population with atypical language experience provide an opportunity to illuminate the relationship between early language deprivation and theory of mind performance. The studies on prelingually DoH children who are treated with CI provide inconsistent results on ToM competences.

Aim: The present study aimed at exploring the theory of mind development in prelingually deafened children who were cochlear implant users (CI). We also explored the relation between ToM performance and language abilities and age at implantation.

Method: 40 children with CI (age 3.5–7.10) and 75 typically developing children (age 3.3–5.11) completed computerized ToM task, which was designed based on standard unexpected transfer false-belief task. The assessment of language skills was performed with Grammar-sentence comprehension from The Test of Language Development. All CI users had hearing parents and were implanted before 2 years of age.

Results: The results showed that after controlling for age and language ability, children with CI lag behind on false belief understanding, but not true belief understanding. Language ability was found to correlate positively with theory-of-mind performance. Children who were implanted before 1 year of age performed better on ToM tasks than children who were implanted later.

Conclusions: Deaf children (with CI) of hearing parents demonstrate delayed ToM development which most probably results from impoverished early conversational experience (prior to CI). Early CI is likely to provide complex language exposure and facilitate ToM development.

The study was supported by NCN 2017/25/B/HS6/01624

P-115

Therapeutic effect of tympanostomy tube placement and Eustachian tube function of intractable Meniere's disease patients

Ogawa Y., Hanyu K., Inagaki T., Otsuka K.

Department of Otolaryngology, Tokyo Medical University Hachioji Medical Center, Japan

Objectives: We studied the therapeutic effect of tympanostomy tube placement for intractable Meniere's disease patients. We also investigated the Eustachian tube function with sonotubometry and studied the relationship of the Eustachian tube function and the therapeutic effects of tympanostomy tube placement in patients with intractable Meniere's disease.

Methods: Eleven patients with intractable Meniere's disease underwent tympanostomy tube placement in the affected ear. Post-operative changes in vertigo attacks and hearing level were recorded and were evaluated according to the American Academy of Otolaryngology-Head and Neck Surgery criteria.

Control of vertigo, as determined by the numeric value, was categorised as follows, 0: complete control, 1–41: substantial control, 41–80: limited control, 81–120: insignificant control, > 120: worse (poor) control, secondary treatment initiated because of vertigo-related disability.

Hearing change was also evaluated using AAO-HNS criteria, but threshold levels of 3 kHz are not usually measured in Japan, therefore, we considered the average hearing thresholds of 0.25, 0.5, 1 and 2 kHz. The patients' poorest hearing levels using a four-frequency (0.25, 0.5, 1 and 2 kHz) pure tone average were assessed before and after treatment. Hearing change was defined as: improved (gain of more than 10 dB), unchanged (± 10 dB) or worse (loss of more than 10 dB).

Results: At 24 months after treatment, 4 patients (36.4%) showed complete control of vertigo, 4 (36.4%) showed substantial control and 1 (9.1%) showed limited control; 2 patients (18.1%) required other treatment. In regard of hearing change, only 1 patient (9.1%) improved, 6 (%) showed unchanged and 3 (27.3%) showed worse; 2 patients (18.1%) required other treatment. In Eustachian tube function with sonotubometry, we tested 8 of 11 patients. Four patients were normal and 4 patients were abnormal. There was no significant relationship between the Eustachian tube function and the therapeutic effects of tympanostomy tube placement.

Conclusions: There is no definite pathophysiological explanation for the effect of tympanostomy tube placement in reducing vertigo attacks. This treatment is not effective for all patients with intractable Ménière's disease. However, tympanostomy tube placement might be an additional surgical therapeutic option to consider prior to contemplating other, more invasive treatments.

P-116

Three cases of attic cholesteatoma with closure of the entrance to *pars flaccida* retraction pocket**Nakano M.¹, Matsui K.², Torii N.², Ishida K.², Hayashi Y.²**¹ Kawakita General Hospital, Oto-Rhino-Laryngology, Suginami, Japan² Seirei Yokohama General Hospital, Oto-Rhino-Laryngology, Yokohama, Japan

Attic cholesteatoma is defined as the cholesteatoma occurred from the *pars flaccida* of tympanum. JOS staging system for middle ear cholesteatoma 2015 has been advocated from Japan Otolaryngological Society which is according to progress of the symptoms such as depression of composite retraction pocket of the *pars flaccida*, debris of retraction pocket and progress level of cholesteatoma from primary site (attic) to the next sites. However, this time, we could not find the debris but only retraction pockets on the tympanic membranes. But on CT scan of temporal bone which is examined in order to investigate of hearing loss, we found the soft lesions of the attic and in fact, cholesteatoma was confirmed by the operation.

We experienced three cases in our hospital during the 14 years from 2004 to 2017. The two cases, a 38-year-old male and a 43-year-old male, were recognized only retraction pocket of the *pars flaccida* on their tympanic membranes when they first visited our hospital. But the CT scan of temporal bone showed the soft lesions in the attic part, and we found that the cholesteatoma extended from the attic to the mastoid part. The other case, a 47-year-old man, was found debris in the *pars flaccida* but the debris was removed by ear treatment and no debris deposition was observed thereafter. However, a CT scan of the temporal bone showed that the soft lesion existed in the attic part. As a result of tympanoplasty, we found that the cholesteatoma localized in the attic. It suspects that as a cause of such a condition, after debris invading to the middle ear cavity from *pars flaccida* retraction, the attic becomes epithelialized so the entry mouth is closed, and then debris remained on the external auditory meatus side is removed by ear treatment or spontaneous falling off. So, when the patients have conductive hearing loss, if the tympanic membrane looks like normal, it is important to exam CT scans of the temporal bone.

P-117

Three-dimensional displacement of an endoscope**Kunimoto Y., Taihei F., Hiroaki Y., Junko K., Hiromi T.**

Department of Otolaryngology, Head and Neck Surgery, Faculty of Medicine, Tottori University, Japan

Introduction: Recently, 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. Unstablens of the endoscope can cause surgical difficulty, furthermore, increases the complication by contacting to the surrounding important structures. Because the intra-operative monitor is 2-dimension, we could not measure how far the endoscope is displaced parallel to the visual axis. We have objectively measured the 3-dimensional displacement of the endoscope in several situations and reported that the fixation of the endoscope with elbow was the most important. In this study, we objectively measured the displacement change by the direction of eyes.

Methods: We created a simple model using a speculum as a model EAC and a ring-shaped clip as a target. The smallest diameter of the speculum was 8 mm, and the endoscope was 180 mm in length and 4 mm in diameter. Four high-speed cameras were placed around the model, facing the tip of the endoscope from various directions. To analyze 3-dimensional displacement, we divided displacement into 3 mutually orthogonal directions with respect to the visual axis: crosswise (X-axis); vertical (Y-axis); and parallel (Z axis). The displacement of the endoscope tip was measured in the movement of receiving the instrument from the scrub nurse using the 3-dimensional motion capture software. The measurements were performed in changing situations such as the fixation of the endoscope and the direction of eyes. Fourteen medical students who have no experience with endoscopic surgery have participated in this study.

Results: The displacement of the endoscope with elbow fixation tended to be smaller than that of without elbow fixation. And the direction of eyes should be fixed toward the monitor during the movement of receiving the instrument from the scrub nurse to reduce the displacement of the endoscope.

Conclusions: From our result, it seemed the most appropriate to fix the endoscope with an elbow and not to move the direction of eyes from the monitor.

P-118

Tinnitus in the patient with neuroendocrine adenoma of the middle ear (NAME)**Buksńska M.¹, Dąbrowska-Bień J.¹, Skarżyński H.^{1,2}, Skarżyński P.H.^{2,3,4}**¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland² World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland³ Institute of Sensory Organs, Kajetany, Poland⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Neuroendocrine adenomas are tumors with double differentiation. Middle ear location of those tumors is rare. NAME causes various clinical signs. One of them could

be tinnitus. This paper presents a case study of a patient with tinnitus related to NAME.

A 23-years old patient was admitted to the World Hearing Center because of hearing loss and tinnitus in the right ear. Physical examination suggested a tumor of the middle ear. The patient underwent surgical treatment (attico-antromastoidectomy) with excision of pathological tissues and myringoplasty. Tinnitus was evaluated using the battery of questionnaires (TFI, THI, THS). The postoperative period was uneventful. The patient reported hearing improvement and tinnitus reduction. Histological examination revealed neuroendocrine adenoma of the middle ear.

P-119

Tinnitus severity change following stapedotomy in patients with otosclerosis

Skarżyński H.¹, Dziendziel H.¹, Świerniak W.¹, Skarżyński P.H.^{1,2,3}

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: To determine whether stapedotomy was effective in reducing tinnitus severity. In addition, the relationship between reduction in tinnitus and improvement in hearing after stapedotomy was analyzed.

Materials: A group of 168 patients diagnosed with chronic tinnitus who qualified for surgical treatment of otosclerosis. All patients underwent stapedotomy and a Skarzynski Piston prosthesis (Heinz Kurz) inserted, which was crimped over the long process of the incus.

Methods: The Tinnitus Functional Index questionnaire (TFI) was used to assess tinnitus severity before surgery, and at 3 and 6 months postoperatively. Pure-tone audiometry was conducted before surgery and 6 months postoperatively.

Results: The TFI Total score before the operation was $M = 34.5$ ($SD = 1.6$) points, and decreased 3 months after stapedotomy to $M = 17.5$ ($SD = 1.7$), a statistically significant change ($T = -8.200$; $p < 0.001$). A weak correlation was found between the pre- and postoperative difference of TFI Total score and air conduction thresholds ($r = 0.21$; $p = 0.013$) as well as between the TFI Total score and the size of the air-bone gap ($r = 0.21$; $p = 0.013$). Preoperatively, 86 patients tinnitus was a not or small problem, and for 82 it was moderate to very big. After stapedotomy, 55% of patients experienced a significant reduction in tinnitus severity, 38% had no change, and 7% had an increase.

Conclusions: Stapedotomy not only improves hearing but also reduces tinnitus severity. The current results extend knowledge of postoperative results in terms of tinnitus severity and might benefit patients undergoing tinnitus counseling. It might also be useful to otolaryngologists when making decisions about qualification criteria.

P-120

Transotic schwannoma – a rare case of middle ear mass

Krasnodebska P.¹, Furmanek M.², Raj-Koziak D.¹, Skarżyński H.³

¹ Audiology and Phoniatrics Clinic, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

² Department of Radiological and Imaging Diagnostics, Medical Centre of Postgraduate Education, Warsaw

³ Department of Oto-Rhino-Llaryngosurgery, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

Objectives: Middle ear is an extremely rare but possible place of occurrence of the acoustic schwannoma (AS). AS is the most common benign neoplasm of the internal auditory canal (ICA) and the cerebellopontine angle (CPA). Not frequently observed extension of the lesion is through the labyrinth into the IAC. Transotic schwannoma has been previously reported in the literature only in ten patients. Only in three of the subjects AS extended from the inner ear to the middle ear, and was not present in the CPA. The aim of the study was to present audiological features of transotic schwannoma in a 72-year-old man.

Materials and Methods: Patient underwent audiological and radiologic diagnostic procedure in the Audiology and Phoniatrics Clinic of the Institute of Physiology and Pathology of Hearing.

Results: The patient presented tinnitus and a history of sudden right-sided hearing loss. He reported bilateral tinnitus from 40 years and both sided hearing impairment. Patient reported an episode of right-sided sudden hearing loss 30 years ago, left-sided progressing hearing loss. The patient was using a hearing aid from 15 years in his left year. Accompanying complaints were balance disorders. Otoscopy revealed a white, not pulsatile mass behind the tympanic membrane. No deficits of cranial nerves were evident in the physical examination. Hearing threshold levels were determined for the right and left ear for air and bone conduction. Pure tone audiometry showed complete left-ear deafness and moderate/severe sensorineural hearing loss according to WHO criteria on the left side. In speech audiometry only results from the left ear could be registered. The speech detection threshold was 65 dB and speech recognition threshold was 85dB. Impedance audiometry showed normal tympanogram in both ears: type A according to Jerger. Patient compared his tinnitus in the right ear to the sound of a frequency of 1 kHz and loudness of 60 dB NBN. Minimal Making Level of tinnitus was 70 dB. Patient underwent hearing aid consultation. Hearing aid, CROS system and Active Middle Ear implants were proposed. The patient decided to continue using a hearing aid in the left ear. Sensory Organization Test (SOT) showed a vestibular deficit, without visual and proprioceptive function deficits. The patient fell twice during the fifth trial (eyes closed, sway referenced surface). Magnetic resonance examination was performed on Siemens Trio A Tim 3T unit. MRI revealed a strongly enhancing tumour within an internal auditory canal (IAC), labyrinth and tympanic

cavity. Presence of fluid in an anterior part of IAC, the direction of a facial nerve displacement, partial atrophy of ipsilateral vestibulocochlear nerve as well as marked widening of a superior vestibular nerve. The tumour filled and widened the vestibule, entered into an anterior part of the superior semicircular duct and filled $\frac{3}{4}$ of the basal turn of the cochlea. The tumour filled: round window niche, oval window niche and posterior part of the tympanic cavity adhering to posteroinferior quadrant of a tympanic membrane. Computed tomography (CT) revealed bony destruction localized at postero-latero-inferior part of the vestibule i.e. near the posterior semicircular canal ampoule and at the posterior edge of the round window. CT confirmed segmental bony obliteration of scala tympani, total bony obliteration of the lateral semicircular canal as well as partial obliteration of superior and posterior semicircular canals. The patient was referred for the neurosurgery consultation. Due to the lack of progress in tumor growth during two-year check-ups, watchful waiting strategy was recommended and so far is continued.

Conclusions: The diagnosis of transotic schwannoma is established on the radiologic evaluation. Transotic schwannoma should be included in the differential diagnosis of middle ear tumors.

P-121

Transvenous stent-assisted coil embolization for management of dehiscent high jugular bulb with tinnitus and contralateral hypoplastic venous sinuses

Lee S.H., Choi S.W., Kong S.K., Oh S.J.

Department of Otorhinolaryngology-Head and Neck Surgery and Biomedical Research Institute, Pusan National University Hospital, Busan, South Korea

Objectives: This study aimed to evaluate the safety and efficacy of transvenous stent-assisted coil embolization for dehiscent high jugular bulb (DHJB) with tinnitus and contralateral hypoplastic venous sinus. Study Design: Case series with chart review. Setting: Tertiary academic medical center.

Methods: From September 2008 to October 2018, a series of patients with DHJB presenting with intractable pulsatile tinnitus abated only by ipsilateral jugular vein compression were included. Patients underwent transvenous stent-assisted coil embolization for selective obstruction to the dome of the high jugular bulb (HJB) due to hypoplastic contralateral transverse or sigmoid venous sinus. Technical safety and clinical efficacy were retrospectively analyzed. Clinical outcome measurements included a pure-tone audiogram, tinnitus character, and tinnitus handicap inventory and evaluated based on the change during the first 6-month after the procedure.

Results: Subjects included five patients with DHJB and troublesome pulsatile tinnitus who refused surgery ($n = 4$), or who experienced recurrence after surgical covering and reinforcement using autologous cartilage ($n = 1$). The mean

age of the five patients (only female) was 45 years. Transvenous stent-assisted coil embolization was technically successful in all patients with symptomatic DHJB, with no procedure-related complications. Temporary postprocedural headache was observed in two patients but resolved within 3 days. Symptoms were completely resolved in all cases. There was no recurrence or aggravation of tinnitus during the follow-up period.

Conclusions: Transvenous stent-assisted coil embolization for DHJB with tinnitus and contralateral hypoplastic transverse or sigmoid venous sinus could be a technically safe and clinically effective treatment strategy while preserving cranial venous drainage.

P-122

Treatment of otosclerosis in the youngest boy – longitudinal results

Skarżyński H.¹, Boruta M.¹, Dziendziel B.², Skarżyński P.H.^{2,3,4}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Otosclerosis is most often diagnosed in adults, in the majority of cases in women. In children is uncommon and even more rare in male children. We present a case of a 5-years-old boy who had bilateral conductive hearing loss and tinnitus. After surgical treatment for otosclerosis, the mean air-bone closure was 25 dB HL and tinnitus has subsided. This case history shows that the surgical treatment of otosclerosis is recommended regardless of the patient's age, particularly when it is associated with a severe progressing hearing loss, tinnitus and increasing thresholds of the bone conduction. The choice of treatment approach has been validated in 4 years of follow-up of the operated ear. Moreover, it allowed setting the indications for surgery in the other ear.

P-123

Urban particle increases biofilm growth and toxicity in human middle ear epithelial cell

Song J.L., Yadav M.K., Go Y.Y., Jeon J.M., Chae S.W.

Department of Otorhinolaryngology, Korea University Guro Hospital, Seoul, Korea

In this study, we evaluated the effect of urban particles (UP) on *S. pneumoniae* in-vitro biofilm formation and colonization on Human middle ear epithelium cells (HMEECs). *S. pneumoniae* in vitro biofilm grown in presence of 200 µg/mL UP were quantified by CV-microplate assay, cfu counts and resazurin staining. Biofilm structures were analyzed using

scanning electron microscope (SEM) and confocal microscopy (CM). Gene expressions of biofilms and HMEECs were evaluated using real-time RT-PCR and Microarray. Colonization of *pneumococci* to HMEECs in presence of UP was evaluated using adhesion assay, and fluorescent in-situ hybridization (FISH). Reactive oxygen species (ROS) and apoptosis in HMEECs were evaluated using ROS kit and Annexin-V/PI based cytometry. Presence of UP significantly ($p < 0.05$) increased biofilm biomass and viable bacteria. The SEM analysis revealed thick, organized with matrix in biofilms grown with UP, however, these structures were absent in control biofilm. CM also revealed thick and organized biofilms in the presence of UP, however, these structures were not seen in control biofilm. The genes involved in bacterial pathogenesis, biofilms formation, and quorum sensing were up-regulated in pneumococci biofilms grown in presence of UP. The HMEECs viability and bacteria colonization were significantly elevated in co-treatment (200 µg/mL UP+ *S. pneumoniae* (MOI 10)) in comparison to a single treatment. Similarly, increased apoptosis and necrosis and ROS produce were detected in HMEECs treated with UP+ *pneumococci*. The microarray analysis of HMEECs treated with UP or pneumococci or co-treatment revealed that the genes involved in apoptosis, cancer, inflammation, and other activity were exclusively differentially regulated in co-treatment. Presence of UP increases *S. pneumoniae* biofilm, pathogenesis, and toxicity and facilitates colonization to HMEECs.

P-124

Use of a cochlear implant in a patient with Cogan's syndrome and profound sensorineural hearing loss – results in long observation

Pastuszak A.¹, Skarżyński H.¹, Pastuszak D.², Włodarczyk E.¹, Ołdak M.³, Skarżyński P.H.^{1,4,5}

¹ Department of Oto-Rhino-Laryngosurgery, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

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

³ Department of Genetics, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁵ Institute of Sensory Organs, Kajetany, Poland

Cogan's syndrome is a very rare autoimmune disease characterized by the coexistence of inflammatory lesions in the eyeball and inner ear dysfunction. The symptoms of Cogan's syndrome within the inner ear appear suddenly and resemble Meniere's disease symptoms: severe vertigo, nausea, vomiting, and usually bilateral, fluctuating sensorineural hearing loss with concomitant tinnitus.

A 62-year-old woman was admitted to the Department of Oto-Rhino-Laryngosurgery to undergo cochlear implantation. At 57 years of age, the patient had been diagnosed with scleritis. About a year later, vertigo and nausea

arose, followed by rapidly progressing hearing loss – at first in the left ear and subsequently in the right, accompanied by tinnitus. At the time of implantation, the patient's speech discrimination score was 0% for both ears. Taking into consideration the audiometric tests results and imaging scans, the cochlear implantation was performed through promontory cochleostomy. There were no complications in the postoperative period. After 24 months of using the speech processor, the subjective assessment of speech intelligibility given by the patient on a 0–10 scale was 8.5 in quiet and 5.0 in a noisy environment. The patient could identify 95% of monosyllabic words in silence and 35% in noise (in conditions of SNR +10 dB, speech level at 70 dB HL, and noise level at 60 dB HL). The benefits obtained were confirmed by results of an *Abbreviated Profile of Hearing Aid Benefit* (APHAB) questionnaire. The 3-years-long period of observation has confirmed that the results are stable. It can be therefore concluded that cochlear implantation is an effective approach to improving hearing in a patient with Cogan's syndrome. It is confirmed by the longitudinal follow-up of the patient.

P-125

Vestibular migraine: impact of dizziness symptoms on patients' quality of life

Ho E.C., Lee B.W.W.

¹ ENT Department, Tan Tock Seng Hospital, Singapore

² Lee Kong Chien School of Medicine, Singapore

Introduction: Dizziness has been found to result in a loss of daily function and quality of life, associated with severe loss of functional ability, increasing risk of falls, disability, handicap and occurrence of fears, anxiety or depression related to symptoms. Vestibular Migraine (VM) is now recognized as one of the commonest causes of recurrent dizziness, and studies have shown the age-related quality of life to be consistently lower in patients with VM compared to dizziness-free controls. Our aim is to assess the impact of dizziness on daily life in patients diagnosed with VM by measuring the degree of self-perceived handicap in functional, physical and emotional domains associated with dizziness as well as negative emotional states of depression, anxiety, and stress.

Materials and Methods: A total of 307 patients with dizziness who came from Tan Tock Seng Hospital ENT clinic, Singapore, were enrolled from August to September 2018. Patients were administered a questionnaire, and 152 patients who were diagnosed with probable or definite VM based on the International Classification of Headache Disorders -3 beta version criteria were included in this study. A modified version of the Migraine Disability Scale (MIDAS) to evaluate Dizziness symptoms rather than headache symptoms, Dizziness Handicap Inventory (DHI) and Depression, Anxiety and Stress Scale 21 (DASS-21) were used to assess the impact on daily life. Statistical analysis was performed using Stata. Shapiro-Wilk test was used to assess data normality and comparison between VM and non-VM groups were made using *t*-test or Mann-Whitney U test for continuous data, and Chi-squared or Fischer's exact test for categorical data.

Results: VM is associated with comorbidity and decrease quality of life, with significantly increased DHI scores and median DASS scores across all 3 categories for Depression, Anxiety and Stress ($P < .001$). Patients with VM have a significantly higher median DHI scores and the significantly higher proportion reporting moderate and severe disability. The mean number of days within the last 3 months that subjects: (i) missed work or school because of dizziness was 3.7 days (± 10.5), (ii) not do household work because of dizziness was 8.4 days (± 17.2), (iii) miss family, social or leisure activities was 7.4 days (± 16.6). The mean total DHI score of patients with VM was 42.1 (± 22.9). A majority (90.8%) of subjects reported some level of self-perceived handicap due to dizziness, with 30.9% mild, 25.7% moderate and 34.2% severe. The commonest difficulties experienced by patients with VM was feeling frustrated (79.6%), increased problem because of quick movements of the head (73.7%) and looking up (69.1%). Using the DASS-21 scale, the prevalence of self-reported depression, anxiety and stress were 12.4%, 20.2%, and 5.2% respectively.

Conclusions: The impact of VM on quality of life as evidenced by increased scores of DHI and DASS 21 on all domains re-enforces the importance for all health care professionals to be familiar and confident in making this diagnosis to avoid negatively impacting patients' quality of life. Such scales can be used in clinical consultation to indicate the impact on the daily life of patients with VM.

P-126

Vestibular schwannoma treatment and its relationship to tinnitus change

Łyczba J.¹, Zaborek M.¹, Rajchel J.J.², Karpiesz L.², Skarżyński P.H.^{2,3,4}

¹ Local Student's Scientific Society at the Institute of Physiology and Pathology of Hearing and Medical University of Warsaw, Kajetany/Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: Schwannomas are a group of histologically benign tumors, which originate from Schwann cells, mainly in the vestibular part of the VIII nerve. Literature data presents that vestibular schwannomas (VS) may be treated in three ways: observation and periodic control using MRI, radiotherapy, and microsurgery. According to the guidelines of the National Institute of Health, one-stage microsurgical treatment is the recommended method due to its effectiveness.

Materials: Retrospective analysis of the medical record of patients admitted to single tertiary clinical ENT center were carefully studied. The eligibility criteria were age ≥ 50 years, diagnosis of unilateral VS confirmed by a magnetic resonance imaging (MRI) and full medical record

of a given patient upon diagnosis and follow-up (carried out within 12 months after operation), including medical interview and hearing evaluation.

Methods: Patients were divided into three groups according to the treatment type: I group – patients under observation and periodic MRI monitoring, II group – patients undergoing radiotherapy, III group – patients undergoing microsurgery.

Results: Based on the eligibility criteria, 15 patients were included in the analysis. In the I group (observation), no statistically significant change in tumor size, tinnitus loudness, and hearing thresholds was observed. Patients from the II group who underwent radiotherapy experienced a statistically significant reduction of tumor size as well as tinnitus loudness. No change of hearing thresholds was observed in this group. Patients from the third group (microsurgery) experienced the biggest reduction in the tumor size and tinnitus loudness, however at the same time they experienced a significant deterioration of hearing.

Conclusions: Microsurgical treatment seems to be the most effective in terms of tumor size reduction as well as tinnitus loudness reduction. However, it also leads to significant hearing deterioration, resulting even in the complete loss of hearing in the operated ear. For this reason, it is necessary to thoroughly discuss the potential consequences of all of the therapies with the patient to let the patient choose the optimal decision in his or her individual case.

P-127

Vibrant Soundbridge with an SP coupler application in *chronic otitis adhesiva*

Skarżyński P.H.^{1,2,3,4}, Skarżyński H.^{1,2}, Porowski M.^{1,2}, Mrówka M.^{1,2}, Barylyak R.^{1,2}, Włodarczyk E.²

¹ Department of Oto-Rhino-Laryngosurgery, World hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

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

³ Institute of Sensory Organs, Kajetany, Poland

⁴ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

Objectives: Case study presenting a surgical method of implantation of the Vibrant Soundbridge (VSB) with an SP coupler and results in a 5-years long follow-up period.

Materials and Methods: Thirty-one-years-old patient with bilateral hearing loss and bilateral atresia of the external ear canal. After multiple failed surgical interventions aimed at restoring the ear canal patency, the patient had been implanted with a VSB middle ear device. In order to avoid risk to a facial nerve related to an extensive posterior tympanotomy surgeons have decided to apply, for the first time in Poland, the SP coupler to fix the FMT transducer to the body and short process of the incus.

Results: The result was a very good level of hearing threshold and speech understanding. The postoperative results have been confirmed in the follow-up period of over 5 years.

Conclusions: VSB implant with an SP coupler is a safe and effective method of management of hearing the loss in patients in whom an FMT should be fixed on incus. It can be a treatment of choice especially in patients with obstructed or under-developed EAC, under-developed middle ear or adhesive lesions of an outer ear.

P-128

Visual Analog Scales as a tool for initial assessment of the severity of tinnitus: a psychometric evaluation in a clinical population

Raj-Koziak D.¹, Gos E.¹, Świerniak W.¹, Karpiesz L.¹, Niedziałek I.¹, Rajchel J.J.¹, Skarżyński H.¹, Skarżyński P.H.^{1,2,3}

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

² Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

Objectives: The aim of the study was evaluation psychometric properties of patient-reported Visual Analog Scales (VAS) for measuring subjectively perceived tinnitus loudness, annoyance, distress and possibility of coping with this condition.

Materials: 100 adult patients (47% women and 53 % men) mean age 51,96 (*SD* = 13,62) with tinnitus lasting more than 3 months were included in the study.

Methods: participants of the study completed Visual Analog Scales twice over a period of three days during the three-day diagnostic hospitalization. Polish version of VAS measuring tinnitus loudness (VAS-L), annoyance (VAS-A), distress (VAS-D) and the possibility of coping with this problem (VAS-C) was created by the group of experts included clinicians: otolaryngologists, audiologists and psychologists. To assess criterion and construct validity of VAS scales Tinnitus Handicap Inventory questionnaire (THI), Tinnitus Functional Index questionnaire (TFI), Beck Depression Inventory (BDI) and Tinnitus and Hearing Survey (Subscale A and B) were filled in by patients. Reproducibility agreement (Bland-Altman limits of agreement) and reliability using Intra Class Correlations (ICC), floor and ceiling effects of VAS scales were measured. Cut off points for VAS scales as a criterion of tinnitus severity were determined.

Results: Spearman's correlations coefficient score result among VAS and TFI global score amounted: VAS-L: $\rho = 0.73$, VAS-A: $\rho = 0.81$, VAS-D: $\rho = 0.77$ and VAS-C: $\rho = 0.52$. Within the identified agreement limits (Bland-Altman method) of VAS-L amounted 95%, of VAS-A: 93%, of VAS-D: 96% and VAS-C: 94%. Results of measuring ICC amounted for VAS-L: ICC= 0.76, for

VAS-A: ICC=0.90, for VAS-D: ICC=0.80 and for VAS-C: ICC=0.67. Determined cutoff points of VASs which suggest the tinnitus severity were set: VAS-L: 59 points, for VAS-A: 56 points, for VAS-D: 66 points and for VAS-C: 45 points.

Conclusions: VAS scales are a valid and reliable brief screening tool for obtaining quick information about tinnitus during the first intake with a patient. Determined cutoff points of VASs are the criterion of tinnitus severity helping in taking a decision whether further specific intervention is needed.

P-129

Voice assessments of patients with *sulcus vocalis* having coexisting benign lesions of the vocal folds

Miaśkiewicz B.¹, Panasiewicz A.¹, Gos E.³, Szkiełkowska A.^{1,2}, Skarżyński P.H.³, Włodarczyk E.³

¹ Audiology and Phoniatrics Clinic, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

² Audiology and Phoniatrics Faculty, Fryderyk Chopin University of Music, Warsaw, Poland

³ Teleaudiology and Screening Department, Institute of Physiology and Pathology of Hearing, Warsaw, Poland

Sulcus vocalis is often associated with different benign lesions such as polyp, edema or nodule, cyst, and fibrous mass of the vocal fold. The purpose of the study was an analysis of clinical characteristics of benign lesions coexisting with *sulcus vocalis* in terms of psychosocial handicapping, auditory-perceptual and acoustic measurements, and vibratory patterns.

Study design: A retrospective study.

Materials and Methods: We reviewed the medical charts of 38 patients with a diagnosis of pathological *sulcus vocalis*. The study group consisted of 16 subjects with *sulcus* and associated benign lesions. Twenty-two patients with isolated *sulcus* were enrolled in the control group. We analyzed psychosocial (VHI-30), auditory-perceptual and acoustic assessments, and laryngovideostroboscopy images.

Results: The mean VHI scores of all subscales ranged from moderate to severe handicap, and the total score was in moderate values. The majority of patients had a mild grade of hoarseness, roughness, breathiness, asthenic and strained voice as well. The most abnormally increased values were observed among amplitude parameters. The incomplete glottal closure was observed in all patients from the study group. The amplitude of vibration was diminished in all patients, mostly in a moderate degree. The mucosal wave was moderately restricted in 75% of patients. The difference between groups in the VHI scores was significant in emotional ($p = 0.004$) and physical ($p = 0.007$) subscales. In all domains of GRBAS, the differences between the study group and the controls were not statistically significant ($p > 0.05$). There was a significant difference between the study group and the controls in the SPI

parameter. Its mean value was lower in patients with coexisting benign lesions ($p = 0.049$). The considerably higher value was also observed in the vAm parameter, but it was not statistically significant ($p = 0.067$). The assessment of stroboscopic measurements did not show significant differences between the study group and the controls.

Conclusions: The patients with sulcus and coexisting benign lesions were more handicapped in emotional and physical subscales of VHI. The glottal gap in most cases was smaller than in isolated sulcus, but vibratory patterns were moderately impaired. The acoustic evaluation of voice shows the most severe disturbances among amplitude parameters.

P-130

VSB can be an effective salvage treatment for patients with mixed hearing loss caused by otosclerosis who cannot benefit from conventional hearing aids

Skarżyński H.¹, Rajchel J.J.², Dziendziel B.²,
Włodarczyk E.², Skarżyński P.H.^{1,2}

¹ Department of Oto-Rhino-Laryngosurgery, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

² Department of Teleaudiology and Screening, World Hearing Center, Institute of Physiology and Pathology of Hearing, Kajetany/Warsaw, Poland

³ Heart Failure and Cardiac Rehabilitation Department, Medical University of Warsaw, Poland

⁴ Institute of Sensory Organs, Kajetany, Poland

Objectives: For patients with otosclerosis, stapedotomy is an elective treatment and it usually results in significant hearing improvement. However, sometimes the improvement of hearing through surgical treatment is not sufficient and a patient needs an additional sound amplification, which can be obtained with a conventional hearing aid or an implantable middle-ear device. In this paper, we present results of such combined treatment (stapedotomy and the salvage application of the Vibrant Soundbridge system).

Materials and Methods: 66-year-old man with progressive bilateral hearing loss due to otosclerosis. Patient's medical history includes stapes surgery in the left ear and then revision surgeries in the same ear. As the auditory effect of treatment was short-lived, the patient received a middle ear implant-system Med-EL Vibrant Soundbridge.

Results: Speech audiometry in free-field shows a significant improvement of speech understanding in the device. Monosyllabic word recognition increased from 5% to 75% in quiet conditions and from 0% to 50% in noise.

Conclusions: VSB can be an effective salvage treatment for patients with mixed hearing loss caused by otosclerosis who cannot benefit from conventional hearing aids.